FLIGHT SAFETY FOUNDATION

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FLIGHT SAFETY DIGEST

SPECIAL DOUBLE ISSUE

Operator's Flight Safety Handbook

Global Aviation Information Network

FLIGHT SAFETY FOUNDATION
SINCE 1947

FLIGHT SAFETY FOUNDATION

For Everyone Concerned With the Safety of Flight

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In This Issue

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Flight Safety Foundation is an international membership organization dedicated to the continuous improvement of aviation safety. Nonprofit and independent, the Foundation was launched officially in 1947 in response to the aviation industry's need for a neutral clearinghouse to disseminate objective safety information, and for a credible and knowledgeable body that would identify threats to safety, analyze the problems and recommend practical solutions to them. Since its beginning, the Foundation has acted in the public interest to produce positive influence on aviation safety. Today, the Foundation provides leadership to more than 880 member organizations in more than 145 countries.

Foreword

This special issue of *Flight Safety Digest* presents the "Operator's Flight Safety Handbook," which was developed by the Global Aviation Information Network (GAIN) to provide aircraft operators with guidelines for establishing or improving internal safety programs.

GAIN is an industry-led international coalition of aircraft operators, manufacturers, aviation organizations and government authorities formed in 1996 to promote and facilitate the voluntary collection and sharing of safety information to improve aviation safety.

Flight Safety Foundation, which serves on the GAIN Steering Committee, distributed copies of the handbook on compact disc to FSF members as a member benefit. Since then, the Foundation has received numerous requests to provide a print version of the handbook. Providing these guidelines on operating an internal safety program is in keeping with the Foundation's charter to disseminate useful information for improving aviation safety worldwide.

— Stuart Matthews
FSF President and CEO

Operator’s Flight Safety Handbook

Global Aviation Information Network (GAIN)
Aviation Operator Safety Practices Working Group

Issue 2
December 2001

Contents

CEO Statement on Corporate Safety Culture Commitment

Core Values

Among our core values, we will include:

- Safety, health and the environment;
- Ethical behavior; and,
- Valuing people.

Fundamental Beliefs

Our fundamental safety beliefs are:

- Safety is a core business and personal value;
- Safety is a source of our competitive advantage;
- We will strengthen our business by making safety excellence an integral part of all flight and ground activities;
- We believe that all accidents and incidents are preventable; and,
- All levels of line management are accountable for our safety performance, starting with the chief executive officer (CEO)/managing director.

Core Elements of Our Safety Approach

The five core elements of our safety approach include:

- Top management commitment:
  - – Safety excellence will be a component of our mission;
  - – Senior leaders will hold line management and all other employees accountable for safety performance; and,
  - – Senior leaders and line management will demonstrate their continual commitment to safety;
- Responsibility and accountability of all employees:
  - – Safety performance will be an important part of our management/employee evaluation system;
  - – We will recognize and reward flight and ground safety performance; and,
  - – Before any work is done, we will make everyone aware of the safety rules and processes, as well as their personal responsibility to observe them;
- Clearly communicated expectations of zero incidents:
  - – We will have a formal written safety goal, and we will ensure that everyone understands and accepts that goal; and,
  - – We will have a communication and motivation system in place to keep our people focused on the safety goal;

- Auditing and measuring for improvement:
  - Management will ensure that regular safety audits are conducted and that everyone will participate in the process;
  - We will focus our audits on the behavior of people as well as on the conditions of the operating area; and,
  - We will establish both leading and trailing performance indicators to help us evaluate our level of safety; and,
- Responsibility of all employees:
  - Each one of us will be expected to accept responsibility and accountability for our own behavior;
  - Each one of us will have an opportunity to participate in developing safety standards and procedures;
  - We will openly communicate information about safety incidents and share the lessons with others; and,
  - Each of us will be concerned for the safety of others in our organization.

Objectives of the Safety Process:

- All levels of management will be clearly committed to safety;
- We will have clear employee safety metrics, with clear accountability;
- We will have open safety communication;
- We will involve everyone in the decision process;
- We will provide the necessary training to build and maintain meaningful ground and flight safety leadership skills; and,
- The safety of our employees, customers and suppliers will be a company strategic issue.

(Signed) ____
CEO/Managing Director/or as appropriate

1. Introduction

1.1 Objective

1.1.1 This handbook is intended to serve as a guide for the creation and operation of a flight safety function within an operator's organization. This handbook is specifically oriented and focused on the impact of safety considerations as they apply to air operations. It also acknowledges the importance of the development of safety practices in all areas of the organization. The handbook also includes reference and guidance to areas that may not have been historically included in the safety department, such as emergency response and crisis management. The Global Aviation Information Network (GAIN) Aviation Operator Safety Practices Working Group strongly emphasizes the importance of independence and authority of the safety function in each organization. Recognizing that the final structure of the safety element will reflect the culture of the organization, the working group urges that the flight safety officer report directly to the chief executive officer (CEO) and be empowered to positively effect safety integration throughout the organization.

1.1.2 The overall objective of the GAIN program is to promote and facilitate the voluntary collection and sharing of safety information by and among users in the international aviation community.

1.2 Background

1.2.1 This *Operator's Flight Safety Handbook* was developed by the working group as a derivation of the Airbus *Flight Safety Manager's Handbook*. This document has been developed to be compatible with the philosophy, practices and procedures of the organization. Where possible, alternative practices and procedures in current use are also shown. This is not a regulatory-approved document, and its contents do not supersede any requirements mandated by the state of registry of the operator's aircraft, nor does it supersede or amend the manufacturer's type-specific airplane flight manuals, crew manuals, minimum equipment lists or any other approved documentation. This handbook is provided for guidance purposes only. The working group does not accept any liability whatsoever for incidents arising from the use of the guidance contained in this document.

1.2.2 The important elements of an effective safety program are:

- Senior management commitment to the company safety program;
- Appointment of a flight safety officer reporting directly to the CEO;
- Encouragement of a positive safety culture;
- Establishment of a safety management structure;
- Hazard identification and risk management;
- Ongoing hazard reporting system;
- Safety audits and assessment of quality or compliance;
- Accident and incident reporting and investigation;
- Documentation;
- Immunity-based reporting systems;
- Implementation of a digital flight data recorder information collection system;
- The exchange of valuable "lessons learned" with manufacturers and other airlines;
- Safety training integration into the organization's training syllabi;
- Human factors training for all personnel;
- Emergency response planning; and,
- Regular evaluation and ongoing fine-tuning of the program.

1.2.3 For further information or to submit comments and/or suggestions related to this handbook, please contact: GAIN Aviation Operator Safety Practices Working Group; e-mail: <GAINweb@abacustech.com>; <http://www.gainweb.org>.

1.2.4 This handbook should be read, where appropriate, in conjunction with:

- The Airbus *Operations Policy Manual*, Chapters 2.03 ("Accident Prevention") and 11.00 ("Handling of Accidents and Occurrences");
- The Boeing Co.'s *Safety Program Model*;
- European Joint Aviation Requirements (JARs) — Operation of Aircraft (commercial air transport airplanes); and JARs 145 (maintenance);
- U.S. Federal Aviation Regulations applicable to the type of operation;
- Relevant International Civil Aviation Organization (ICAO) annexes; and,
- The operator's operations policy manuals/flight operations manual, as appropriate.

1.3 Scope

1.3.1 The methods and procedures described in this handbook have been compiled from experience gained in the successful development and management of flight safety programs in commercial airlines and corporate and cargo operations, as well as proven resources from governments, manufacturers and various other aviation organizations.

1.3.2 The aim of this handbook is to assist an operator in developing an effective safety program and/or allow an existing flight safety organization to further refine and improve its existing program.

2. Organization and Administration

Note: This handbook is intended to serve as a guide for the creation and operation of a flight safety function within the structure of an operator's organization. The final structure of the safety element will reflect the culture of the organization; nevertheless, the flight safety officer must be empowered to positively effect safety integration within this structure.

2.1 Executive Commitment

2.1.1 A safety program is essentially a coordinated set of procedures for effectively managing the safety of an operation. It is more than just safe operating practices. It is a total management program. Top management sets the safety standards. The chief executives or managers should:

- Specify the company's standards;
- Ensure that everyone knows the standards and accepts them; and,
- Make sure there is a system in place so that deviations from the standards are recognized, reported and corrected.

2.1.2 The company must maintain its standards through the support of the flight safety department. This requires that the staff are involved in developing the standards, their responsibilities are made clear, and all staff consistently work to the standards.

The ultimate responsibility for safety rests with the directors and management of the company. The company's attitude to safety— the company's *safety culture* — is established from the outset by the extent to which senior management accepts responsibility for safe operations, particularly the proactive management of risk. Regardless of the size, complexity or type of operation, senior management determines the company's safety culture. However, without the wholehearted commitment of all personnel, any safety program is unlikely to be effective.

2.1.3 There will always be hazards, both real and potential, associated with the operation of any aircraft. Technical, operational and human failures induce the hazards. The aim of every flight safety program, therefore, is to address and control them. This is achieved through the establishment of a safety program (see section 3, page 18) which ensures the careful recording and monitoring of safety-related occurrences for adverse trends in order to prevent the recurrence of similar incidents which could lead to an aircraft accident.

2.1.4 In some countries, the regulatory authority may require any commercial aircraft operator to nominate an individual to coordinate the company's flight safety program. This task is sometimes allocated to a pilot, flight engineer or ground engineer who acts in the capacity of flight safety officer as a secondary duty. The effectiveness of this arrangement can vary, depending on the amount of time available to carry out the secondary duty and the operational style of the company. It is best accomplished by the appointment of a full-time flight safety officer whose responsibility is to promote safety awareness and ensure that the prevention of aircraft accidents is the priority throughout all divisions and departments in the organization.

2.1.5 The company's policy manual should contain a signed statement by the accountable manager (usually the CEO) which specifies the company's safety commitment in order to give the manual credence and validation.

2.2 Elements of a Safety Management System

2.2.1 Management Commitment

2.2.1.1 An operator's commitment to safety is reflected in corporate values, mission, strategy, goals and policy. Ultimate responsibility, authority and accountability for the safety management process lie with the chairman, president and CEO. Each divisional vice president has the final responsibility, authority and accountability for the safety process in his/her division. The responsibility, authority and accountability to carry out the daily safety function are managed by this officer along organizational lines within the department(s) or by special assignment. Corporate workplace safety and health management is accomplished using the following mechanisms and recognized business practices:

- The three-year strategic business planning process (i.e., mission, strategies, goals and initiatives);
- The annual business and operating plan process;
- The establishment of specific safety performance measurements by each operating division;
- Inclusion of safety responsibility in each manager's job description and performance review;
- Naming of specific individuals responsible to achieve divisional/departmental safety initiatives;
- Requiring each location within an operational division to develop, maintain and implement a written workplace safety business plan;
- Establishing procedures that address the location's contractor exposures; and,
- Establishing a continuous improvement process, which utilizes a safety team or safety improvement team format within each operational division.

2.2.2 Employee Requirements/action

2.2.2.1 Each employee is responsible and personally accountable for:

- Performing only those technical functions for which they are trained;
- Observing/following/supporting established safety and health policies, practices, procedures and operational requirements;
- Notifying management of unsafe conditions directly or through anonymous procedures; other divisional and local methods are encouraged;
- Operating only that equipment on which they have been trained and are qualified to operate;
- Using required personal protective equipment as trained;
- Availing oneself of safety and health training;
- Following the established procedures to acquire, use and dispose of chemicals;
- Keeping work areas free of recognized hazards; and,
- Reporting occupational injuries and illnesses and aircraft damage in accordance with company policy.

2.2.3 Corporate Safety Responsibilities

2.2.3.1 The corporate safety group is responsible for ensuring that the safety and health management process is established, communicated, implemented, audited, measured and continuously improved for the corporation and divisional key customers. This will be accomplished via the following:

- Preparing and maintaining a corporate safety manual;
- Serving as a safety and health resource for all operational divisions and employees;
- Assisting with the organization/development of written workplace safety business plans;
- Assisting with the three-year and annual divisional planning processes (e.g., safety performance goals);
- Maintaining the official company safety management information database;
- Providing human factors expertise and program development;
- Providing consulting services on regulatory compliance issues;
- Providing ergonomics consulting and workplace safety training;
- Providing regular safety communication through corporate and divisional news media;
- Providing industrial hygiene services;
- Establishing and maintaining the chemical safety management process;
- Supporting continuous safety improvement programs;
- Providing emergency management tools and consulting services; and,
- Maintaining operating business partner safety relationships.

Note: Within an operator's organization, the complementary but different aspects of flight safety (including airworthiness) and health and safety management must be considered. Many of the principles of safety management are common to both areas, but this document deals with flight safety only.

2.2.3.2 Managers can achieve their results only through the efforts of their staff. An effective safety management system requires commitment from both the staff and management, but this can be achieved only if the managers provide the necessary leadership and motivation. This is true at all levels of management, but it is essential that the process is led by the CEO. The management's commitment to safety is fundamental and must be readily visible at all levels. Every opportunity for actively demonstrating this commitment to safety should be taken.

2.2.3.3 Safety management standards should be set which clearly allocate responsibilities. To provide a focus for the detail of the safety management system, a senior manager (the custodian of the system) should be tasked with this responsibility and trained in safety management to provide guidance in the development of the safety program. Monitoring performance levels against the agreed standards is vital to ensure that the objectives are achieved. Managers should set a positive example in safety matters at all times.

2.2.3.4 Continued reduction in accidents and serious incidents has been achieved by companies that lead the world in safety management and that have adopted safe working procedures. Safe working procedures must be combined with disciplined behavior to minimize accidents and serious incidents. Sustained leadership and motivation are required to achieve this often difficult aim. Effective leadership at all levels of management can focus the attention of all employees on the need to develop the right attitude and pride in the safe operation of the company.

2.2.4 Safety Management Policy Document

2.2.4.1 This document should be customized and signed by the CEO or managing director, and may be integrated within the quality manual. The document should include:

- Company safety principles:
  - Safety objectives;
  - Arrangements for the achievement of safety objectives;
  - Flight safety policy;
  - Health and safety policy;
  - Quality policy; and,
  - Corporate and safety standards;
- Provisions of flight safety services:
  - Management responsibilities;
  - Production of safety cases;
  - Review, verification and revision of safety cases with changing structure of business;
  - Regular provision of information to the Board and management;
  - Monitoring and auditing of safety;
  - Safety management guide;
  - Initial and recurrent training;
  - Improvement of safety culture;
  - Emergency planning;
  - Ownership and liabilities;
  - Director's responsibilities;
  - Interface with the regulatory authorities;
  - Third-party liabilities; and,
- Arrangements for technical support:
  - Use of contractors.

2.3 Organizational Structures

2.3.1 Accountable Manager — Definition

The person acceptable to the country's regulatory authority who has corporate authority for ensuring that all operations and maintenance activities can be financed and carried out to the standard required by the authority, and any additional requirements defined by the operator.

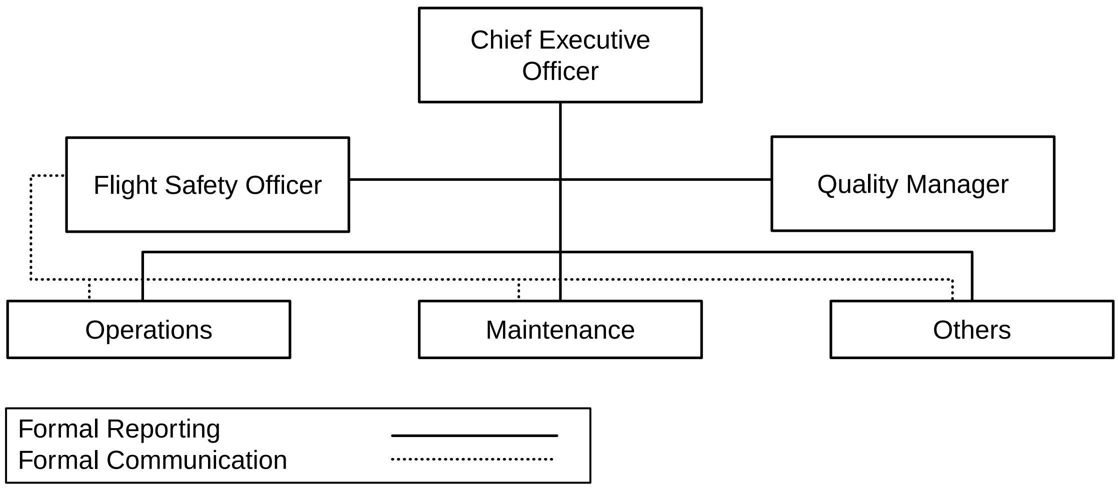
2.3.1.1 The responsibilities and authority of the flight safety officer and the chief pilot must be clear and understood to prevent conflict. The flight safety officer should report directly to the CEO. However, it is essential that the chief pilot's position is not undermined in the process. Senior level management needs to identify any potential problems and promulgate clear policy to maintain the integrity of the safety program and to avert any conflict.

2.3.1.2 Ideally, the flight safety officer should report directly to the CEO on all safety matters, because in this way safety reports and recommendations can be assured of the proper level of study, assessment and implementation. The flight safety officer needs to have the CEO's support and trust in order to effectively discharge his responsibilities without fear of retribution.

2.3.2 Examples of Flight Operations Management Organization

In order to interact freely, the flight safety officer must have uninhibited access to top management and all departments. The organizational structure shown in Figure 1, page 13 is one suggestion that provides direct access to the CEO and therefore eases communication throughout the organization. The exact placement of the flight safety officer

Example Organizational Structure



Note: Safety and quality functions may be combined under the same management function.

Figure 1

function can vary from organization to organization, according to the culture, but the critical elements of access to top management, operations and maintenance should always be maintained.

2.4 Safety Policies, Standards and Procedures

2.4.1 The management of safety is not only the responsibility of management. It is management that introduces the necessary procedures to ensure a positive cultural environment and safe practices.

2.4.2 Reviews of the safety performance of leading companies in safety-critical industries have shown that the best performers internationally use formal safety management systems to produce significant and permanent improvements in safety. Reporting situations, events and practices that compromise safety should become a priority for all employees.

2.4.3 Each element will be measurable, and its level of performance or efficiency will be measured at introduction and then at regular intervals. Specific and detailed targets will be set and agreed in each area to ensure continued incremental improvement of safety.

There are three prerequisites for successful safety management:

- A comprehensive corporate approach to safety;
- An effective organization to implement the safety program; and,
- Robust systems to provide safety assurance.

These aspects are interdependent, and a weakness in any one of them will undermine the integrity of the organization's overall management of safety. If the organization is effective in all three aspects, then it should also have a positive safety culture.

2.4.5 It is important to adhere to some important management disciplines:

- The manager responsible for developing the safety management system must ensure that all new safety management initiatives are well coordinated within a safety management development program approved by top management;
- The development program should be managed as a formal project, with regular reviews by top management; and,
- Each major change should be introduced only when the management team is satisfied that the change is compatible with existing procedures and management arrangements.

2.4.6 Standard operating procedures (SOPs) are a major contribution to flight safety. Procedures are specifications for conducting actions; they specify a progression of steps to help operational personnel perform their tasks in a logical, efficient and, most important, error-resistant way. Procedures must be developed with consideration for the operational environment in which they will be used.

Incompatibility of the procedures with the operational environment can lead to the informal adoption of unsafe operating practices by operational personnel. Feedback from operational situations, through observed practices or reports from operational personnel, is essential to guarantee that procedures and the operational environment remain compatible.

2.5 Flight Safety Officer — Job Description

2.5.1 Overall Purpose

The flight safety officer is the individual responsible for the oversight of the company's flight safety performance.

2.5.2 Dimension

2.5.2.1 The flight safety officer must possess the highest degree of integrity.

The position demands a meticulous approach and the ability to cope with rapidly changing circumstances in varying situations entirely without supervision. The flight safety officer acts independently of other parts of the company.

2.5.2.2 The job holder will be responsible for providing information and advice to the CEO on all matters relating to the safe operation of company aircraft. Tact and diplomacy are therefore prerequisite.

2.5.2.3 Assignments must be undertaken with little or no notice in irregular and unsocial hours.

2.5.3 Nature and Scope

2.5.3.1 The flight safety officer must interact with line flight crew, maintenance engineers, cabin crew and other general managers and department heads throughout the company to encourage and achieve integration of all activities, regardless of an individual's status and job discipline. The flight safety officer should also foster positive relationships with regulatory authorities and outside agencies.

The main functional points of contact within the company on a day-to-day basis are:

- Chief pilot;
- Head of operations;
- Head of security services;
- Head of technical services;
- Ground operations management;
- Flight training and standards management;
- Flight crew fleet management;
- Flight crew training management;
- Flight operations management;
- Cabin crew management;
- Engineering quality management;
- Flight operations quality management;
- Maintenance/technical control management; and,
- Human factors/crew resource management (CRM) management.

2.5.4 Qualifications

2.5.4.1 There are few individuals who readily possess all the skills and qualities necessary to fulfill this post. The suggested minimum attributes and qualifications required are:

- A broad aviation/technical education;
- A sound knowledge of commercial operations — in particular, flight operations procedures and activities;
- Experience as a flight crewmember or engineer;
- The ability for clear expression in writing;
- Good presentation and interpersonal skills;
- Computer literacy;
- The ability to communicate at all levels, both inside and outside the company;
- Organizational ability;
- The capability of working alone (at times under pressure);
- Good analytical skills;
- To exhibit leadership and an authoritative approach; and,
- Be worthy of commanding respect among peers and management officials.

2.5.5 Authority

2.5.5.1 On flight safety matters, the flight safety officer has direct and immediate access to the CEO and all management, and is authorized to conduct audits in connection with any aspect of the operation.

2.5.5.2 Where it is necessary to convene a company inquiry into an incident, the flight safety officer has the authority to implement the proceedings on behalf of the CEO in accordance with the terms of the company operations policy manual.

2.5.6 Training

2.5.6.1 The person selected would be expected to become familiar with all aspects of the company's organization, activities and personnel. This will be achieved in part by in-house induction training, but such knowledge is best acquired by self-education and research.

2.5.6.2 In-company training in basic computer skills such as word processing, database management and spreadsheets should be undertaken. A flight safety officer appointed from an engineering background should be given a condensed ground school and full flight simulator course which teaches the basics of aircraft handling, navigation and the use of aeronautical charts.

2.5.6.3 External training at the very least should cover the management of a flight safety program and basic accident investigation and crisis management.

2.5.6.4 Formal air safety training is available from a number of reputable sources internationally. Minimum training will consist of courses of instruction in basic air safety management and air accident investigation.

2.5.7 Flight Safety Officer — Terms of Reference

2.5.7.1 To enable the flight safety officer to implement and control the company flight safety program, the post-holder must have access to all departments at all levels. The primary responsibility is to provide information and advice on flight safety matters to the CEO.

2.5.7.2 The flight safety officer is responsible to the CEO for:

- Maintaining the air safety occurrence reporting database;
- Monitoring corrective actions and flight safety trends;
- Coordinating the regulatory authority's mandatory occurrence reporting scheme;
- Liaising with the heads of all departments companywide on flight safety matters;
- Acting as chairman of the company flight safety committee, arranging its meetings and keeping records of such meetings;
- Disseminating flight safety-related information companywide;
- Maintaining an open liaison with manufacturers' customer flight safety departments, government regulatory bodies and other flight safety organizations worldwide;
- Assisting with the investigation of accidents and conducting and coordinating investigations of incidents;
- Carrying out safety audits and inspections;
- Maintaining familiarity with all aspects of the company's activities and its personnel;
- Planning and controlling the flight safety budget;
- Managing or having oversight of the flight operational quality assurance (FOQA) program;
- Publishing the periodic company flight safety magazine; and,
- Participating in corporate strategic planning.

2.5.7.3 The basic fundamentals of salary, office space and furniture (including a dedicated telephone and fax machine) will most likely be allocated from a central administrative department. Additional funds will need to be obtained for:

- Personal computer (PC) hardware (including printer) of an approved industry standard;
- PC software to support all flight safety functions;
- Establishment of the electronic database, plus its maintenance;
- Information technology (computer services) support for e-mail and Internet service providers;
- Travel, accommodation and subsistence when undertaking assignments away from base;
- Printing and stationery;
- Subscriptions to industry publications and the purchase of regulatory authority documents and manuals;
- Travel and subsistence for outstation visits (audit and liaison) and attendance at industry meetings and conferences; and,
- Mobile telephone and pager.

2.5.7.4 The following items are desirable but not essential in a small operation:

- Home fax machine;

- A supply of protective clothing for use in extreme climates;
- Polaroid camera/digital camera; and,
- Memberships in professional organizations.

2.5.7.5 As an operator expands its activities, it will become increasingly difficult for the flight safety officer to function as a single entity. A developing route network means an increase in fleet size and the introduction of new, perhaps different types of aircraft to the inventory. When this happens, the number of occurrences will increase in proportion to growth.

2.5.7.6 As an example, one European airline which started operations with a single wide-body aircraft operating long-haul transatlantic passenger services in 1984 had increased its fleet size to four by 1989. In that year, 42 occurrences were recorded — only one of which was reportable to the regulatory authority — and there were no major incidents. By 1999, the airline was operating 31 aircraft of four different types, its route network had expanded across the world and the incidence of occurrences had risen to about 1,500 per year.

2.5.7.7 In the above circumstances, a minimally staffed flight safety department cannot provide an adequate monitoring function, so additional specialists will be needed. A method which works well in practice is to create the following secondary duty appointments:

- Fleet flight safety officers (pilots or flight engineers qualified in type);
- Engineering safety officers (licensed ground engineers with broad experience); and,
- Cabin safety officers (senior cabin crewmembers who are experienced in cabin crew training and SEP [safety equipment and procedures] development).

Their task is to assist with the monitoring of events peculiar to their own fleet or discipline and to provide input during the investigation of occurrences.

2.6 Responsibility and Accountability

2.6.1 The primary responsibilities for safety are as follows:

- The CEO is responsible for the safety and efficiency of company operations and for authorizing budgets accordingly. The annual aviation safety report produced by the company will be authorized by the CEO;
- The flight safety officer reports to the CEO and is responsible for proposing safety policy, monitoring its implementation and providing an independent overview of company activities insofar as they affect safety; maintaining, reviewing and revising the safety program; providing timely advice and assistance on safety matters to managers at all levels; and managing a reporting system for hazards;
- The quality manager reports to the CEO and is responsible for proposing quality policy, monitoring its implementation and providing an independent overview of company activities insofar as they affect quality;
- The accountable managers are responsible to the CEO for the efficient administration and professional management of all safety-significant activities and tasks important to safety which are within their defined areas of responsibility; and,
- The safety committees (flight, engineering and ground safety) review and coordinate the processes required to ensure that the operations of the company and subcontractors are as safe as practicable.

2.7 Recruiting, Retention and Development of Safety Personnel

2.7.1 The flight safety officer must maintain a constant awareness of developments and various other company activities. Personnel change routinely; therefore, working relationships with new colleagues must be established. In a successful company, new appointments will be created as departments expand, there will be changes in commercial policy, more aircraft will be acquired and new routes added to the existing structure.

2.7.2 Safety culture should start during the hiring process. If people with the right attitude are hired, their behavior will be the cornerstone of a safety culture.

2.7.3 When recruiting a new employee or transferring an existing member of staff, their physical abilities and intellectual capacity should obviously match the requirements of the tasks they are to perform. Workers who are not suitable for the job cannot be expected to perform satisfactorily. Thorough selection procedures are therefore necessary.

2.7.4 The selection procedure, particularly the interview, is designed to assess the ability, attitudes and motivation of potential recruits. Where appropriate, references should be reviewed to substantiate previous experience. Relevant documentary evidence in the form of certificates or licenses should be requested where appropriate.

The objectives of using such procedures are:

- To improve safety, quality, efficiency and employee morale;
- To minimize the risk of placing employees in jobs to which they are not suited; and,
- To reduce absenteeism and staff turnover.

2.8 Safety Training and Awareness

2.8.1 Training is of fundamental importance to effective job performance. Effective performance means compliance with the requirements of safety, profitability and quality. To meet this training need, it is necessary to establish a program which ensures:

- A systematic analysis to identify the training needs of each occupation;
- The establishment of training schemes to meet the identified needs; and,
- The training is assessed and is effective, in that each training session has been understood and the training program is relevant.

The program involves the review of all occupations, analysis and observation of critical activities, accident and incident analysis, and statutory requirements. The objective of all training is to equip employees with the skills and knowledge to carry out their duties safely and effectively.

All appropriate training methods should be used, but there will be no substitute for practical on-the-job instruction in some occupations. Whatever training techniques are adopted, it is important that the effectiveness of the training is assessed and that training records are maintained. Periodic reviews of the training program are required to ensure that it remains relevant and effective.

2.8.2 Management Safety Awareness and Training

2.8.2.1 For the successful operation of any management system, it is essential that the management team understand the principles on which the system is based. Effective training of management ensures this objective. Training should equip all those having supervisory responsibility with the necessary skills to implement and maintain the safety program.

2.8.2.2 This element details the training of managers and supervisors in the following areas:

- Initial training soon after appointment to a supervisory position to acquaint new managers and supervisors with the principles of the safety management system, their responsibilities and accountability for safety and statutory requirements;
- Detailed training in the safety management system, including the background and rationale for each element;
- Skills training in relevant areas such as communications, safety auditing and conducting group meetings; and,
- Regular update and refresher training.

2.8.2.3 Corporate training courses ensure that managers and supervisors are familiar with the principles of the safety management system and their responsibilities and accountabilities for safety. On-site training ensures that all staff are acquainted with the relevant information appropriate to their function.

2.8.2.4 It is also important that training is provided at an early stage for the safety custodian. The custodian needs to be aware of the detail of the safety management system and proven techniques for implementing the elements. As the focal point for the system, the safety custodian should be thoroughly conversant with the program and safety management principles.

2.8.3 Fundamentals of Training Implementation

2.8.3.1 The greatest benefits are achieved by adhering to the following practices:

- Assess the status of the organization before implementation. It is important to know how widely concepts are understood and practiced before designing specific training. Surveys, observations at work and analysis of incident/accident reports can provide essential guidance for program designers;
- Get commitment from all managers, starting with senior managers. Resource management programs are received much more positively by operations personnel when senior managers, flight operations managers and flight standards officers conspicuously support the basic concepts and provide the necessary resources for training. Training manuals should embrace concepts by providing employees with the necessary policy and procedures guidance;
- Customize the training to reflect the nature and needs of the organization. Using knowledge of the state of the organization, priorities should

be established for topics to be covered, including special issues such as the effects of mergers or the introduction of advanced technology aircraft;

- Define the scope of the program. Institute special training for key personnel, including developers/facilitators and supervisors. It is highly beneficial to provide training for these groups before beginning training for others. The training may later be expanded to include pilots, flight attendants, maintenance personnel and other company resource groups as appropriate. It is also helpful to develop a long-term strategy for program implementation; and,

- Communicate the nature and scope of the program before start-up. Training departments should provide employees with a preview of what the training will involve and plans for initial and continuing training. These steps can prevent misunderstanding about the focus of the training or any aspect of its implementation.

2.8.3.2 In conclusion, effective resource management begins in initial training; it is strengthened by recurrent practice and feedback; and it is sustained by continuing reinforcement that is part of the corporate culture and embedded in every element of an employee's training.

3. Safety Program Activities

3.1 Introduction

3.1.1 The elements of the safety management system outlined in this document are not exhaustive but give an introduction to one approach to safety management. It is important to understand that the information contained in this section is designed to explain the principles and does not constitute an action plan.

3.1.2 These elements are the individual building blocks of the system, but they should only be introduced in a planned and project-managed process, and their implementation should be phased to ensure the success of each stage. Aspects of some of the elements may already be in place but may need to be modified in order to be compliant with the requirements of the company's safety management system.

3.2 Objectives and Descriptions

3.2.1 Maintaining Familiarity With the Company's Activities

3.2.1.1 The flight safety officer must maintain a constant awareness of developments. Personnel change routinely; therefore, working relationships with new colleagues must be established. In a successful company, new appointments will be created as departments expand, there will be changes in commercial policy, more aircraft will be acquired and new routes added to the existing structure. As well, in times of economic constraint, positions may be eliminated and duties increased.

3.2.1.2 The procedures set out in this handbook are designed to accommodate such changes, but in order to obtain the best benefits, a periodic review of the flight safety program in relation to the company's development is essential.

3.3 Company Flight Safety Committee

3.3.1 The formation of a flight safety committee (sometimes called a flight safety review board) provides a method of obtaining agreement for action on specific problems. Its tasks are to:

- Provide a focus for all matters relating to the safe operation of company aircraft; and,
- Report to the chief executive officer (CEO) on the performance of the company in relation to its flight safety standards.

3.3.2 The committee should not be granted the authority to direct individual departments or agencies. Such authority interferes with the chain of command and is counterproductive. Where the need for action is identified during matters arising at meetings, a recommendation from the committee is usually sufficient to obtain the desired result.

3.3.3 Membership

3.3.3.1 Membership of the committee should be made up of management representatives from key flight operations, engineering, flight and cabin crew training departments. It is at this departmental level where most problems surface.

3.3.3.2 Numbers should be kept to a minimum. The following list is not exhaustive, and membership should typically consist of:

- Flight safety officer;
- Flight operations director;
- Chief pilot;
- Flight training and standards management;
- Fleet management (or fleet training captains);

- Quality management (engineering and flight operations);
- Line maintenance management;
- Flight operations management;
- Ground operations management; and,
- Cabin crew management.

3.3.4 Managing the Committee

3.3.4.1 In a small, developing organization, the flight safety officer may have the dual role of chairman and secretary. Chairmanship (i.e., control of the committee) can be vested in any other member, but the independence of office grants the flight safety officer an overall view of the operation so that he/she is the least likely member to become focused on an isolated issue. As the organization expands and the size of the committee increases, the flight safety officer may relinquish one or both duties to another member of the committee.

3.3.4.2 Minutes must be recorded for circulation to the CEO, committee members and other staff as appropriate. The minutes should contain a summary of incidents which have occurred since the last meeting and brief details of corrective action and preventive measures implemented.

3.3.4.3 Secretarial duties also include arranging meetings, booking the venue and developing and circulating the agenda.

3.3.4.4 Safety committees are an important tool of safety management and are invaluable in fostering a positive safety culture. These committees will help to identify problem areas and implement solutions. The details of safety improvements derived from these meetings should be widely communicated throughout the organization.

3.3.4.5 The importance of regularly held, formal safety meetings cannot be overstated. The safety management system can continue to be relevant to the company only if the decisions made at these meetings are acted upon and supported by senior management.

3.3.4.6 The active representation of the CEO and department heads is vital if safety committees are to be effective. The people who have the capacity to make and authorize decisions should be in attendance. Without the involvement of these decision makers, the meetings will just be “talking shop.” Department heads should also hold regular meetings with their staff to allow safety concerns and ideas to be discussed.

3.3.4.7 The importance given by the CEO and all levels of management to resolving safety issues at these meetings will demonstrate the company’s commitment to safety.

3.3.4.8 The structure and number of committees will depend on the size of the organization. It might be sufficient for a small operation to manage with one committee covering all areas. Larger organizations may require a formal structure of safety review boards and safety committees to manage their requirements. A method should also be established for all employees to have written or verbal input into the appropriate meetings.

3.3.4.9 The purpose of these committees and review boards is to coordinate the required processes to ensure that the operations of the company and its subcontractors are as safe as reasonably practicable.

3.3.4.10 A quarterly meeting is a reasonable and practical timetable. This can be reviewed as the committee’s activities (and those of the company) develop. An extraordinary meeting may be called at any other time the chairman considers it necessary (following a major incident, for example).

3.3.4.11 Meetings should be arranged on a regular basis and the schedule published well in advance, ideally a year. The circulation list should include members’ secretaries and crew scheduling for flight crewmembers. Scheduled meetings should be re-notified two weeks before the appointed day.

3.3.5 Agenda

3.3.5.1 The agenda should be prepared early and distributed with the two-week notification. Solicit members for items they wish to be included for discussion, and make it known that only published agenda items will be discussed.

3.3.5.2 An example format that allows the chairman to exercise proper control is:

- Review of the minutes of the previous meeting;
- Review of events (including incidents/accidents);
- Mandatory occurrence reports (MORs) issued since the last meeting; and,
- New business.

3.3.5.3 Have spare copies of the agenda and any relevant documents to distribute at the start of the meeting.

3.3.6 Summary:

- Notify meetings and distribute the agenda well in advance;
- Place a time limit on the proceedings — start and finish on time;
- Discuss only agenda items — summarize frequently;
- When collective agreement on a particular issue is reached, write it down for publication in the minutes;
- Keep the meeting flowing. Its purpose is to present reasoned, collective judgment;
- Do not let arguments develop or allow members to return to items already closed;
- Make sure that the minutes are an accurate record of the committee's conclusions;
- Always let the committee know when action items are completed; and,
- Ban mobile telephones from the meeting room.

3.4 Hazard Reporting

3.4.1 Staff must be able to report hazards or safety concerns when they become aware of them. The ongoing hazard reporting system should be nonpunitive, confidential, simple, direct and convenient. Once hazards are reported, they must be acknowledged and investigated. Recommendations and actions must follow to address the safety issues.

3.4.2 There are many such systems in use. The reporting form for the Australian Transport Safety Bureau (ATSB) Confidential Aviation Incident Reporting (CAIR) system could be adapted for this purpose (see Appendix A, page 56). Ensuring a confidential and nonpunitive system will encourage reporting of hazards. It should also allow for the reporting of hazards associated with the activities of any contracting agency where there may be a safety impact. The system should include a formal hazard-tracking and risk-resolution process. Hazards should be defined in a formal report. The report should be tracked until the hazard is eliminated or controlled to an acceptable risk. The controls should also be defined and should be verified as formally implemented.

3.4.3 What hazards should staff report?

3.4.3.1 All staff should know what hazards they are required to report. Any event or situation with the potential to result in significant degradation of safety, damage and/or injury should be reported.

3.4.4 How will staff report hazards?

3.4.4.1 The company might like to use existing paperwork, such as the pilot's report, for flying operations. It is easy to provide a dedicated reporting form for other functional areas. Make sure that reports are acted upon in a timely manner by the person responsible for your safety program.

3.4.4.2 In a small organization, it may be difficult to guarantee the confidentiality of safety reports, so it is vital that a trusting environment is fostered by management. Make the reporting system simple and easy to use. Suggested reports:

- Pilot's report; and,
- Hazard/safety report.

3.4.4.3 The reporting system should maintain confidentiality between the person reporting the hazard and the flight safety officer. Any safety information distributed widely as a result of a hazard report must be de-identified.

3.4.4.4 The system should include procedures such as:

- All safety reports go to the flight safety officer;
- The flight safety officer is responsible for investigation of the report and for maintenance of the confidentiality of reports;
- While maintaining confidentiality, the flight safety officer must be able to follow through on a report to clarify the details and the nature of the problem;
- Anyone submitting a safety report must receive acknowledgement and feedback; and,
- After investigation, the de-identified safety report and recommendations should be made widely available for the benefit of all staff.

3.4.5 To whom will the reports go, and who will investigate them?

3.4.5.1 Management should be included in the risk management process. Decisions concerning risk acceptability should be made by management, and management should be kept informed of all high-risk considerations. Hazards that were not adequately resolved should be communicated to management for resolution.

3.4.5.2 Reports should be distributed to, as a minimum, the following:

- The person responsible for managing the safety program;

- The flight safety committee (if applicable); and,
- The originator of the report.

3.4.6 Human Element in Hazard Identification and Reporting

3.4.6.1 The human is the most important aspect in the identification, reporting and controlling of hazards. Most accidents are the result of an inappropriate human action (e.g., human error, less-than-adequate design, less-than-adequate procedure, loss of situational awareness, intentional action, less-than-adequate ergonomic or human factor consideration). Human contributors account for 80 percent to 90 percent of accidents. To a system safety professional, almost all accidents are the result of human error.

3.4.6.2 At inception of a system, a hazard analysis should be conducted in order to identify contributory hazards. However, if these hazards were not eliminated, then administrative hazard controls must be applied (e.g., safe operating procedures, inspections, maintenance and training).

3.4.6.3 The behavior-based approach to safety focuses on the human part of the equation. The approach is proactive and preventive in nature. It is a process of identifying contributory hazards and gathering and analyzing data to improve safety performance. The goal is to establish a continued level of awareness, leading to an improved safety culture.

3.4.6.4 To successfully apply the behavior-based approach, everyone in the organization should participate. In summary, the people in the organization are trained in hazard identification. The concept of a hazard (i.e., an unsafe act or unsafe condition that could lead to an accident) is understood. Participants develop lists of hazards in their particular environment and then conduct surveys to identify unsafe acts or unsafe conditions. Hazards are then tracked to resolution. The process should be conducted positively rather than negatively. One does not seek to lay blame or assign causes. The participants are to be positively rewarded for efforts, thereby improving the safety culture.

3.4.7 Monitoring and Tracking (Feedback)

3.4.7.1 Maintaining the Air Safety Occurrence Database

3.4.7.1.1 Data for trend analysis is gathered from air safety reports (ASRs) submitted by flight crew and ground crew. The purpose of these reports is to enable effective investigation and follow-up of occurrences, and to provide a source of information for all departments. The objective of disseminating reported information is to enable safety weaknesses to be quickly identified.

3.4.7.1.2 Paper records can be maintained in a simple filing system, but such a system will suffice only for the smallest of operations. Storage, recording, recall and retrieval is a cumbersome task. ASRs should therefore preferably be stored in an electronic database. This method ensures that the flight safety officer can alert departments to incidents as they occur and that the status of any investigation together with required follow-up action to prevent recurrence can be monitored and audited on demand.

3.4.7.1.3 There are a number of specialized air safety electronic databases available. The functional properties and attributes of individual systems vary, and each should be considered before deciding on the most suitable system for the operator's needs. Once information from the original ASR has been entered into an electronic database, recall and retrieval of any number of single or multiple events over any period of time are almost instantaneous. Occurrences can be recalled by aircraft type, registration, category of occurrence (e.g., operational, technical, environmental, etc.) by specific date or time span.

Note: The International Air Transport Association (IATA) Safety Committee (SAC) operates a safety information exchange (SIE) and compiles statistics using an electronic database. Stored records are de-identified, and subscribers have free access. Very small airlines (i.e., those having only one or two aircraft) can benefit in that they can measure their progress against the rest of the world and quickly identify global trends.

3.4.7.1.4 The database is networked to key departments within flight operations and engineering. It is the responsibility of individual department heads and their specialist staffs to access records regularly in order to identify the type and degree of action required to achieve the satisfactory closure of a particular occurrence. It is the flight safety officer's responsibility to ensure that calls for action on a particular event are acknowledged and addressed by the department concerned within a specified time. The database should not be used simply as an electronic filing cabinet.

3.4.7.1.5 Once the required action is judged to be complete and measures have been implemented to prevent recurrence, a final report must then be produced from consolidated database entries. The event can then be recommended for closure.

3.5 Immunity-based Reporting

3.5.1 It is fundamental to the purpose of a reporting scheme that it be nonpunitive, and the substance of reports should be disseminated in the interests of flight safety only.

3.5.2 The evidence from numerous aviation accidents and incidents has shown that the lack of management control of human factors is detrimental to the safe operation of aircraft. The management of safety is not just the responsibility of management, but it is management that has to introduce the necessary procedures to ensure a positive cultural environment and safe practices.

3.5.3 Reviews of the safety performance of leading companies in safety-critical industries have shown that the best performers internationally use formal safety management systems to produce significant and permanent improvements in safety. It is also important to develop a safety culture that encourages openness and trust between management and the work force. For example, all employees should feel able to report incidents and events without the fear of unwarranted retribution. Reporting situations, events and practices that compromise safety should become a priority for all employees.

3.5.4 The aim of this guide is to introduce the elements of a safety management system. Each element will be measurable, and its level of performance or efficiency will be measured at introduction and then at regular intervals. Specific and detailed targets will be set and agreed in each area to ensure continued incremental improvement of safety.

3.5.5 Confidential Reporting Programs

3.5.5.1 It has been estimated that for each major accident (involving fatalities), there are as many as 360 incidents that, properly investigated, might have identified an underlying problem in time to prevent the accident. In the past two decades, there has been much favorable experience with nonpunitive incident and hazard reporting programs. Many countries have such systems, including the Aviation Safety Reporting System (ASRS) in the United States and the Confidential Human Factors Incident Reporting Program (CHIRP) in the United Kingdom. In addition to the early identification and correction of operational risks, such programs provide much valuable information for use in safety awareness and training programs.

3.5.5.2 These aspects are interdependent, and a weakness in any one of them will undermine the integrity of the organization's overall management of safety. If the organization is effective in all aspects, then it should also have a positive safety culture.

3.5.5.3 Reports should preferably be recorded in an electronic database such as BASIS (British Airways Safety Information System). This method ensures that departments are made aware of incidents as they occur, and the status of any investigation together with required follow-up action to prevent recurrence can be monitored.

3.5.6 Occurrence Reporting Schemes

3.5.6.1 Some countries legislate a mandatory occurrence reporting scheme. If such a scheme does not exist, it is beneficial for the company to initiate its own. Without prejudice to the proper discharge of its responsibility, neither the regulatory authority nor the company should disclose the name of any person submitting a report or that of a person to whom it relates unless required to do so by law, or unless the person concerned authorizes a disclosure. Should any flight safety follow-up action be necessary, the regulatory authority will take all reasonable steps to avoid disclosing the identity of the reporter or of individuals involved in the occurrence.

3.5.6.2 The following list of occurrences which should be reported to the flight safety officer is neither exhaustive nor shown in order of importance. Sample reporting forms are provided in Appendix A. If there is any doubt, a report should be filed for any of the following:

- System defect which adversely affects the handling characteristics of the aircraft and renders it unfit to fly;
- Warning of fire or smoke;
- An emergency is declared;
- Safety equipment or procedures are defective or inadequate;
- Deficiencies exist in operating procedures, manuals or navigational charts;
- Incorrect loading of fuel, cargo or dangerous goods;
- Operating standards are degraded;
- Any engine has to be shut down in flight;
- Ground damage;
- A rejected takeoff is executed after takeoff power is established;

- A runway or taxiway excursion;
- Significant handling difficulties;
- A navigation error involving a significant deviation from track;
- An altitude excursion of more than 500 feet;
- An exceedance of the limiting parameters for the aircraft configuration or a significant unintentional speed change;
- Communications fail or are impaired;
- A ground-proximity warning system (GPWS) warning;
- A stall warning;
- A heavy landing check is required;
- Serious loss of braking;
- Aircraft evacuation;
- Aircraft lands with reserve fuel or less remaining;
- An AIRPROX (Airmiss) or traffic-alert and collision avoidance system (TCAS) event, air traffic control (ATC) incident or wake turbulence event;
- Significant turbulence, wind shear or other severe weather;
- Crew or passengers become seriously ill, are injured or become incapacitated;
- Difficulty in controlling violent, armed or intoxicated passengers, or when restraint is necessary;
- Toilet smoke detectors are activated;
- Any part of the aircraft or its equipment is sabotaged or vandalized;
- Security procedures are breached;
- Bird strike or foreign object damage (FOD);
- Unstabilized approach under 500 feet; or,
- Any other event considered to have serious safety implications.

3.5.6.3 The objective and systematic observation of activities being performed can yield much useful information for the safety management system and help to reduce losses. The aim is to reveal problems and shortcomings which could lead to accidents. Typically, such shortcomings can be inadequate equipment or procedures, lack of effective training, or the use of inappropriate materials. The outcome should be action to reduce and control risks.

3.5.6.4 Follow-up and Closure of Reports

3.5.6.4.1 Some reports can be closed on receipt. If follow-up is required, action will have been assigned to the appropriate department(s). The flight safety officer will review responses and, if satisfactory, recommend closure of the incident at the next flight safety committee meeting. If responses are unsatisfactory and do not address the problem, the incident must remain open for continuing review and action as required.

3.5.6.4.2 If a mandatory occurrence reporting scheme is in effect in the country, recommendation for the closure of a report must be agreed with the regulatory authority. The authority and the reporter must be informed of action taken once the report is closed.

3.6 Compliance and Verification (Quality System)

3.6.1 Complying with policies and safety regulations can require considerable time commitments and resources. Planning ahead to complete required compliance issues can save the company money by improving employee scheduling and help to avoid potential penalties resulting from noncompliance. Compliance issues can require a wide variety of safety activities on the part of the operator. The primary compliance items generally involve training, walk-through functions and monitoring existing programs.

3.6.2 When a quality system is in operation, compliance and verification of policies and regulations is accomplished through quality audits.

3.6.3 When the safety management system is first implemented, a system safety assessment will have been carried out to evaluate the risks and introduce the necessary controls. As the organization develops, there will inevitably be changes to equipment, practices, routes, contracted agencies, regulations, etc. In order for the safety management system to remain effective, it must be able to identify the impact of these changes. Monitoring will ensure that the safety management system is updated to reflect the changes in organizational circumstances (and is reviewed constantly).

3.6.4 Monitoring the safety management system is the way in which it is constantly reviewed and refined to reflect the company’s changing arrangements. Statistical recording of all monitoring should be undertaken and the results passed to the safety manager.

3.7 Safety Trends Analysis

3.7.1 *One event can be considered to be an isolated incident; two similar events may mean the start of a trend*. This is a safe rule to follow. If an event recurs after preventive measures are in place, the cause must be determined to ascertain whether further corrective action is necessary or whether the steps in a particular operating procedure or maintenance schedule have been ignored.

3.7.2 An electronic database is capable of providing an automatic trend analysis by event and aircraft system type, with the results being displayed in either graphic or text format.

3.7.3 Flight safety-related incidents are best recorded and tracked using a PC-driven electronic database. Most programs are modular, Microsoft Windows-based applications designed to run on Windows versions 3.1, 95, 98 or NT. The number of features available will depend on the type and standard of system selected.

3.7.4 Basic features enable the user to:

- Log flight safety events under various categories;
- Link events to related documents (e.g., reports and photographs);
- Monitor trends;
- Compile analyses and charts;
- Check historical records;
- Data-share with other organizations;
- Monitor event investigations;
- Apply risk factors; and,
- Flag overdue action responses.

3.7.5 When notes relating to an event have been entered, the program will automatically date- and time-stamp the record and also log the name of the person who input the information. The system administrator can limit or extend an individual user's viewing and amendment capability by controlling rights of access (e.g., view-only/add notes/edit notes/delete entries/access crew names, etc.).

3.7.6 Additional modules provide enhancements such as:

- Flight parameter exceedances;
- Flight instrument replay;
- Flight path profile display; and,
- Cost analysis.

3.8 FOQA Data Collection and Analysis

3.8.1 Flight operational quality assurance (FOQA) is the routine downloading and systematic analysis of digital flight data recorder (DFDR) data whose threshold limits are set (with a suitably built-in safety margin) from aircraft systems parameters. The European community has enjoyed the benefits from this process of analysis for over 30 years. The U.S. community is currently implementing FOQA via a demonstration project sponsored by the U.S. Federal Aviation Administration (FAA). Airline participation is increasing, and positive results have been realized.

3.8.2 Modern glass-cockpit and fly-by-wire aircraft are delivered equipped with the necessary data buses from which information can be downloaded virtually on demand to a quick-access recorder (QAR) for subsequent analysis. Older aircraft can be retrofitted to suit the needs of the operator.

3.8.3 A FOQA program should be managed by a dedicated staff within the safety or operations departments. It should have a high degree of specialization and logistical support. It must be recognized as a program which is founded on a bond of trust between the operator, its crews and the regulatory authority. The program must actively demonstrate a nonpunitive policy. The main objective of a FOQA program is to improve safety by identifying trends, not individual acts.

3.8.4 The purpose of a FOQA program is to detect latent patterns of behavior among flight crews, weaknesses in the ATC system and anomalies in aircraft performance which portend potential aircraft accidents.

3.8.5 Benefits of a FOQA Program

3.8.5.1 A successful FOQA program encourages adherence to standard operating procedures (SOPs), deters nonstandard behavior and so enhances flight safety. It will detect adverse trends in any part of the flight regime and so facilitates the investigation of events other than those which have had serious consequences. Examples include:

- Unstabilized and rushed approaches;
- Exceedance of flap limit speeds;
- Excessive bank angles after takeoff;
- Engine over-temperature events;
- Exceedance of recommended speed thresholds (V speeds);

- GPWS/terrain awareness and warning system (TAWS) warnings;
- Onset of stall conditions;
- Excessive rates of rotation;
- Glide path excursions; and,
- Vertical acceleration.

3.8.5.2 For crewmembers, a properly developed and executed FOQA program (i.e., one that is nonpunitive, confidential and anonymous) is nondisciplinary and does not jeopardize the crewmember's career.

3.8.6 FOQA in Practice

3.8.6.1 After the data are analyzed and verified by the FOQA staff, the events are grouped by aircraft fleet and examined in detail by fleet representatives. They use their knowledge of the aircraft and its operation to make an assessment. If necessary, a pilots' association representative may be requested to speak informally with the flight crew concerned to find out more about the circumstances.

3.8.6.2 The pilots' association representative may either just take note of the crew's comments or highlight any deviation from SOPs. If deficiencies in pilot handling technique are evident, then the informal approach, entirely remote from management involvement, usually results in the pilot self-correcting any deficiencies. If any retraining is found to be necessary, this is carried out discreetly within the operator. An agreed-upon representative should be the contact with crewmembers in order to clarify the circumstances, obtain feedback and give advice and recommendation for training or other appropriate action. It is suggested that a formal written agreement between the organization and the industrial/trade organizations representing the employees be implemented concerning the FOQA program, as well as any voluntary reporting systems.

3.8.6.3 Where the development of an undesirable trend becomes evident (e.g., within a fleet or at a particular phase of flight or airport location), then the fleet's training management can implement measures to reverse the trend through modification of training exercises and/or operating procedures.

3.8.6.4 As a quality control tool, flight data monitoring through a FOQA program will highlight deviations from SOPs which are of interest even if they do not have direct safety consequences. This is particularly useful in confirming the effectiveness of training methods used either in recurrent training or when crews are undergoing type conversion training.

3.8.7 Implementing a FOQA Program

3.8.7.1 Bearing in mind the high degree of specialization and extensive resources required, it would take up to 12 months for a FOQA program to reach the operational phase and a further 12 months before safety and cost benefits can begin to be accurately assessed.

3.8.7.2 Planning and preparation should be undertaken in the following sequence:

- Establish a steering committee. Involve the pilot's association from the start;
- Define the objective;
- Identify participants and beneficiaries;
- Select the program;
- Select specialist personnel;
- Define event parameters;
- Negotiate pilot and union agreement; and,
- Launch FOQA.

3.8.7.3 Implementation:

- Establish and check security procedures;
- Install equipment;
- Train personnel; and,
- Begin to analyze and validate data.

3.8.8 U.S. FAA FOQA Program

3.8.8.1 The FAA has sponsored a FOQA demonstration study in cooperation with industry in order to permit both government and industry to develop hands-on experience with FOQA technology in a U.S. environment, document the cost-benefits of voluntary implementation and initiate the development of organizational strategies for FOQA information management and use. The FOQA demonstration study has been conducted with major operators in the United States. Analysis of the flight data information, which is de-identified at the time of collection, has provided substantial documentation of the benefits of FOQA. The study results are very similar to the results of foreign air carriers, many of which have long experience in the use of this technology.

3.8.8.2 Based on the results of this study, the FAA has concluded that FOQA can provide a source of objective information on which to identify needed improvements in flight crew performance, air carrier training programs, operating procedures, ATC procedures, airport maintenance and design, and aircraft operations and design. The acquisition and use of such information clearly enhance safety.

3.8.8.3 For further information, contact: Federal Aviation Administration, Air Transport Division, Flight Standards Service, PO Box 20027, Washington, DC 20591 USA. Web: <www.faa.gov/avr/afshome.htm>.

3.8.9 FOQA Summary

3.8.9.1 A flight safety department is generally seen by accountants as one that does not contribute to the profitability of an operator; it only appears to spend money. Although there may be monetary benefits to be gained by the introduction of a FOQA program, its main contribution is that overall flight safety is enhanced.

3.8.10 Flight Data Recorder (FDR) Data Collection and Analysis

3.8.10.1 One of the most powerful tools available to a company striving for improvements in the safe operation of its aircraft is the use of FDR data analysis. Unfortunately, it is often viewed as one of the most expensive in terms of the initial outlay, software agreements and personnel requirements. In reality, it has the potential to save the company money by reducing the risk of a major accident, improving operating standards, identifying external factors affecting the operation and improving engineering monitoring programs.

3.8.10.2 FDR data analysis allows the monitoring of various aspects of the flight profile such as adherence to the prescribed procedures for takeoff, initial climb, descent, approach and landing. By selecting specific aspects, it is also possible to concentrate on them in either a proactive way prior to changes in the operation or retrospectively. The introduction of a new fleet or new routes, for example, will inevitably expose the company to new hazards and influence existing ones, potentially increasing the risk of a major incident.

3.8.10.3 Using the analysis of FDR data after an incident is becoming quite common, but the ability to compare a specific flight with the fleet profile gives the ability to analyze the systemic aspects of the incident. It may be that the parameters of the incident vary only slightly from numerous other flights, indicating the requirement for a change in operating technique or training. For example, it would be possible to determine whether a tail strike on landing was an isolated incident or symptomatic of mishandling during the approach or over-flaring on touchdown.

3.8.10.4 Engine monitoring programs are often computer-based but rely on the manually recorded subjective data being manually input. This time-consuming and labor-intensive process limits its potential to be accurate and proactive. For example, an engine may fail before a trend has been identified. Using FDR data, accurate analysis is possible within a short time scale, increasing the potential for preventative action. It also becomes possible to monitor other aspects of the airframe and components.

3.8.10.5 A properly constituted FDR program has the greatest potential for improving the safety of operating techniques and increasing the company's knowledge of its aircraft performance.

3.8.10.6 It should be emphasized that the standardization of data collection and reporting programs across the aviation industry is essential to enable information sharing between all operators. For example, Transport Canada has sponsored the development of a flight recorder configuration standard (FRCS) that defines the content and format for electronic files that describe the flight data stored on a flight data recorder system. Further efforts are required to accomplish this goal.

3.9 Dissemination of Flight Safety Information

3.9.1 The flight safety officer must have sound knowledge and understanding of the types and sources of information available, and must therefore have ready access to libraries and files. Operations and engineering procedures are set out in individual aircraft type operations manuals (OMs), airplane flight manuals (AFMs), flight crew operations manuals (FCOMs) and maintenance manuals (MMs). Any supplementary flight safety-related information that is of an operational or engineering nature is promulgated by:

- Notices issued by the aircraft or equipment manufacturer; and,
- Company notices.

3.9.2 Effective communication is vital to promoting a positive safety culture. The crucial point is not so much the apparent adequacy of safety plans but the perceptions and beliefs that people hold about them. A company's safety policies and procedures may appear well considered, but the reality among the work force may be sullen skepticism and false perceptions of risk.

3.9.3 Research clearly shows that openness of communication and the involvement of management and workers characterize companies with positive safety culture while poor safety culture is associated with rumor-driven communication, step-change reorganization, lack of trust, rule book mentality and "sharp-end" blame culture.

3.9.4 Critical safety topics should be selected for promotional campaigns based on their potential to control and reduce losses due to accidents and incidents. Selection should therefore be based on the experience of past accidents or near misses, matters identified by hazard analysis and observations from routine safety audits. Employees should also be encouraged to submit suggestions for promotional campaigns.

3.9.5 Recognition of good safety performance can have promotional value provided that it is based on safety performance measured against high safety standards. Awards for good accident records have unfortunately been found to encourage the concealment of accidents and are not recommended.

3.9.6 Communication is a major part of any management activity. To communicate effectively, a company must first assess the methods available and then determine those that are the most appropriate. All methods of communication must allow upward as well as downward transfer of information and must encourage feedback from all users of the safety management system.

3.9.7 The flight safety officer must coordinate the dissemination of flight safety information within and outside the company. The precise method adopted and the channels used will depend on the degree and type of administrative support available.

3.9.8 Other Flight Safety Information

3.9.8.1 The regulatory authority may require the operator to disseminate other flight safety-related information as part of its accident prevention and flight safety program. Joint Aviation Requirements — Operations (JAR-OPS) 1.037, for example, requires operators to "establish programs … for the evaluation of relevant information relating to accidents and incidents and the promulgation of related information." Whether compulsory or voluntary, such a program is essential in maintaining a flight safety awareness throughout the company. There are many sources from which to draw.

3.9.8.2 All personnel should be responsible for keeping themselves apprised of flight safety matters and for studying promptly any material distributed to them. The company operations policy manual should contain an instruction to this effect. The flight safety officer should also encourage the submission of flight safety information from any source for evaluation and possible distribution.

3.9.8.3 The method of disseminating general flight safety information in-company must be decided by the flight safety officer. It is best accomplished by the publication of regular flight safety newsletters, magazine-type reviews and the use of bulletin boards. The former can be distributed either in paper form or electronically using an Intranet facility if it is available. Whatever the chosen methods, information relative to each discipline must be circulated to every member of flight crew, cabin crew, maintenance staff and ground/flight operations.

3.9.8.4 Industry occurrence reports can sometimes be obtained from the regulatory authority. The U.K. Civil Aviation Authority (CAA), for example, through its Safety Data Analysis Unit, publishes a monthly list of reportable occurrences involving aircraft and equipment failures, malfunctions and defects during U.K. public transport operations. Occurrences are listed under fixed-wing, rotary-wing and ATC categories. There is also a monthly *Digest of Occurrences*, which amplifies selected incidents and discusses various flight safety topics of interest. Occurrence lists are provided free to the U.K. civil aviation industry and supporting organizations. They are available on subscription to any other airline or organization worldwide that has a legitimate interest in flight safety. De-identified reports submitted through the CHIRP (U.K.) and ASRS (U.S.) voluntary reporting schemes are also available on request.

3.9.8.5 Industry accident reports and bulletins are published only when government investigation is complete. The following are examples of organizations that make reports available either free, by subscription or on payment of a fee:

- Australian Bureau of Air Safety Investigation;
- Canadian Transportation Safety Board;
- French Bureau Enquetes-Accidents;
- U.K. Air Accidents Investigation Branch;
- U.S. National Transportation Safety Board; and,
- Brazilian Centro de Investigagco e Prevengco de Acidentes Aeronauticos.

3.9.8.6 Company flight safety reviews and newsletters should ideally be published quarterly and contain a varied selection of flight safety topics presented in a magazine format. A proven successful layout is to lead with an editorial (preferably composed by a senior manager), follow with one major article which analyzes a major accident (whether historic or recent, there are lessons to be learned) and then include articles on ATC, maintenance, flight crew training, aviation medicine, winter operations, etc. A summary of company occurrences over the previous quarter should be included. Small ingredients of humor in the form of anecdotes and cartoons will sustain the reader's interest. Production of copy for printing is a continuous activity and entirely the province of the flight safety officer; its success and appeal are limited only by the editor's imagination and resourcefulness as well as budgetary constraints. The main disadvantage of in-house magazines is that they are labor-intensive to research and compile, and can be costly to produce. However, an informative, balanced, well-written publication fosters good relations with flight crews and lets the whole organization know who the flight safety officer is; it also demonstrates commitment to improving flight safety awareness.

3.9.9 Company NOTAMs

3.9.9.1 A system of notifying crews quickly of critical flight safety-related events should be established. Company notices to airmen (NOTAMs) can be originated from within the flight planning department and promulgated via telex to crew report centers worldwide. These "must-read" notices enable all crews reporting for duty throughout the network to evaluate information immediately and act on it without delay. The flight safety officer can make effective use of this system.

3.9.9.2 An example of a selection of topics covered by company NOTAMs is shown in Figure 2.

Example of Topics Covered by Company Notices to Airmen (NOTAMs)

QD
.LHRODXY 291300 31 FEB 99
XYZ AIRLINES - COMPANY NOTAMS
PREPARED BY FLIGHT PLANNING DEPARTMENT - PHONE 11111-222222

STOP PRESS - A320 ONLY:

TFN PLS ENSURE THAT THE ALT BRAKE CHECK IS CARRIED OUT ON EVERY ARRIVAL AND MAKE APPROPRIATE TECH LOG ENTRY. (A320 FLT MGR 31.02.99)

BRITISH ISLES:
EGLL/LHR

PLATES PAGE 9 SHOWS MID 2J/2K SIDS. SHOULD READ MID 3J/3K. AUTHORITY ADVISED AND WILL BE AMENDED. (RTE PLNG 30.02.99)

URGENT///URGENT
A340

THERE HAS BEEN A REPORTED INCIDENT OF CONFLICTING FLIGHT DIRECTOR COMMANDS - CAPTAIN TO FLY IN ONE DIRECTION AND FO IN OPPOSITE DIRECTION ON DEPARTURE. THE INCIDENT OCCURRED ON 09R AT LHR ON A BPK 5J SID (CAPT TO FLY RIGHT, FO TO FLY LEFT). PLEASE EXERCISE CAUTION ON ALL DEPARTURES AND ENSURE THAT THE FLIGHT DIRECTORS COMMAND A TURN IN THE CORRECT DIRECTION. AIRBUS AND ALL AGENCIES HAVE BEEN INFORMED. AN INVESTIGATION BY COMPANY AND AIRBUS IS ACTIVE. FLEET NOTICE 99/99 REFERS.
(FLT SAFETY MGR + A340 FLEET MGR 31.02.99)

Note: The last item concerning A340 operations, which was received via an air safety report, is clearly the type of event to which crews need to be alerted quickly. It informs them of the basic circumstances surrounding the event and explains what action has been taken to start investigating the problem.

Figure 2

3.9.10 Flight Crew Notices

3.9.10.1 Detailed information is best disseminated through the medium of flight crew notices. These are maintained in loose-leaf folders and divided into sections according to the particular subject (e.g., information specific to aircraft type or general information which is applicable to all fleets). Copies are distributed to all crew report centers and placed in the aircraft library for crewmembers to read when they have an opportunity (e.g., after a period of leave or other absence from duty), with a master copy being maintained by flight operations management. E-mail distribution of all notices is another option currently in use.

3.9.10.2 Notices are withdrawn after the information contained has been incorporated into the appropriate company publication (operations policy manual, FCOM, MM, etc.) or has expired. The system must be maintained to ensure that out-of-date or superseded notices are removed.

3.9.10.3 An example of a flight crew notice is provided in Appendix A. It shows the relationship between an air safety report, company NOTAM and a typical manufacturer's flight ops telex. It also demonstrates the importance of prompt information exchange with the manufacturer.

3.10 Liaison With Other Departments

3.10.1 The departmental structure of a commercial airline varies according to the type of operation. Whatever the type of operation, the flight safety officer can expect to have direct input to all divisions of the company over a period of time.

3.10.2 Routine "business" generated through action and follow-up in the wake of a reported occurrence brings the flight safety officer into formal contact with the department concerned. A flight safety officer must foster trust and understanding; this is necessary in order to develop a flight safety culture; therefore, an open-door policy coupled with a supportive, outgoing attitude is essential.

3.10.3 For example, by regularly visiting the crew report and engineering control, production and development centers, effective working relationships with line pilots, cabin crew and line maintenance engineers become established and a free exchange of information, ideas and confidences is encouraged. In this way, feedback is obtained and something is occasionally learned which can be used to reduce hazards and thus enhance the safety of the operation as a whole.

3.10.4 A word of caution: *Rumor cannot be processed*. For example, a pilot may voice strong views on the handling of simultaneous cross-runway operations at a particular airport or on having been put at risk by a questionable ATC procedure; a ground engineer may highlight discrepancies in maintenance procedures, particularly where third-party work is involved. When such allegations are made, the source should be invited to submit the facts — place, date, time, cause, effect, etc. — using the air safety reporting system. Only then can the necessary research begin and, if warranted, measures implemented for change or improvement.

3.10.5 There are other (some perhaps less obvious) areas where working relationships will develop, usually as the result of a particular incident. The following are examples:

- Cabin crew training — quality, development and content of safety equipment and procedures (SEP) training; interpretation of regulations; advice on applying procedures; incident reviews;
- Commercial — effect of schedules on crew fatigue; flight numbering confusion; passenger complaints alleging company infringement of safety rules;
- Legal and insurance — warranty claims; litigation following incidents;
- Marketing — unauthorized loading of duty-free sales goods;
- Airport services — inadequate ground handling procedures; aircraft ground damage;
- Cargo — mishandling/loading of dangerous goods and general cargo;
- Medical — crew sickness on duty; passenger illness; deaths in flight;
- Public relations — preparation of press releases following an incident or accident; and,
- Security services — events concerning violent passengers; aircraft sabotage.

4. Human Factors

4.1 General

4.1.1 The following discussion is just one method of addressing human factors issues. Several other methods are available, including Boeing's Maintenance Decision Error Aid (MEDA) program, Air Transport Association of America (ATA) Specification 113, U.K. Civil Aviation Authority (CAA) Notice 71 and U.S. Federal Aviation

Administration (FAA) Human Factors Analysis and Classification System (HFACS). Also suggested for review is International Civil Aviation Organization (ICAO) *Digest No. 7*, "Investigation of Human Factors in Accidents and Incidents."

4.1.2 Flight safety is a main objective of the aviation industry. A major contributor to achieve that objective is a better understanding of human factors and the broad application of its knowledge. Increasing awareness of human factors in aviation will result in a safer and more efficient working environment.

4.1.3 The purpose of this chapter is to introduce this subject and to provide guidelines for improving human performance through a better understanding of the factors affecting it through the application of crew resource management (CRM) concepts in normal and emergency situations and through understanding of the accident causation model.

4.2 The Meaning of Human Factors

4.2.1 Human Error

4.2.1.1 The human element is the most flexible, adaptable and valuable part of the aviation system. But it is also the most vulnerable to influence which can adversely affect its performance. Lapses in human performance are cited as causal factors in the majority of incidents/accidents which are commonly attributed to "human error." Human factors have been progressively developed to enhance the safety of complex systems, such as aviation, by promoting the understanding of the predictable human limitations and its applications in order to properly manage the human error. It is only when seeing such an error from a complex system viewpoint that we can identify the causes that lead to it and address those causes.

4.2.2 Ergonomics

4.2.2.1 The term "ergonomics" is derived from the Greek words "ergon" (work) and "nomos" (natural law). It is defined as "the study of the efficiency of persons in their working environment."

4.2.2.2 It is often used by aircraft manufacturers and designers to refer to the study of human-machine system design issues (e.g., pilot-cockpit, flight attendant-galley, etc.). ICAO uses the term ergonomics in a broader context, including human performance and behavior, thus synonymous with the term human factors.

4.2.3 The SHEL Model

4.2.3.1 To best illustrate the concept of human factors, we shall use the SHEL model as modified by Hawkins. The name SHEL is derived from the initial letters of the model's components: software, hardware, environment and liveware. The model uses blocks to represent the different components of human factors and is then built up one block at a time, with a pictorial impression being given of the need for matching the components (see Figure 3).

The Shel Model as Modified by Hawkins

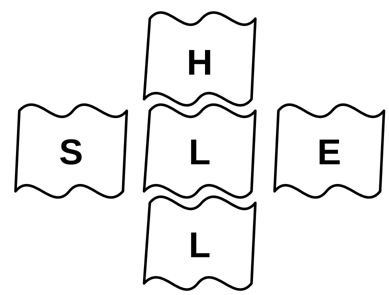


Figure 3

When applied to the aviation world, the components will stand for:

- S = software (procedures, manuals, checklists, drills, symbology, etc.);
- H = hardware (the aircraft and its components [seats, controls, layouts, etc.]);
- E = environment (the situation in which the liveware, hardware and software should function [e.g., weather, working conditions, etc.]); and,
- L = liveware (the human element [e.g., you and other crewmembers, ground staff, air traffic controllers, etc.]).

Aircrew work is a continuous interaction between those elements, and matching those elements is as important as the characteristics of blocks themselves.

On a daily basis, every staff member is the middle "L," who has to interact with the other elements to form a single block. As such, any mismatch between the blocks can be a source of human error.

4.2.3.2 What is human factors?

- It studies people working together in concert with machines;

- It aims at achieving safety and efficiency by optimizing the role of people whose activities relate to complex hazardous systems such as aviation;
- A multidisciplinary field devoted to optimizing human performance and reducing human error; and,
- It incorporates the methods and principles of the behavioral and social sciences, physiology and engineering.

4.3 The Aim of Human Factors in Aviation

4.3.1 By studying the SHEL model of human factors, we notice that the liveware constitutes a hub and the remaining components must be adapted and matched to this central component. In aviation this is vital, as errors can be deadly.

4.3.2 For that, manufacturers study the liveware-hardware interface when designing a new machine and its physical components. Seats are designed to fit the sitting characteristics of the human body, controls are designed with proper movement and instrument layout and information provided are designed to match the human characteristics, etc.

4.3.2.1 The task is even harder since the liveware, the human being, adapts to mismatches, thus masking any mismatch without removing it and constituting as such a potential hazard. Examples of that are three-pointer altimeters, bad seating layout in cabins that can delay evacuation, etc. It is current common practice for manufacturers to encourage airlines and professional unions to participate in the design phase of aircraft in order to cater for such issues.

4.3.3 The other component which continuously interacts with the liveware is the software (i.e., all nonphysical aspects of the system, such as procedures, checklist layout, manuals and all what is introduced, whether to regulate the whole or part of the SHEL interaction process or to create defenses to cater for deficiencies in that process). Nevertheless, problems in this interface are often more tangible and consequently more difficult to resolve (e.g., misinterpretation of a procedure, confusion of symbology, etc.).

4.3.4 One of the most difficult interfaces to match in the SHEL model is the liveware-environment part. The aviation system operates within the context of broad social, political, economical and natural constraints that are usually beyond the control of the central liveware element, but those aspects of the environment will interact in this interface. While part of the environment has been adapted to human requirements (pressurization and air conditioning systems, sound-proofing, etc.) and the human element adapts to natural phenomena (weather avoidance, turbulence, etc.), the incidence of social, political and economical constraints is central on the interface and should be properly considered and addressed by those in management with enough power to alter the outcome and smooth the match.

4.3.5 The liveware-liveware interface represents the interaction between the human elements. Assembling proficient and effective individuals to form a group or a set of views does not automatically imply that the group will function in a proficient and effective way unless they can function as a team. For them to successfully do so, we need leadership, good communication, crew cooperation, teamwork and personality interactions. CRM and line oriented flight training (LOFT) are designed to accomplish that goal.

4.3.5.1 When advanced, CRM becomes corporate or company resource management; staff-management relationships are within the scope of this interface, as corporate climate and company operating pressures can significantly affect human performance.

4.3.6 In brief, human factors in aviation aims at increasing the awareness of the human element within the context of the system and provides the necessary tools to perfect the match of the SHEL concept. By doing so, it aims at improving safety and efficiency.

4.4 Safety and Efficiency

4.4.1 Safety and efficiency are so closely interrelated that in many cases their influences overlap and factors affecting one may also affect the other. Human factors have a direct impact on those two broad areas.

4.4.2 Safety is affected by the liveware-hardware interface. Should a change affect the interface, the result might be catastrophic. In one aircraft accident, a causal factor cited in the report was that “variation in panel layout among the aircraft in the fleet had adversely affected crew performance.”

4.4.2.1 Safety is also affected by the liveware-software interface. Wrong information set in the database and unnoticed by the crew or erroneously entered by them can result in a tragedy. In a case where an aircraft struck terrain, information transfer and data-entry errors committed by navigation personnel and unchecked by the flight crew were among the causal factors.

4.4.2.2 The liveware-liveware interface also plays a major role in safety. Failure to communicate vital information can result in aircraft and life loss. In one runway collision, misinterpretation of verbal messages and a breakdown in normal communication procedures were considered as causal factors.

4.4.2.3 Finally, safety is affected by the liveware-environment interface. This interface is not only limited to natural, social or economic constraints, it is also affected by the political climate which could lead to a tragedy beyond the control of the aircrew. The most famous illustration of such a tragedy is the loss of Pan Am Flight 101 over Lockerbie, Scotland, in 1988. An airworthy aircraft which "had been maintained in compliance with the regulations" and flown by "properly licensed and medically fit crew" disintegrated in flight due to "the detonation of an improvised explosive device located in a baggage container" (U.K. Air Accidents Investigation Branch Aircraft Accident Report 2/90). As a result of that accident, latent failures present in the aviation security system at airports and within the airlines were identified, and regulations and procedures were redefined to address those failures and avoid their recurrence.

4.4.3 Efficiency is also directly influenced by human factors and its application. In turn, it has a direct bearing on safety, as follows:

- Motivation constitutes a major boost for individuals to perform with greater effectiveness, which will contribute to a safe operation;
- Properly trained and supervised crewmembers working in accordance with standard operating procedures (SOPs) are likely to perform more efficiently and safely;
- Cabin crew understanding of passenger behavior and the emotions they can expect on board is important in establishing a good relationship which will improve the efficiency of service, but will also contribute to the efficient and safe handling of emergency situations; and,
- The proper layout of displays and controls in the cockpit enhances flight crew efficiency while promoting safety.

4.5 Factors Affecting Aircrew Performance

4.5.1 Although the human element is the most adaptable component of the aviation system, that component is influenced by many factors which will affect human performance, such as fatigue, circadian rhythm disturbance, sleep deprivation, health and stress. These factors are affected by environmental constraints like temperature, noise, humidity, light, vibration, working hours and workload.

4.5.2 Fatigue

4.5.2.1 Fatigue may be physiological whenever it reflects inadequate rest, as well as a collection of symptoms associated with disturbed or displaced biological rhythms. It may also be psychological as a result of emotional stress, even when adequate physical rest is taken. Acute fatigues are induced by long duty periods or an accumulation of particularly demanding tasks performed in a short period of time. Chronic fatigue is the result of cumulative effects of fatigue over the longer term. Temperature, humidity, noise, workstation design and hypoxia are all contributing factors to fatigue.

4.5.3 Circadian Rhythm Disturbance

4.5.3.1 Human body systems are regulated on a 24-hour basis by what is known as the circadian rhythm. This cycle is maintained by several agents: day and night, meals, social activities, etc. When this cycle is disturbed, it can negatively affect safety and efficiency.

4.5.3.2 Circadian rhythm disturbance, or circadian dysrhythmia, is not only expressed as jet lag resulting from long-haul flights where many time zones are crossed, but can also result from irregular or night scheduled short-haul flights.

4.5.3.3 Symptoms of circadian dysrhythmia include sleep disturbance, disruption of eating and elimination habits, lassitude, anxiety and irritability. That will lead to slowed reaction, longer decision making times, inaccuracy of memory and errors in computation which will directly affect operational performance and safety.

4.5.4 Sleep Deprivation

4.5.4.1 The most common symptom of circadian dysrhythmia is sleep disturbance. Tolerance to sleep disturbance varies among individuals and is mainly related to body chemistry and emotional stress factors. In some cases, sleep disturbance can involve overall sleep deprivation. When that stage is reached, it is called situational insomnia (i.e., it is the direct result of a particular situation). In all cases, reduced sleep will result in fatigue.

4.5.4.2 Some people have difficulty sleeping even when living in normal conditions and in phase with the circadian rhythm. Their case is called clinical insomnia. They should consult a medical doctor and refrain from using drugs, tranquilizers or alcohol to induce sleep, as they all have side effects which will negatively affect their performance and therefore the safety of flight.

4.5.4.3 To overcome problems of sleep disturbance, one should dine close to normal meal times, learn relaxation techniques, optimize the sleeping environment, recognize the adverse effects of drugs and alcohol, and be familiar with the disturbing effects to circadian dysrhythmia to regulate sleep accordingly.

4.5.5 Health

4.5.5.1 Certain pathological conditions (heart attacks, gastrointestinal disorders, etc.) have caused sudden pilot incapacitation and in rare cases have contributed to accidents. But such incapacitation is usually easily detectable by other crewmembers and taken care of by applying the proper procedures.

4.5.5.2 The more dangerous type is developed when a reduction in capacity results in a partial or subtle incapacitation. Such incapacitation may go undetected, even by the person affected, and is usually produced by fatigue, stress, the use of certain drugs and medicines, and certain mild pathological conditions such as hypoglycemia. As a result of such health conditions, human performance deteriorates in a manner that is difficult to detect and, therefore, has a direct impact on flight safety.

4.5.5.3 Even though aircrew are subjected to periodic medical examinations to ensure their continuing health, that does not relieve them from the responsibility to take all necessary precautions to maintain their physical fitness. It hardly needs to be mentioned that fitness has favorable effects on emotions, reduces tension and anxiety, and increases resistance to fatigue. Factors known to positively influence fitness are exercise, healthy diet and good sleep/rest management. Tobacco, alcohol, drugs, stress, fatigue and unbalanced diet are all recognized as having damaging effects on health. Finally, it is each individual's responsibility to arrive at the workplace "fit to fly."

4.5.6 Stress

4.5.6.1 Stress can be found in many jobs, and the aviation environment is particularly rich in potential stressors. Some of these stressors have accompanied the aviation environment since the early days of flying, such as weather phenomena or in-flight emergencies; others like noise, vibration and G forces have been reduced with the advent of the jet age, while disturbed circadian rhythms and irregular night flying have increased.

4.5.6.2 Stress is also associated with life events which are independent of the aviation system but tightly related to the human element. Such events could be sad ones like a family separation, or happy ones like weddings or childbirth. In all situations, individual responses to stress may differ from one person to another, and any resulting damage should be attributed to the response rather than to the stressor itself.

4.5.6.3 In an aircrew environment, individuals are encouraged to anticipate, recognize and cope with their own stress, and perceive and accommodate stress in others, thus managing stress to a safe end. Failure to do so will only aggravate the stressful situation and might lead to problems.

4.6 Personality vs. Attitude

4.6.1 Personality traits and attitudes influence the way we behave and interact with others. Personality traits are innate or acquired at a very young age. They are deep-rooted, stable and resistant to change. They define a person and classify him/her (e.g., as ambitious, dominant, aggressive, mean, nice, etc.).

4.6.2 Conversely, attitudes are learned and enduring tendencies or predispositions to respond in a certain way; the response is the behavior itself. Attitudes are more susceptible to change through training, awareness or persuasion.

4.6.3 The initial screening and selection process of aircrew aims at detecting undesired personality characteristics in the potential crewmember in order to avoid problems in the future.

4.6.3.1 Human factors training aims at modifying attitudes and behavior patterns through knowledge, persuasion and illustration of examples revealing the impact of attitudes and behavior on flight safety. That should allow the aircrew to make rapid decisions on what to do when facing certain situations.

4.7 Crew Resource Management (CRM)

4.7.1 CRM is a practical application of human factors. It aims at teaching crewmembers how to use their interpersonal and leadership styles in ways that foster crew effectiveness by focusing on the functioning of crewmembers as a team, not only as a collection of technically competent individuals (i.e., it aims at making aircrew work in "synergy" — a combined effect that exceeds the sum of individual effects).

4.7.2 Changes in the aviation community have been drastic: sophisticated technology, the jet age, airplane size, deregulation, hub and spokes, security threats, industrial strikes and supersonic flights. In every one of those changes, some people saw a threat that made them anxious, even angry sometimes.

4.7.2.1 When first introduced to CRM, some people might see a threat, since it constitutes a change. However, with the majority of accidents having lapses in human performance as a contributing/causal factor, and with nearly two decades of CRM application in the international aviation community revealing a very positive feedback, we see this "change" as strength.

4.7.3 CRM can be approached in many different ways; nevertheless, there are some essential features that must be addressed. The concept must be understood, certain skills must be taught and interactive group exercises must be accomplished.

4.7.4 To understand the concept, one must be aware of certain topics, such as synergy, the effects of individual behavior on teamwork, the effect of complacency on team efforts, the identification and use of all available resources, the statutory and regulatory position of the pilot-in-command as team leader and commander, the impact of company culture and policies on the individual, and the interpersonal relationships and their effect on teamwork.

4.7.5 Skills to be developed include:

- Communication skills — Effective communication is the basis of successful teamwork. Barriers to communication are explained, such as cultural difference, rank, age, crew position and attitude. Aircrew are encouraged to overcome such barriers through self-esteem, participation, polite assertiveness, legitimate avenue of dissent and proper feedback;
- Situational awareness — Total awareness of the surrounding environment is emphasized, as is the necessity for the crewmember to differentiate between reality and perception of reality, to control distraction, enhance monitoring and cross-checking and to recognize and deal with one's or others' incapacitation, especially when subtle;
- Problem solving and decision making — These skills aim at developing conflict management within a time constraint. A conflict could be immediate or ongoing, it could require a direct response or certain tact to cope with it. By developing aircrew judgment within a certain time frame, we develop skills required to bring conflicts to safe ends;
- Leadership — In order for a team to function efficiently, it requires a leader. Leadership skills derive from authority but depend for their success on the understanding of many components, such as managerial and supervisory skills that can be taught and practiced, realizing the influence of culture on individuals, maintaining an appropriate distance from team members to avoid complacency without creating barriers, care for one's professional skill and credibility, the ability to hold the responsibility for all crewmembers and the necessity of setting the good example. The improvement of leadership skills will allow the team to function more efficiently and effectively;
- Stress management — Commercial pressure, mental and physical fitness to fly, fatigue, social constraints and environmental constraints are all part of our daily lives, and they all contribute in various degrees to stress. Stress management is about recognizing those elements, dealing with one's stress and helping others manage their own. It is only by accepting things that are beyond our control, changing things that we can and knowing the difference between the two that we can safely and efficiently manage stress; and,
- Critique — Discussing cases and learning to comment and critique actions are ways to improve one's knowledge, skills and understanding. Review of actual airline accidents and incidents to create problem-solving dilemmas that participant aircrew should act-out, and critique through the use of a feedback system will enhance crewmembers' awareness of their surrounding environment, make them recognize and deal with similar problems, and help them solve situations that might occur to them.

4.7.6 Finally, for a CRM program to be successful, it must be embedded in the total training program, it must be continuously reinforced, and it must become an inseparable part of the organization's culture. CRM should thus be instituted as a regular part of periodic training and should include practice and feedback exercises, such as complete crew LOFT exercises.

4.7.7 Line Oriented Flight Training (LOFT)

4.7.7.1 LOFT is considered to be an integral part of CRM training, where the philosophy of CRM skills is reinforced. LOFT refers to aircrew training which involves a full mission simulation of situations which are representative of line operations, with emphasis on situations which involve communication, management and leadership. As such, it is considered as a practical application of the CRM training and should enhance the principles developed therein and allow a measurement of their effectiveness.

5. Accident/incident Investigation and Reports

5.1 Definitions

- 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:
    - Being in the aircraft;
    - Direct contact with any part of the aircraft, including parts which have become detached from the aircraft;
    - 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 adversely affects the structural strength, performance or flight characteristics of the aircraft and would normally require major repair or replacement of the affected component;

    Except for engine failure or damage, when the damage is limited to the engine, its cowlings or accessories; or for damage limited to propellers, wing tips, antennas, tires, brakes, fairings, small dents or puncture holes in the aircraft skin; or,
  - The aircraft is missing or completely inaccessible.
- Causes — Actions, omissions, events, conditions or a combination thereof which led to the accident or incident.
- Incident — An occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation.
- 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, commission or other body charged, on the basis of his/her/their qualifications, with the responsibility for the organization, conduct and control of an investigation.
- Serious incident — An incident involving circumstances indicating that an accident nearly occurred. The difference between an accident and a serious incident lies only in the result.

5.2 Policy

5.2.1 All incidents are investigated through follow-up of occurrences. It should be part of operational policy to conduct an in-house independent and formal investigation following an accident or incident even though it may also be the subject of a government investigation. A government investigation can become a protracted affair, whereas the airline needs to ascertain quickly whether any immediate changes in procedures are necessary. Also, the airline may be asked to investigate and make a report on the government agency's behalf.

5.2.2 Internal accident/incident investigations are carried out under the authority of the CEO by the flight safety officer.

5.2.3 This handbook suggests a suitable procedure for the conduct of an internal investigation commensurate with the organization's divisional structure. The procedure should be standardized and outlined in the company's general operations manual.

5.3 Objectives

5.3.1 The investigation should seek to determine not only the immediate causes, but the underlying causes and inadequacies in the safety management system.

5.3.2 The appropriate prevention and intervention procedures should then be developed, and remedial action should be taken.

5.3.3 Clearly detailed investigation of each accident/incident concentrates on the way the key aspects of accident causation are inherently interrelated with the accident/incident.

5.4 Incident/accident Notification

5.4.1 Incident Notification and Investigation

5.4.1.1 An aircraft incident can be defined as any occurrence, other than an accident, which places doubt on the continued safe operation of the aircraft and:

- Has jeopardized the safety of the crew, passengers or aircraft but has terminated without serious injury or substantial damage;
- Was caused by damage to or failure of any major component not resulting in substantial damage or serious injury but which will require the replacement or repair of that component;
- Has jeopardized the safety of the crew, passengers or aircraft and has avoided being an accident only by exceptional handling of the aircraft or by good fortune;
- Has serious potential technical or operational implications;
- Causes trauma to crew, passengers or third parties; or,
- Could be of interest to the press and news media.

5.4.1.2 Examples include loss of engine cowlings, portions of flap or control surfaces, items of ancillary equipment or fuselage panels; an altitude excursion or other air traffic violation; a minor taxiing accident; damage due to collision with ground equipment.

5.4.1.3 In collaboration with other management staff, the flight safety officer will need to devise a procedure for containing such incidents within flight operations.

5.4.2 Accident Notification and Investigation

5.4.2.1 Aircraft accident investigation is a highly specialized discipline and a dedicated profession, and full company emergency procedures in the wake of an accident are not the flight safety officer's responsibility. It is, therefore, outside the scope of this handbook to cover both subjects completely. However, the flight safety officer must have a good understanding of the procedures involved. When any accident occurs — and this does not necessarily mean a hull loss involving loss of life — the flight safety officer will be seen as the person who knows what to do.

5.4.2.2 In most countries' regulations, a duty is placed upon the commander of an aircraft or, if the commander has been killed or incapacitated, upon the operator to report an aircraft accident to the appropriate government investigating authority. For practical purposes, this becomes the flight safety officer's responsibility.

5.4.3 International Investigations

5.4.3.1 When an aircraft operated by one country is involved in an accident in a foreign country, the procedures involving investigation are set out in International Civil Aviation Organization (ICAO) Annex 13. The procedures are complex, but the basic points are:

- The two countries can agree on a procedure not specifically covered in Annex 13;
- The country in which the accident occurs always has the right to appoint a person to conduct the investigation and prepare the subsequent accident report. If the accident occurs in international waters, then this right reverts to the country of registry of the aircraft;
- The country of registry has the right to send an accredited representative to participate in the investigation. This person is authorized to be accompanied by advisers who may represent the aircraft operator, the manufacturer or employee trade unions;
- The country of registry is obliged to provide the country of occurrence with information on the aircraft, its crew and its flight details;
- The accredited representative and any advisers should be entitled to:
  - Visit the scene of the accident;
  - Examine the wreckage;
  - Question witnesses;
  - Gain access to all relevant evidence;
  - Receive copies of all pertinent documents;
  - Make submissions to the investigation; and,
  - Receive a copy of the final report; and,
- There is no entitlement for the country of registry to take part in the analysis of the accident or the development of its cause(s). This is the right of the country conducting the investigation.

5.4.3.2 Being mindful of any changes to the provisions of ICAO Annex 13, the flight safety officer could certainly be expected to become involved in several items above.

5.4.4 All staff have the responsibility to report an incident to the operations control center or other company-required contact point by the most expeditious way.

5.4.5 In case of reportable incidents, an investigation will commence at the earliest possible opportunity and shall be undertaken by the responsible line manager.

5.4.6 The digital flight data recorder (DFDR) and/or cockpit voice recorder (CVR) may be removed from the aircraft if it is believed that the data may contribute to the investigation of an incident or accident.

5.4.7 The operations control manager on duty shall inform all concerned per the emergency group list provided whenever an accident or serious incident occurs (see Table 1).

5.4.8 The operations control manager on duty shall inform the flight safety officer or his alternate on duty whenever an air safety report (ASR) is received by fax.

5.4.9 It is the operator's duty to notify the appropriate authorities.

5.4.9.1 When safety violations by ground service personnel occur (e.g., opening of cargo doors with engines running, ramp maneuvering traffic violations, misuse of ground support equipment, etc.), the ramp safety expert will normally assume the principal role in any investigation and follow-up.

5.4.9.2 In order to instigate appropriate action, aircraft commanders are requested to:

- If in communication with air traffic control (ATC), advise of any incidents;
- Complete an ASR; and,
- Inform flight operations as soon as possible by the most expeditious means.

5.5 Accident/incident Group Flow Chart and List of Responsibilities

(See Table 1.)

5.6 Incident/accident Investigation Procedure

5.6.1 In case of an accident or serious incident, and whenever the operator decides that an investigation

Table 1
Accident/incident Group Flow Chart and List of Responsibilities

Authority	Deals With	Nominated Person	Phone Number
Director of Operations (Crisis Manager)	Commercial department, press and media, customer relations, legal department, insurance department	plus alternate(s)	Normal(s) Mobile(s) Pager(s)
Director of Engineering	Commercial department, legal department, insurance department	As above	As above
Chief Pilot	Regulatory authorities, flight crew information	As above	As above
Flight Safety Officer	Investigation, crew documentation and information, internal and external liaison	As above	As above
Administration Manager	Security department, company emergency procedure	As above	As above
Fleet Manager	Crew welfare, operational analysis, minimum equipment list procedures	As above	As above
Engineering Manager	Engineering analysis, maintenance manual procedures	As above	As above
Flight Operations Manager	Operations status, communications	As above	As above
Human Resources Manager	Personnel records and welfare	As above	As above
Chief Cabin Crew	Cabin crew information and welfare, cabin procedures	As above	As above
Aircraft Commander	Communication with flight operations control center, filing air safety report, documentation, preserving evidence, passenger and crew welfare	Liaises with local authorities and support agencies	No comments to press or media
Public Relations Representative	Press and media	As above	As above

into an incident is required, the flight safety officer who heads the safety department/section shall decide on the level of the investigation.

The investigator-in-charge could be one of the following:

- Flight safety officer;
- An air safety investigator representing him/her; or,
- Delegate(s) from flight operations and/or engineering and maintenance, or an investigating committee headed by the flight safety officer or the air safety investigator representing him/her, in which flight operations and engineering and maintenance are represented by persons who could be from the fleet/section involved in the incident, but who do not have direct influence on the operating process (i.e., not the fleet or training manager, etc.).

5.6.2 A trade representative of the concerned association can attend the appropriate interviews and the investigation process as an observer provided he/she maintains confidentiality and refrains from releasing any information. Should he/she have any reservation, he/she should raise it with the investigator-in-charge or with the head of the investigation committee. If not satisfied, he/she can raise it with the accountable manager.

5.6.3 The investigator-in-charge should investigate and report to the accountable manager any aspect considered to be relevant to an understanding of the incident by examining the circumstances surrounding the incident in order to discover the likely latent and active causes that led to it.

5.6.4 The investigation report should then be reviewed with the flight operations and engineering and maintenance post-holders, and all safety recommendations should be implemented. However, if a safety recommendation is not considered necessary by a post-holder, he/she should so state to the accountable manager and to the investigator-in-charge the reason(s) for rejecting it. The accountable manager has final authority.

5.7 Preparation

5.7.1 As soon as a notification of an incident/accident is received, it is the duty of the flight safety officer to ensure that all relevant documents are gathered and made available for reference. The documents typically will include, as appropriate:

- The original ASR;
- Crew statements;
- Crew license details and training records;
- Witness statements;
- Photographs;
- Flight documentation (navigation log, weight and balance information, etc.); and,
- Operating/maintenance manuals and checklists.

5.7.2 Obtain also, if appropriate:

- All relevant DFDR printouts and CVR transcripts;
- ATC voice tapes or transcripts; and,
- ATC radar transcript.

5.8 Accident Investigation Report

5.8.1 The investigator-in-charge report should be written under the headings suggested in ICAO Annex 13 (see "Accident Investigation Report Suggested Headings," page 39).

5.9 Accident Investigator's Kit

5.9.1 An investigator's kit should always be available in the company to be used by all air safety investigators whenever they are exercising their duties. It should contain at least the following:

- Clothing and personal items:
  - Disposable personal protective equipment (PPE);
  - Nondisposable PPE;
  - Waterproof trousers and jackets;
  - Coveralls;
  - Fluorescent tabards (tunics);
  - Vinyl gloves;
  - Industrial work gloves;
  - Industrial work boots;
  - Rubber boots;
  - Face masks;
  - Woolen hats;
  - Lightweight jackets and trousers;
  - Passport and extra photos;

Continued on page 40

Accident Investigation Report Suggested Headings

1. Factual Information

1.1 History of the flight. A brief narrative giving the following information:

- Flight number, type of operation, last point of departure, time of departure (local time or universal coordinated time [UTC]), point of intended landing;
- Flight preparation, description of the flight and events leading to the accident, including reconstruction of the significant portion of the flight path, if appropriate; and,
- Location (latitude, longitude, elevation), time of the accident (local time or UTC), whether day or night.

1.2 Injuries to persons. Use table below to indicate the number of people who received fatal injuries, serious injuries and minor/no injuries.

Injuries	Crew	Passengers	Other
Fatal			
Serious			
Minor/None			

1.3 Damage to aircraft. Brief statement of the damage sustained by aircraft in the accident (e.g., destroyed, substantially damaged, slightly damaged, no damage).

1.4 **Other damage.** Brief description of damage sustained by objects other than the aircraft.

1.5 **Personnel information:**

- Pertinent information concerning each of the flight crewmembers, including: age, validity of licenses, ratings, mandatory checks, flying experience (total and in type) and relevant information on duty time;
- Brief statement of qualifications and experience of other crewmembers; and,
- Pertinent information regarding other personnel, such as air traffic services, maintenance, etc., when relevant.

1.6 **Aircraft information:**

- Brief statement on airworthiness and maintenance of the aircraft, including indication of deficiencies known prior to and during the flight, if pertinent to the accident;
- Brief statement on performance, if relevant, and whether the weight and center of gravity were within the prescribed limits during the phase of operation related to the accident (if not, and if of any bearing on the accident, give details); and,
- Type of fuel used.

1.7 Meteorological information:

- Brief statement on the meteorological conditions appropriate to the circumstances, including both forecast and actual conditions, and the availability of meteorological information to the crew; and,
- Natural light conditions at the time of the accident (sunlight, moonlight, twilight, etc.).

1.8 Aids to navigation. Pertinent information on navigation aids available, including landing aids such as ILS (instrument landing system), MLS (microwave landing system), NDB (nondirectional beacon), PAR (precision approach radar), VOR (very-high-frequency omnidirectional radio), visual ground aids, etc., and their effectiveness at the time.

1.9 Communications. Pertinent information on aeronautical mobile and fixed service communications and their effectiveness.

1.10 Airport information. Pertinent information associated with the airport, its facilities and condition, or with the takeoff or landing area if other than an airport.

1.11 Flight recorders. Location of the flight recorder installations in the aircraft, their condition on recovery and pertinent data available therefrom.

1.12 Wreckage and impact information. General information on the site of the accident and the distribution pattern of the wreckage, and detected material failures or component malfunctions. Details concerning the location and state of the different pieces of the wreckage are not normally required unless it is necessary to indicate a breakup of the aircraft prior to impact. Diagrams, charts and photographs may be included in this section or attached in the appendixes.

1.13 Medical and pathological information. Brief description of the results of the investigation undertaken and pertinent data available therefrom.

Note: Medical information related to flight crew licenses should be included in 1.5 (personnel information).

1.14 Fire. If fire occurred, information on the nature of the occurrence, the fire fighting equipment used and its effectiveness.

1.15 Survival aspects. Brief description of search, evaluation and rescue, location of crew and passengers in relation to injuries sustained, failure of structures such as seats and seat-belt attachments.

1.16 Tests and research. Brief statements regarding the results of tests and research.

1.17 Organizational and management information. Pertinent information concerning the organizations and their management involved in influencing the operation of the aircraft. The organizations include, for example, the operator; the air traffic services; airway, airport and weather service agencies; and the regulatory authority. The information could include, but not be limited to, organizational structure and functions, resources, economic status, management policies and practices, and regulatory framework.

1.18 Additional information. Relevant information not already included in 1.1 to 1.17 above.

1.19 Useful or effective investigation techniques. When useful or effective investigation techniques have been used during the investigation, briefly indicate the reason for using these techniques, refer here to the main features and describe the results under the appropriate subheadings 1.1 to 1.18.

2. Analysis

Analyze, as appropriate, only the factual information documented above that is relevant to the determination of conclusions and causes.

3. Conclusions

List the findings and causes established in the investigation. The list of causes should include both the immediate and the deeper systemic causes.

4. Safety Recommendations

As appropriate, briefly state any recommendations made for the purpose of accident prevention and any resultant corrective action.

Appendixes

Include, as appropriate, any other pertinent information considered necessary for the understanding of the report.

Note: All the above should be included in the report in the same sequence. If not relevant to the accident/incident, they should be included and the term "not relevant" mentioned next to them whenever appropriate.

- Tickets;
- Credit cards;
- Immunization records;
- Cash, traveler's checks and/or letter of credit;
- Business cards;
- Travel authorization;
- Medical kit;
- Sun/reading/safety glasses;
- Insect repellent;
- Toiletries; and,
- Towelettes;

• Stationery:
- Clipboards;
- Waterproof colored marker pens;
- Felt-tipped pens, ballpoint pens and pencils;
- Assorted clear plastic envelopes;
- Pocket notepads;
- Staplers and spare staple packs;
- Assorted office envelopes;
- Tie-on labels;
- String (500 meters [20 inches]);
- Map or plan of area, preferably highly detailed with topographic information;
- Company emergency procedures manual;
- File folders;
- Chalk;
- Eraser;
- Cellophane tape;
- Paper clips and rubber bands;
- Pins; and,
- Ruler;

• Hardware:
- Torches (flashlights) and spare batteries;
- Battery-powered tape recorder;
- Camera — Polaroid or digital, with spare film/memory;
- Camera — 35-millimeter, with flashgun and spare film;
- Camera — video;
- Mobile UHF (ultra-high-frequency) radios with spare battery packs and charger unit;
- 100-meter (328-foot) measuring tape;
- Valises for carrying equipment;
- Labels and signs;
- Cellular phone — modem-capable with spare battery packs;
- Laptop computer with fax and e-mail modem with spare battery packs;
- Calculator;

- Compass;
- Binoculars;
- Knife;
- Telephone lists;
- Matches;
- Can opener;
- Plotter;
- Padlock;
- Mirror;
- Tape measure;
- Magnifying glass;
- Water container and cup;
- Whistle;
- Tools;
- Plastic bags and ties; and,
- Magnet.

Important note: PPE is mandatory in the United States and Canada. PPE must be worn to protect investigators on site from blood-borne pathogens. PPE training must be received prior to its use. Investigators not equipped with appropriate PPE will not be permitted to enter the accident site.

5.9.2 Investigator Departure Checklists

- Briefings:
  - Accident;
  - Locale and weather;
  - Rendezvous location and contact information;
  - Management and legal;
  - Trip duration; and,
  - Personal security (as required).
- Travel plans:
  - Airline reservations (always get round-trip tickets);
  - Money, traveler's checks, credit cards; and,
  - Paycheck disposition.
- Visa:
  - Learn if required (travel office or airline can advise);
  - Delay if necessary;
  - Medical items;
  - Get travel medical kit;
  - Doxycyclene (an antibiotic);
  - Personal medications;
  - Hand-carry valuables and essentials;
  - Check remaining luggage (label inside and outside);
  - Use "Go Kit" checklist; and,
  - Cancel appointments (business, personal and medical).

5.9.2 All accident investigators should have received the HBV (hepatitis B virus) vaccination and completed the bloodborne pathogens training program.

6. Emergency Response and Crisis Management

6.1 General

6.1.1 Because commercial air transport operations are based almost entirely on public confidence, any accident has a significant impact. Even those organizations that do not cater to external customers operate within a mutual trust agreement between the pilots, mechanics, schedulers and management. A major accident which results in a hull loss, human suffering and loss of life inevitably undermines the customers' confidence in aviation as a whole. For these reasons, it is vital for every aviation organization to implement and develop contingency plans to deal with and manage a crisis effectively.

6.1.2 Past accidents have highlighted the fact that many organizations do not have effective plans in place to manage a post-accident crisis. This may be due to lack of either resources or a proper organizational structure, or a combination of both factors. The aim of this section is to provide practical guidelines for developing and implementing a crisis management plan.

Note: Due to differences in corporate structures and organizational requirements, the guidelines should be further developed by each operator in order to adapt them to the organization's needs and resources.

6.1.3 In a developing organization, the flight safety officer may be tasked with planning the company's emergency response and crisis management procedures. In larger, established organizations, these procedures are usually the responsibility of a dedicated emergency planning department. The development of these procedures is a highly specialized and time-consuming task; therefore, serious consideration should be given to engaging external resources.

6.1.4 All procedures, including local airport emergency plans at route stations, must be promulgated in a dedicated company emergency procedures manual that is distributed selectively throughout the network. This should include procedures of code-sharing and alliance partners. Individuals who have responsibilities following a major accident or who are liable to become involved in the aftermath are obliged to keep themselves apprised of its contents. The emergency response plan should be exercised at regular intervals to ensure its completeness and suitability (both full and table-top exercises).

6.1.5 Tens of thousands of public-inquiry telephone calls can be expected if the accident occurs to a relatively well-known airline. Smaller airlines, cargo carriers and corporate entities may find much less trouble with phone calls and media inquiries. The company may therefore be required to provide or contract for toll-free lines to receive public calls and also ensure that an adequate number of trained staff can be made available to respond. The company Web site should have a link to deal only with information regarding this event. Consideration should be given to setting up a separate Web site for this function alone. This information should be controlled and administered through the crisis management center (CMC). Large national carriers who have specialized emergency response centers may be willing to provide a contracted service for public telephone inquiries and liaison with the authorities.

6.2 Responsibilities

6.2.1 Although an organization may have in place a procedure to be followed in the event of becoming involved in an accident or incident (as in the sample flight operations procedure in section 5.5), it is often the case that little thought is given to the aftereffects of a fatal accident on the whole company, particularly with small organizations.

6.2.2 Airports — International Civil Aviation Organization (ICAO) Annex 14 states that before operations commence at an airport, an emergency plan should be in place to deal with an aircraft accident occurring on or in the vicinity of the airport. If an organization utilizes these ICAO member airports, the following plan would be available to be viewed by those organizations wishing to do so. This plan, in addition to specifying the airport authority's role, must show the details of any local organization that could assist and would include, for example:

- Police, fire and ambulance services;
- Hospitals and mortuaries;
- Armed (military) services;
- Religious and welfare organizations (e.g., Red Cross/Red Crescent);
- Transport and hauling contractors;
- Salvage companies; and,
- Foreign embassies, consulates and legations.

6.2.3 The airport authority normally should establish an emergency coordination center (ECC) through which all post-accident activities are organized and controlled. It will also provide a reception area to temporarily house survivors, their families and friends.

6.2.4 Flight operations — It is the organization's responsibility to maintain familiarity with the emergency plans at all airports into which it operates. If an accident occurs, senior representatives of the airline(s)/organization(s) concerned must report to the airport's ECC to coordinate its activities with the airport authority and representatives of all other agencies responding.

6.2.5 The organization's own emergency response procedures will be implemented immediately.

6.2.6 The airline or flight operations organization is responsible for:

- Removal and salvage of the aircraft and any wreckage;
- Providing information on any dangerous goods carried as cargo aboard the aircraft;
- Coordination of media coverage relating to the incident;
- Notifying local customs, immigration and postal authorities;
- Victim support — A senior organization official must be made responsible for:
  - Directing relatives to the designated survivors' reception area;
  - Providing overnight accommodation as required;
  - Being in attendance at hospitals to provide assistance for accident victims;
  - Notifying survivors' next of kin, other family members and friends;
  - Making arrangements for transporting relatives to a location near the accident site; and,

– Returning deceased victims' remains to the country of domicile.

Note: In some countries, an airline involved in an accident is also responsible for notifying the deceased's next of kin.

6.2.7 To fulfill the above responsibilities, the organization must establish and equip:

- A CMC at headquarters (HQ);
- A local incident control center (LICC) at the airport to coordinate activities with HQ and the airport authority's ECC; and,
- A mobile support and investigation team.

6.3 Example of a Company Emergency Response Organization

6.3.1 In the event of an accident, there are basically three areas of response:

- HQ — activation of the company's CMC;
- Local — activation of the LICC in conjunction with the airport's ECC; and,
- Mobile — activation and dispatch of the company's incident support team.

6.3.2 Secure HQ office space will need to be allocated to house a CMC, which may be subdivided into:

- Incident control center (ICC);
- Media information center (MIC);
- Passenger information center (PIC);
- LICC liaison; and,
- Engineering liaison.

6.3.3 The CMC team for a passenger airline will typically consist of:

- CEO;
- Director of operations (who may be designated as in command);
- Commercial director;
- Marketing director;
- Director of support services (e.g., legal, insurance and administration);
- Head of safety;
- Head of security;
- Head of engineering;
- Head of public relations; and,
- Head of customer relations.

6.3.4 The CMC is responsible for coordinating all external and internal information, communication and response to the accident. It will:

- Arrange any special flights required;
- Brief and dispatch the mobile support team;
- Respond to public inquiries;
- Prepare statements to the media;
- Liaise with the accident site and nearest airport to the site; and,
- Collect and analyze all relevant information concerning the possible cause of the accident, its consequences and casualty assessment.

6.3.5 In addition to office furniture and stationery supplies, the CMC must be equipped with:

- An ARINC/SITA (Societe Internationale de Telecommunications Aeronautiques) facility with a dedicated address;
- Sufficient telephones and fax machines (unlisted) for all users;
- Personal computer (PC) equipment;
- Investigation and field kit for issue to the mobile response team;
- All relevant company manuals;
- Internal and external telephone directories;
- Accurate wall clocks to indicate coordinated universal time (UTC) at HQ and at the accident site;
- Televisions tuned to an all-news channel and an all-weather channel; and,
- Aeronautical charts.

6.3.6 The CMC must be maintained in a constant state of preparedness. It should be borne in mind that once activated, the CMC will require 24-hour manning for an unspecified period; therefore, alternative members should be nominated to provide shift coverage.

6.3.7 The LICC will be an extension of the station manager's (or handling agent's) office at the incident airport and must be equipped with adequate communications facilities for liaison with the CMC and the airport ECC. It will be necessary to reinforce the station's staff in order to man the LICC on a shift basis in addition to maintaining routine operations. In the early stages, this can be accomplished by utilizing off-duty personnel until the mobile team arrives.

6.3.8 The mobile investigation and support team will be made up of:

- Flight safety officer or representative;
- Engineering specialist(s);
- Representative for aircraft type fleet and/or training manager (ideally both); and,
- Volunteers who can support staff at the incident airport in the handling of the incident (e.g., LICC duties) and assist with maintaining normal operations and members of the country's air accident investigating authority and victim identification team (see the notes at the end of this section).

6.3.9 The mobile support and investigation team will travel by the fastest possible means and must be prepared for an extended period of absence. They must also be equipped for work in the field (refer to paragraph 5.9).

6.4 Response Guidelines

6.4.1 Flight operations control will most likely receive first notification of an accident. Keep in mind that first notification of an accident may come from someone totally disassociated with the primary organization involved. Quite often, the first notification has been from the media or a news reporter. Call-out of key personnel must then be initiated, beginning with the members of the CMC. This in turn leads to a call-out cascade to all other people and organizations involved.

6.4.2 The media cannot and must not be treated curtly or rudely. The first inquiries by the media may catch organization personnel off guard and may seem prying or overzealous; however, reporters may be referred to the organization spokesperson, or a simple statement may suffice temporarily, such as:

> "We have just received word concerning one of our aircraft being involved in an incident. As soon as we here at (XYZ Airlines headquarters) gather the details, we will release the information to the media."

The person answering the initial call from the media should try not to sound surprised or "thrown off" by the questions. If they are unable to maintain composure, they should pass the phone call quickly to someone else, after placing the reporter on hold temporarily. It is important that the flight organization sound and appear on camera as though business is being handled professionally and thoughtfully throughout the entire crisis.

6.4.3 Establish control of media communications by trying to be the best source of information. As soon as possible, provide a means for the public to obtain accurate information, such as a toll-free telephone line and/or a Web site that is frequently updated.

6.4.4 Be readily available. Be well prepared. Be accurate. Be cooperative.

6.4.5 Do not talk "off the record."

6.5 Corporate Accident Response Team Guidelines

6.5.1 One method that many corporate aviation departments use to ensure all-important tasks are completed is "CARE," which stands for "confirm, alert, record and employees." The CARE method details can be found in Appendix F (page 99).

6.6 Small Organization Emergency Response

6.6.1 This section is intended for small airlines or corporate operators that have not yet developed a full-scale crisis management plan. Consultants are available to assist in the development of the plan.

6.6.2 Senior Executive

- Call the next primary or alternate member (the legal representative) of your response team. Inform him/her of the name and phone number of each team member notified. All senior executives should be trained to deal with the media;
- Schedule and hold a press conference as soon as practicable within the first 24 hours after the incident/accident. Show concern for the victims and their families and state only the facts. Do not talk "off the record." Answer a few questions, then delegate a public relations representative to address additional inquiries. Consider reciting other information, such as (if applicable):
  - The corporate aircraft use policy (e.g., to enhance corporate productivity);
  - Refer reporters to an industry organization and/or the Flight Safety Foundation at +1 (703) 739-6700 regarding corporate aviation safety statistics;
  - Average number of years of experience for your pilots;
  - Pilot recurrent training program; and,
  - Type and age of aircraft;

- Issue an in-house statement for company employees; and,
- Notify the board of directors and other executives as necessary.

6.6.3 Legal Representative

- Call the next primary or alternate member of your response team. Inform him/her of the name and phone number of each team member notified;
- Coordinate with your aviation insurance claims specialist in obtaining statements from the flight crew. Represent crewmembers in discussions with investigation officials;
- Collect information on any third party injuries or property damage;
- Notify the regulatory and investigative agencies. In the case of criminal acts such as sabotage, hostages or a bomb threat, notify the criminal authorities;
- When notifying the regulatory and investigative agencies, simply give the facts. Do not speculate or draw your own conclusions; and,
- Follow the guidelines of ICAO Annex 13 and U.S. National Transportation Safety Board (NTSB) Part 830, or equivalent.

6.6.4 Preservation of Evidence

- Verify that your team leader is collecting flight department records; and,
- Verify with your aviation insurance claims specialist that the wreckage has been preserved.

6.6.5 Aviation Insurance Claims Specialist

- Call the next primary or alternate member (the human resources specialist) of your response team. Inform him/her of the name and phone number of each team member notified;
- Notify your aviation insurance broker and the field claims office nearest to the accident site; and,
- Review the provisions of your aircraft insurance policy.

6.6.6 Human Resources Specialist

- Call the next primary or alternate member (the public relations representative) of your response team. Inform him/her of the name and phone number of each team member notified;
- Obtain an accurate list of passengers and crewmembers involved from your team leader or flight department scheduler. Verify exact names and contact telephone numbers;
- Obtain an accurate report of medical conditions for each individual;
- Arrange to have family members of accident victims notified in person. Use company representatives, local police, Red Cross representatives, etc., for this purpose. Only if this is impossible, contact family members by telephone. Do not leave a message other than for a return call;
- Be sensitive to immediate needs of family:
  - Consider flying the spouse(s) by airline to the location of the accident;
  - Offer to pick up children from school or childcare; and,
  - Offer to inform clergy of each family's choice. Clergy can be helpful as trauma counselors and assisting with family needs;
- Consider having a professional trauma counselor available for the families of the victims;
- Coordinate group health care coverage with hospitals; and,
- Photocopy personnel records of flight crew employees for your purposes. Store originals in a secure place for future reference.

6.6.7 Public Relations Representative

- Call your team leader. This will confirm that all members of your team have been contacted. Inform him/her of the name and phone number of each team member notified;
- Be prepared with a statement for the media. State only the facts. Never speculate as to the possible cause of the incident/accident. Defer determination of probable cause to the investigative authorities. The following is an example of a prepared statement:

  > "I have received notification that one of our company's aircraft has been involved in an (accident/incident/threatening act). Our sincere concern goes out to all of the families involved. We are in the process of notifying the families of these individuals. I understand that (number) passengers and (number) crewmembers were onboard.

"The aircraft was on a flight from (departure point) to (intended destination). This is all we know at this time. We have activated our emergency response plan and are fully cooperating with the investigative authorities in charge to determine exactly what happened. We will inform the media of additional information as soon as it becomes available. Otherwise, we will (hold a press conference/issue a press release) tomorrow at (time)."

- Checklists must be devised for every stage of the procedure. These will form part of the emergency procedures manual. Once a plan has been devised, a network-wide practice exercise should be accomplished at least once annually to ascertain the effectiveness of the system; and,
- Personalities and contact details change. Communications and appointment lists should therefore be updated at frequent intervals.

Section 6 Notes

1. Although suitable emergency response procedures can be devised based on the foregoing information, their development is not an easy task. The exact procedures to be adopted will depend on the size of the organization, its corporate structure, route network, type of operation and the requirements of prevailing legislation not only in the operator's country but also in the country in which the accident occurs. With this in mind, it is advisable to enlist the aid of a specialist organization which can provide training and advice on procedures which are practicable and specific to the operator's needs.

2. U.S. Federal Family Assistance Plan for Aviation Disasters — The Aviation Disaster Family Assistance Act of 1996 and the Foreign Air Carrier Family Support Act of 1997 stipulate that in the event of an aviation disaster, the NTSB Office of Family Affairs role is to coordinate and provide additional resources to the airline and local government to help victims and their families by developing a core group of experienced personnel who have worked aviation accidents while preserving local responsibility jurisdiction. Presently, this legislation applies only to U.S. carriers and those flying to and from the United States; however, it may well set a standard for the industry. This is confirmed by the fact that many international operators, some which do not even fly to the United States, are implementing procedures that are compatible with U.S. legislation.

   NTSB tasks include: Coordinate federal assistance and serve as liaison between airline and family members; coordinate with airline about family and support staff logistics; integrate federal support staff with airline staff to form joint family support operations center (JFSOC); coordinate assistance efforts with local and state authorities; conduct daily coordination meetings; provide and coordinate family briefings; coordinate with the investigator-in-charge for possible visit to accident site; provide informational releases to media on family support issues; maintain contact with family members and provide updates as required.

   Airline tasks include: Provide public with continuous updates on progress of notification; secure a facility to establish a family assistance center (FAC) in which family members can be protected from the media and unwelcome solicitors; make provisions for a JFSOC to include communication and logistical support; provide contact person to meet family members as they arrive and while at incident site; maintain contact with family members that do not travel to incident site; coordinate with American Red Cross to provide mental health services to family members; establish joint liaison with American Red Cross at each supporting medical treatment facility.

   Contact: National Transportation Safety Board, Office of Family Affairs, 490 L'Enfant Plaza SW, Washington, DC 20594 USA; Tel: +1 (202) 314-6185; Fax: +1 (202) 314-6454; 24-hour communications center (non-public) tel: +1 (202) 314-6290.

7. Risk Management

7.1 Definitions

7.1.1 Risk management can be defined as the identification, analysis and economic elimination or control to an acceptable level of risks that can threaten the assets or earning capacity of an enterprise such as a commercial airline. The risk management process seeks to identify, analyze, assess and control the risks incurred in airline operations so that the highest standard of safety can be achieved. It must be accepted that absolute safety is unachievable but that reasonable safety can be achieved across the spectrum of the operation. If the flight safety program outlined in this handbook is adopted and the methods diligently applied, the hazards and risks associated with commercial airline operations can be controlled and minimized. A detailed discussion on the risk management process is provided in Appendix E (page 90).

7.1.2 The dictionary defines the word "risk" variously as:

- A hazard, danger, chance of loss or injury;
- The degree of probability of loss;
- A person, object or factor likely to cause loss or danger;
- To expose to danger; and,
- To incur the chance of an unfortunate consequence by some action.

"Hazard" is defined as:

- A condition that has the potential to cause harm; and,
- To expose to chance.

7.2 The True Cost of Risk

7.2.1 One insurance company has calculated the following (1998 figures):

- Ramp incidents alone cost the industry $3 billion a year, which equates to $300,000 per jet aircraft; and,
- Indirect costs, noninsurable costs, loss of revenue, etc., can exceed the direct costs by 20 times, at least.

7.2.2. Examples are shown in Table 2.

7.2.3 A typical incident and some of its possible consequences are shown in Figure 4 (page 48).

7.3 Risk Profiles

7.3.1 The profile in Figure 5 (page 49) compares the type of event with the frequency.

7.3.2 Another accident statistics profile is shown in Figure 6 (page 49).

7.4 Summary

7.4.1 A hazard becomes a risk because of:

- People;
- Procedures;
- Aircraft and equipment; and/or,
- Acts of nature.

Table 2
Examples of the Cost of Risk

Type of Event	Direct costs	Indirect Costs
Aircraft struck by catering truck	$17,000	$230,000
Aircraft struck by another while taxiing	$1.9 million	$4.9 million
Maneuvering pier struck parked aircraft	$50,000	$600,000
Aircraft struck by tug during pushback	$250,000	$200,000

Notes: The above examples refer to all-too-common ramp incidents only. It is not generally appreciated that over 1 million vehicle movements a year are required to service one gate, where control and coordination are often poor. The direct and indirect costs will increase considerably if the incident occurs at a remote location.

7.4.2 People present the biggest risk for such reasons as:

- Attitude;
- Motivation;
- Perception; and,
- Ability.

7.4.3 A flight safety program, through its methods of recording and monitoring safety-related occurrences and audit procedures can be considered to be a continuous risk management process. Assessing risk, however, is a difficult task, and it is best to seek the advice of a specialist risk management company. A risk management program will help the airline to improve in areas such as:

- Training and awareness;
- Culture and attitudes;
- The ability of the operator to carry out self-assessment;
- Loss prevention and control; and,
- Auditing procedures.

7.4.4 The benefits to the airline are:

- Safer operation;
- Cost savings;
- Reduced claims;
- Establishment of a healthy risk management culture;
- An enhanced reputation; and,
- More business.

Continued on page 49

Cost of Risk, A Typical Incident and Some Possible Consequences

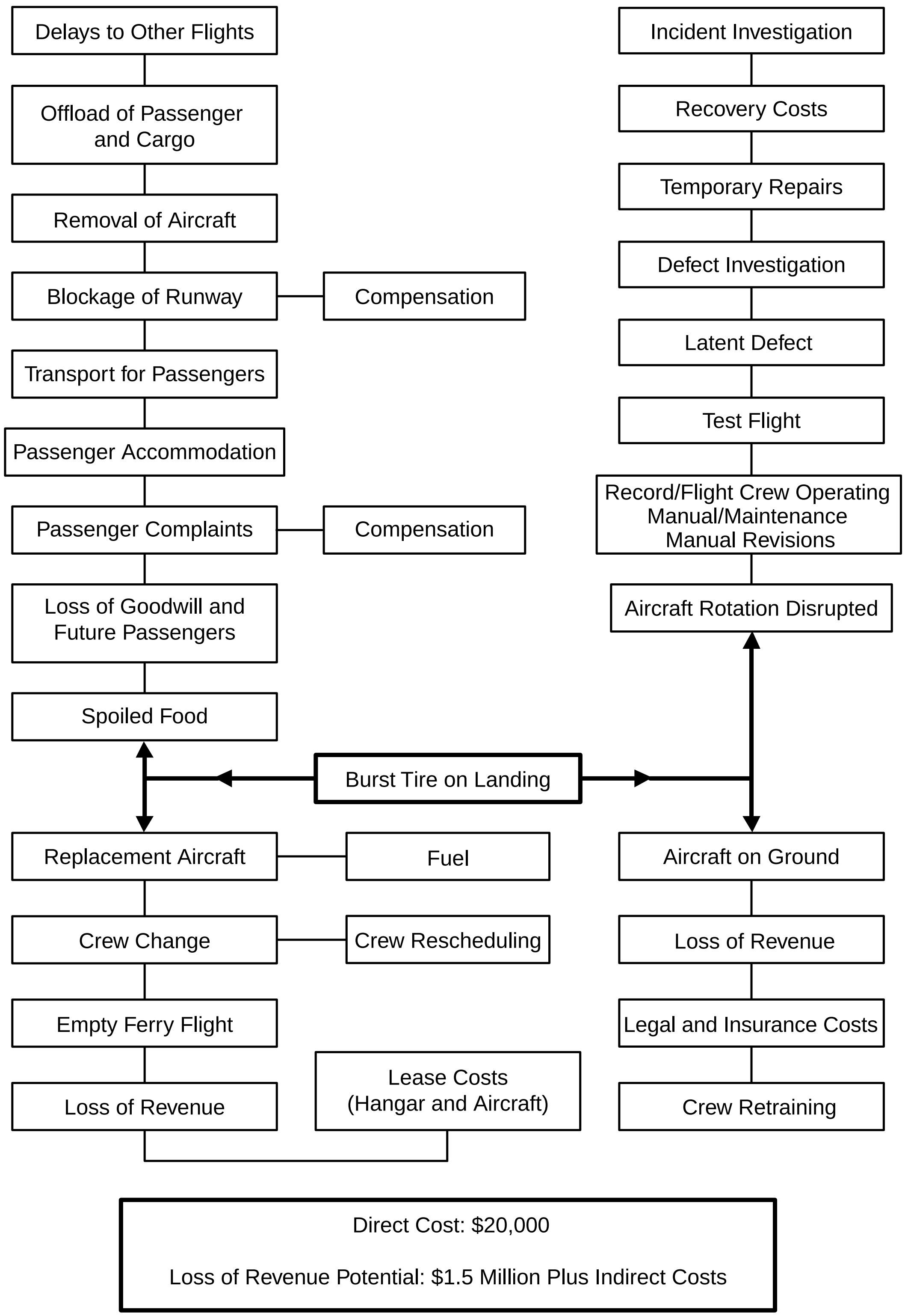


Figure 4

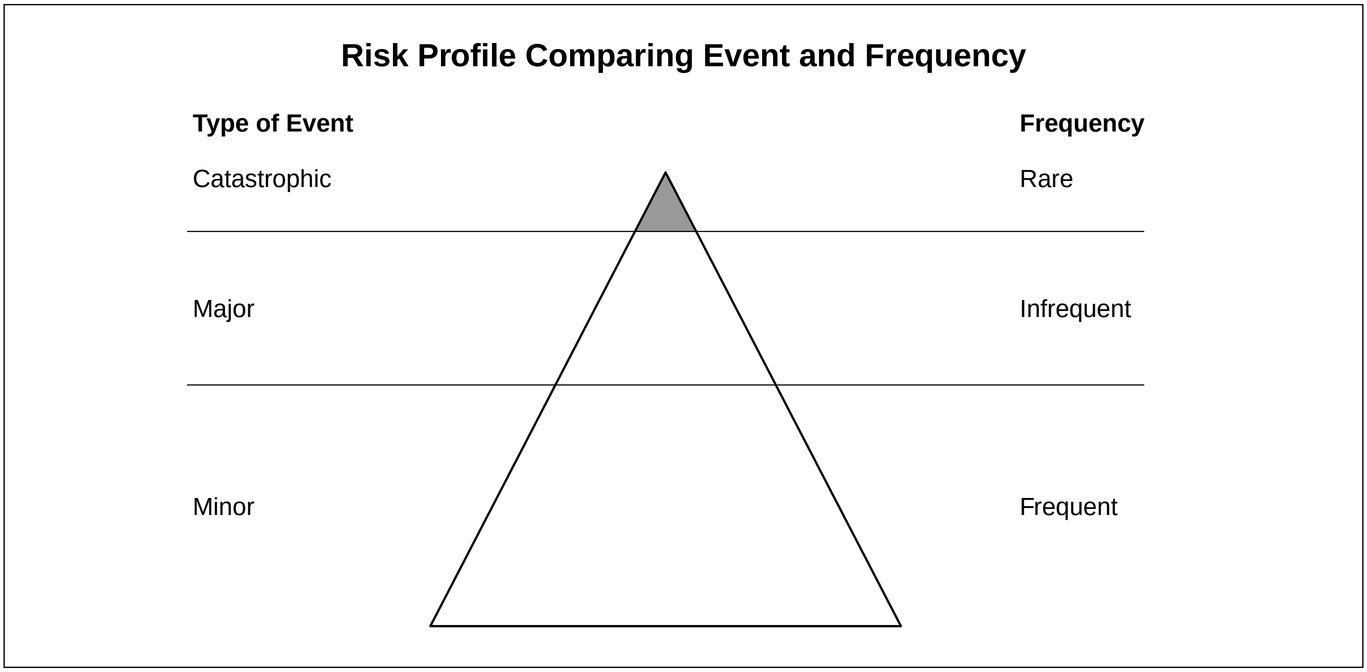


Figure 5

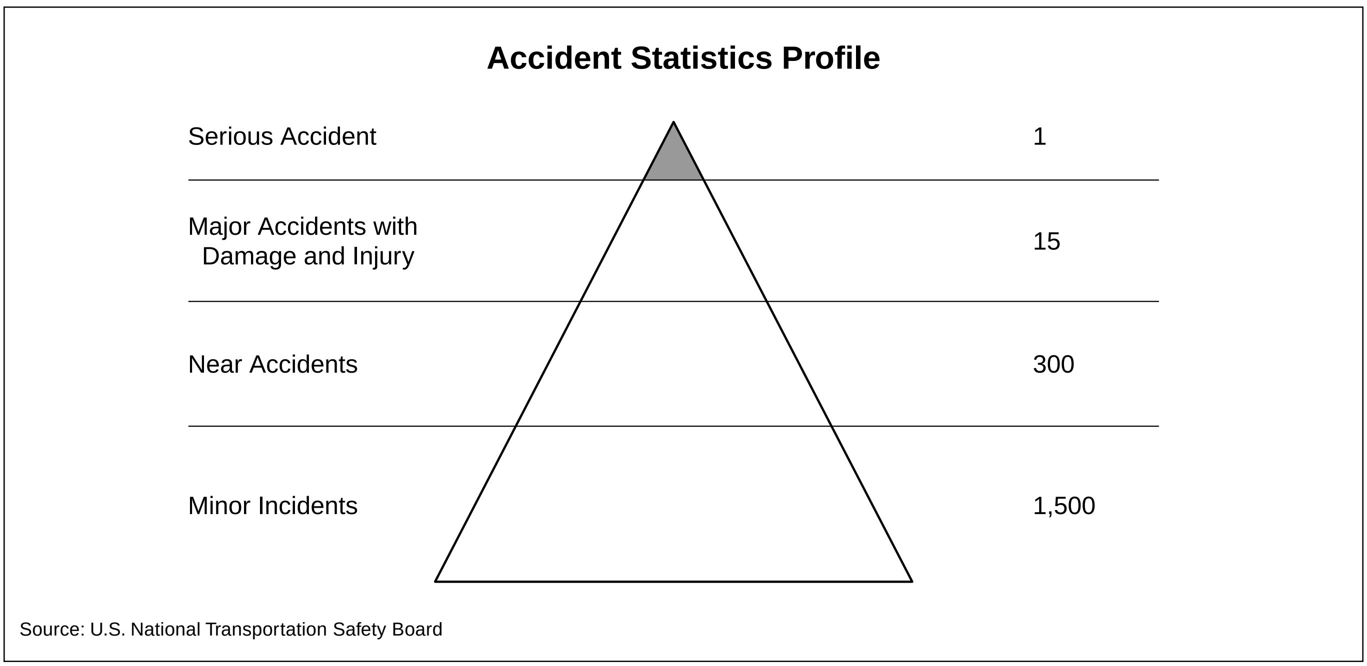


Figure 6

7.5 Decision Making

7.5.1 Operational and technical risks are manageable. Collecting data and appropriate analysis of all data available form a sound basis for decisions about actions required. It is the responsibility of the flight safety manager (or his/her equivalent [e.g., engineering manager]) to ensure proper decisions and that calls for actions are acknowledged and addressed by the department concerned within a specified time frame. However, it has to be accepted that absolute safety is not achievable but reasonable safety can be attained across the full spectrum of the operation. Provided that the risk management tools are used diligently, the risks and hazards associated with commercial airline operations are controlled and minimized. Risk management, however, is incomplete without the consideration of the financial impacts.

7.6 Cost-Benefit Considerations

7.6.1 Typical common incident cost factors may be:

- Operational:
  - Flight delays;
  - Flight cancellations;
  - Runway obstruction;
  - Alternate passenger transportation;
  - Passenger accommodation;
  - Passenger complaints;
  - Catering;
  - Loss of revenue;
  - Ferry flight;
  - Crew change;
  - Training/instruction; and,
  - Loss of reputation; and/or,
- Technical:
  - Aircraft recovery;
  - Aircraft repair;
  - Test flight;
  - Incident investigation;
  - Technical documentation;
  - Spare parts;
  - Technical inventory;
  - Aircraft on ground;
  - Lease of technical facilities;
  - Repair team accommodation;
  - Training/instruction; and,
  - Recertification.

8. Organizational Extensions

8.1 Safety Practices of Contractors, Subcontractors and Other Third Parties

8.1.1 When using subcontractors, the responsibility for quality of the product or service remains with the operator. A written agreement between the operator and the subcontractor clearly defines the services and quality to be provided. In that written statement, one should define in detail the policies for the subcontractor officially or contractually. The subcontractor's activities relevant to the agreement should be included in the operator's quality assurance program. An assessment/audit role is to be taken when addressing the adequacy of the safety practices of outside organizations. Enhancements and/or changes to the outside organization's safety standards and practices should be suggested prior to the commitment to contractual obligations.

8.1.2 Operators may decide to subcontract certain activities to external agencies for the provision of services related to areas such as:

- Deicing/anti-icing;
- Maintenance;
- Ground handling;
- Flight support (performance calculations, flight planning, navigation database and dispatch);
- Training;
- Manual preparation;
- Safety audits; and,
- Parts suppliers.

8.1.3 The operator should ensure that the subcontractor has the necessary authorization/approval when required and commands the resources and competence to undertake the task. If the operator requires the subcontractor to conduct an activity that exceeds the subcontractor's authorization/approval, the operator is responsible for ensuring that the subcontractor's quality assurance takes account of such additional requirements.

8.1.4 If, for example, the operator purchases a performance manual from a subcontractor, the operator remains responsible for the contents and shall undertake the necessary control, including quality assurance.

8.1.5 Quality System Training

8.1.5.1 Effective, well-planned and resourced quality related training for all of their personnel should be established. Those responsible for managing the quality system should receive training covering at least the following topics:

- An introduction to the concept of a quality system;
- Quality management;
- Concept of quality assurance;
- Quality manuals;
- Audit techniques;

- Reporting and recording; and,
- The way in which the quality system will function in the company.

8.1.5.2 Time should be provided to train every individual involved in quality management and for briefing the remainder of the employees. The allocation of time and resources should be governed by the size and complexity of the operation concerned.

8.1.6 Sources of Training

8.1.6.1 Quality management courses are available from various national and international training facilities. Operators with sufficient appropriately qualified staff may decide to carry out in-house training.

8.2 Safety Practices of Partners

8.2.1. Liaison With Flight Safety Organizations Outside the Company

8.2.1.1 There are many flight safety organizations worldwide. It is up to the individual flight safety officer to become acquainted with them and evaluate their activities in order to obtain the most effective benefits on behalf of the company.

8.2.1.2 By becoming involved with other flight safety organizations and colleagues in other airlines, the flight safety officer is able to obtain advice in all aspects of operations for consideration by flight operations and engineering management. Such information can be used to develop, improve or otherwise modify company procedures in the interest of enhancing flight safety.

8.2.1.3 It is important to establish working contacts throughout other airlines and the industry on a global basis. In the event of an accident or incident occurring in a foreign country, lack of local knowledge coupled with wide time zone differences will certainly complicate the start of a company investigation. Consider the immediate concerns, all of which can be addressed initially by the flight safety officer's opposite colleague in a remote area:

- Preservation of digital flight data recorder (DFDR)/cockpit voice recorder (CVR) data;
- Security of the aircraft;
- The welfare of crew and passengers;
- Contact with airport, air traffic control (ATC), local and government authorities;
- Assessing the need for operational and engineering assistance; and,
- Provision of facilities to accommodate the company's investigation team (office space, phone, fax and telex facilities, living quarters on site).

8.2.2 Aircraft manufacturers maintain their own flight safety organizations and often promote their activities through regular seminars and conferences. Airbus, for example, hosts an annual flight safety conference to which all customer flight safety officers and their associates are invited. The conference highlights incidents and accidents that have occurred during the preceding year and provides updates on other events. Customer presentations on any flight safety-related topic are welcomed, and a free exchange of information is encouraged. Airbus also operates a confidential information exchange scheme for crews in its customer airlines (AIRS, the Aircrew Incident Reporting System).

8.2.3 Regulatory and airport authorities form standing committees whose task is to address flight safety problems in specific regions and airports. The U.K. Civil Aviation Authority (CAA) Overseas Working Group and the British Airport Authority Regional Airport Safety Committee are two such examples. Government- and industry-sponsored initiatives that serve a similar function include the U.S. Commercial Aviation Safety Team (CAST), European Joint Aviation Authorities Safety Strategy Initiative (JSSI) and the Pan American Aviation Safety Team (PAAST).

8.2.4 The International Air Transport Association (IATA) Safety Committee (SAC) is an international committee made up of a limited number of elected flight safety managers drawn from the world's airlines. The committee has a balanced membership from the global regions of Africa, Asia-Pacific, Canada, Europe, the Middle East, North America, Oceania and South America. It meets biannually, in February and July, and invites observers from member airlines, aircraft equipment manufacturers and formal investigation authorities.

8.2.5 The U.K. Flight Safety Committee (UKFSC) offers membership through subscription to all European operators of transport aircraft. Affiliated membership is offered to non-European airlines. The UKFSC meets eight times a year.

8.2.6 Other industry associations and organizations include:

- Arab Air Carrier's Organization (AACO);
- Asia-Pacific Airline Association (APAA);

- Air Transport Association of America (ATA);
- Africa Aviation Safety Council (AFRASCO, formerly the East, Central and Southern Africa Flight Safety Council);
- Flight Safety Foundation;
- International Association of Latin American Carriers (AITAL); and,
- International Federation of Air Line Pilots' Associations (IFALPA).

8.2.8 Maintaining Familiarity With the Company's Activities

8.2.8.1 The flight safety officer must maintain a constant awareness of developments. Personnel change routinely; therefore, working relationships with new colleagues must be established. In a successful company, new appointments will be created as departments expand; there will be changes in commercial policy, more aircraft will be acquired and new routes added to the existing structure.

8.2.8.2 The procedures set out in this handbook are designed to accommodate such changes; but in order to obtain the best benefits, a periodic review of the flight safety program in relation to the company's development is essential. For example:

- Code-sharing agreements — Code-sharing is a practice that allows two airlines to use the same flight designator to market a through or single service. It is highly recommended that a safety audit is conducted of a code-sharing partner which is at least as rigorous as the company's own internal safety audit. In addition, it is highly recommended that safety information be shared on a regular basis between organizations. Entry into a code-sharing agreement with another airline often requires the exchange of a token number of cabin crew for assignment for duty on each operator's aircraft as part of the agreement. In this case, the flight safety officer must establish with the other operator an agreed procedure for the reporting, investigation and follow-up of occurrences in which their respective company's crewmembers are involved.
- Wet-lease aircraft agreements — It is common practice for an airline to lease another's (the lessor's) aircraft and crew to operate some of its services. In some cases, the lessor may be operating to a different set of rules and reporting requirements than the host airline (the lessee). The lessor needs to be made aware of its obligations in the reporting and follow-up of occurrences while operating on behalf of the host company. It is not sufficient for the lessor to report occurrences only to the regulatory authority in its own country of registry. There may be differences in the reporting requirements and culture of the two companies that will need to be resolved. As in code-share agreements, the flight safety officer should establish with the other operator an agreed reporting and follow-up procedure to regulate their relationship.
- Damp-lease aircraft agreements — Under this arrangement, an airline may lease an aircraft plus flight crew but use its own cabin crew. The procedures above must be applied where appropriate in the interests of all concerned.

9. Cabin Safety

9.1 Scope

9.1.1 This section of the handbook was developed to provide information to supplement the flight safety program and provide the flight safety officer with information related to cabin safety issues and personnel. This section is to be used as a quick reference for the flight safety officer and to guide the cabin safety investigator on the policies and processes of their duties. The flight safety officer and cabin safety investigator should refer to a companion document, the *Cabin Safety Compendium* (*CSC*), developed by the Global Aviation Information Network (GAIN) Aviation Operator Safety Practices Working Group. The *CSC* provides detailed information and guidelines on cabin safety to establish and support the company flight safety program.

9.2 Cabin Safety Investigator

9.2.1 Mission Statement

9.2.1.1 The cabin safety investigator will define the parameters and role of the cabin safety department. The cabin safety investigator will also identify issues related to cabin crew and passenger safety, determine stakeholders, agree on the validity of an issue and assist to facilitate change.

9.2.2 Position Description

9.2.2.1 The cabin safety investigator reports through the flight safety program's office and represents the flight safety program on issues which may affect the cabin crew and/or passengers in the cabin of the airplane while in the flight environment (block to block).

9.2.3 Required Experience

9.2.3.1 Experience in any of the following areas is pertinent to the position of cabin safety investigator:

- Cabin crew experience;
- Pilot experience;
- Engineering background;
- Aircraft/employee accident investigation;
- Operational experience;
- Weather knowledge;
- Education in safety and/or aviation safety; and,
- Emergency-evacuation-qualified in all fleet types.

9.2.4 Position Responsibilities

9.2.4.1 The cabin safety investigator will act as a consultant to the operating divisions on cabin safety issues and act as a representative of the flight safety program. The cabin safety investigator's responsibilities include the following:

- Facilitate/coordinate cabin crew safety debriefings;
- Provide investigative and design expertise in areas which directly affect the aircraft cabin environment, including:
  - Review procedures, analyze incidents and submit recommendations for improvement;
  - Coordinate findings with the flight safety officer, if applicable;
  - Coordinate resolution of identified prevention techniques with the appropriate divisions; and,
  - Obtain agreement and responsibility for the findings from the operating division (note that the operating division must "be responsible" for the issue);
- Coordinate the development of future procedures and policies to ensure overall cabin safety for cabin crew and passengers:
  - Partner with the operating division to trend cabin crew and passenger injuries and assist in determining methods to reduce them; and,
  - Assist the operating division in analyzing employee injuries;
- Remain apprised of industry safety related issues throughout the world:
  - Ensure the operating divisions are aware of pending legislation and trends which may affect the company; and,
  - Become active in industry organizations which have an impact on the safety issues and the formation of regulations which may affect cabin safety;
- Establish a safety assessment system to evaluate key safety issues:
  - The operating division must be responsible to establish a quality control system;
  - The flight safety program may assist the operating divisions by providing consultation as requested in areas related to the area of expertise; and,
  - Determine what area of the company will be accountable for quality assurance, which will assess the performance of the operating divisions based on established criteria;
- Liaise with the following groups within the organization:
  - Regulatory;
  - Quality assurance;
  - Passenger service;
  - Labor organizations (passenger service and cabin crew);
  - Flight safety;
  - Flight operations;
  - Medical;
  - Engineering; and,
  - Marketing;
- Liaise with regulatory and accident investigation authorities outside the organization (establishing a company contact for outside authorities will expedite responses to requests and reduce confusion within both organizations);
- Ensure cabin safety manual revisions are approved and issued by the flight safety program and regular reviews of the manual are established;
- Cabin investigations:
  - Establish criteria of "must investigate" incidents based on company policy and regulatory requirements (e.g., broken bones, hospitalization);
  - Investigation requests may be initiated by any stakeholder;

- Establish a process which is acceptable to all participants; provide a written document supporting your processes to all departments that may have involvement and obtain an agreement on the submitted processes; and,
- The cabin investigation process must be “discipline-free” in order to obtain the maximum benefit from the program;

- Maintain a current organization chart and document the cabin safety role within the organization and company;
- Safety communication:
  - Establish an effective method to communicate important issues to the cabin crew population, especially immediate critical communications;
  - Provide cabin crew with a vehicle to report safety related issues and hazards (see paragraphs 3.4 and 3.5);
  - Ensure that the reporting system has a feedback loop (including newsletters):
    - Track and trend concerns and responses; and,
    - Operational management needs to respond and be responsible for employee concerns regarding safety; and,
  - Provide updates to the safety committees on relevant issues (see paragraph 3.3);
- Establish and maintain regular dialogue with labor counterparts to obtain feedback on cabin safety related issues;
- Encourage operating divisions to establish safety committees at the local level:
  - Membership should always include management and labor;
  - Encourage participants to be proactive by looking for ways to improve safety;
  - Establish a feedback loop to obtain information on issues relating to individual committees;
  - Ensure local issues are shared with all locations to identify common occurrences before they escalate;
  - Each committee must establish a system to provide agendas, minutes and action items;
  - Each committee should assess the most common injuries in the cabin; the cabin safety investigator should work with the committees to assess what elements and behaviors contributed to the injuries (e.g., identify “at risk” behavior).

9.2.5 Accident Response

9.2.5.1 The company flight safety manual should include cabin crew issues in the accident response plan (see section 6). The plan should ensure that personnel are designated to represent the cabin crew perspective in cases of serious accidents. Normally, these personnel will be appointed from the operating division.

9.2.5.2 The flight safety officer should establish the responsibilities of the cabin safety investigator within the organization when an accident occurs:

- The cabin safety investigation guidelines presented in Appendix A of the *CSC* should be referenced and documented in the accident/incident manual; and,
- Review paragraph 5.9 to determine equipment and personal items necessary to conduct an accident investigation.♦

[FSF editorial note: To ensure wider distribution in the interest of aviation safety, this report has been adapted from the Global Aviation Information Network (GAIN) Aviation Operator Safety Practices Working Group’s *Operator’s Flight Safety Handbook*, Issue 2, December 2001. Some editorial changes were made by FSF staff for clarity and for style, and some ancillary sections were deleted. The following organizations contributed to the research and preparation of the handbook: Abacus Technology Corp., Aer Lingus, Air Safety Management, Airbus, Australian Civil Aviation Authority, Australian Transport Safety Bureau, Aviation Research, British Midland Airways, Delta Air Lines, DuPont Aviation, Flight Safety Foundation, Gemini Air Cargo, Gulf Air, JetBlue Airways, Middle East Airlines, National Business Aviation Association, Saudi Arabian Airlines, South African Airways, Swissair, TAM Brazilian Airlines, United Airlines, University of Southern California, U.K. Flight Safety Committee, United States Aviation Insurance Group, U.S. Federal Aviation Administration Office of System Safety, and U.S. National Aeronautics and Space Administration Aviation Safety Program.]

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Appendix A
Sample Forms and Reports

Contents

Air Safety Report Sample 1

AIR SAFETY REPORT

!! THIS BLOCK FOR FLIGHT SAFETY OFFICE USE !!
IS THIS EVENT A REPORTABLE OCCURRENCE? YES ☐ NO ☐
REFERENCE No:

XYZ AIRLINES

1. TYPE OF EVENT (CHECK ALL THAT APPLY) — ASR ☐ AIRPROX/ATC ☐ TCAS RA ☐ WAKE TURBULENCE ☐ BIRD STRIKE ☐

2. CM1 | CM2 | CM3

3. DATE OF OCCURRENCE DD MM YR | 4. TIME LOCAL / UTC DAY / NIGHT | 5. SERVICE NR./CALLSIGN | 6. ROUTE FROM / ROUTE TO

7. DIVERTED TO | 8. AIRCRAFT TYPE | 9. REGISTRATION | 10. NR. OF PASSENGERS / CREW | 11. TECH LOG REFERENCE NR.

12. FLIGHT PHASE: TOWING - PARKED - PUSHBACK - TAXI OUT - TAKE-OFF - INITIAL CLIMB CLIMB - CRUISE - DESCENT - HOLDING - APPROACH - LANDING - TAXI -IN

13. ALTITUDE FL .... FT ....

14. SPEED MACH NR. | 15. FUEL DUMPED: QUANTITY TIME LOCATION | 16. MET CONDITIONS: IMC VMC km

17. WX ACTUAL: WIND VISIBILITY CLOUD TEMP (°C) QNH (mb)

18. SIGNIFICANT WX: MODERATE/SEVERE: RAIN - SNOW - ICING - FOG - TURBULENCE - HAIL - STANDING WATER - WINDSHEAR

19. RUNWAY: L / C / R | 20. RUNWAY STATE: RVR: DRY - WET - ICE - SNOW - SLUSH - DEBRIS

21. AIRCRAFT CONFIGURATION: AUTOPILOT AUTOTHRUST GEAR FLAP SLAT SPOILER

22. EVENT SUMMARY (CONCISE DESCRIPTION OF EVENT)

23. ACTION TAKEN, RESULT AND ANY SUBSEQUENT EVENT(S)

24. OTHER INFORMATION AND SUGGESTIONS FOR PREVENTIVE ACTION

!! PLEASE COMPLETE APPLICABLE SECTIONS OVERLEAF !!

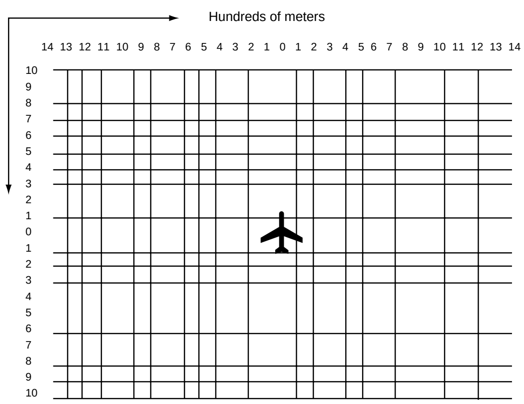
Air Safety Report Sample 1 *(continued)*

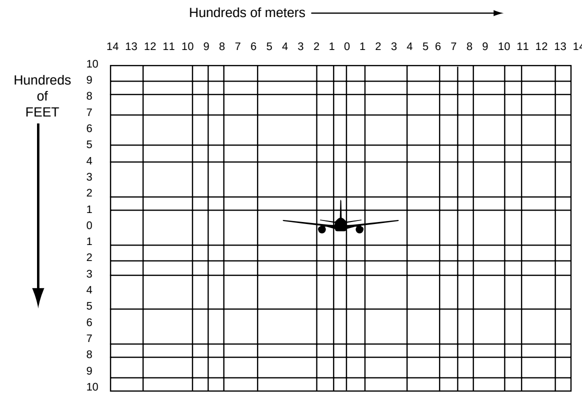
25. MAINTENANCE ENGINEER'S BRIEF REPORT

AIRPROX - ATC INCIDENT - TCAS - WAKE TURBULENCE - BIRD STRIKE
COMPLETE ASR SECTIONS 1 TO 25 AND ADD RELEVANT DETAILS FOR SPECIFIC EVENT BELOW (26, 27 OR 28)

26. AIRPROX/ATC INCIDENT and/or TCAS

Mark the passage of the other aircraft relevant to you, in plan on the left and in elevation on the right, assuming YOU are at the center of the diagram





VIEW FROM ABOVE (horizontal plane meters ☐ or n.m. ☐)

VIEW FROM ASTERN (vertical plane; feet)

1. SEVERITY OR RISK LOW / MED / HIGH
2. AVOIDING ACTION TAKEN? YES / NO
3. REPORT TO ATC ....UNIT
4. ATC INSTRUCTIONS ISSUED? ....
5. YOUR CALL SIGN ....
6. FREQUENCY IN USE ....
7. HEADING .... DEG
8. VERTICAL DISTANCE FROM CLOUD .... FT
9. HORIZONTAL DISTANCE FROM CLOUD ....KM
10. MINIMUM VERTICAL SEPARATION ....FT
11. MINIMUM HORIZONTAL SEPARATION .... M/n.m.
12. SQUAWK C
13. TCAS ALERT RA / TA / NONE
14. RA FOLLOWED? YES / NO VERT DEVIATION ....FT
15. OTHER AIRCRAFT: TYPE ....
    MARKINGS/COLOR ....
    CALLSIGN/REGISTRATION ....
    LIGHTING ....

27. WAKE TURBULENCE

1. HEADING ....
2. TURNING? LEFT / RIGHT / NO
3. POSITION ON GLIDESLOPE HIGH / LOW / ON
4. POSITION ON EXTENDED CENTERLINE LEFT / RIGHT / ON
5. CHANGE IN ALTITUDE PITCH......... ROLL ....YAW .... DE ....
6. CHANGE IN ALTITUDE .... FT
7. WAS THERE BUFFET? YES / NO STICK SHAKE? YES / NO
8. WHAT MADE YOU SUSPECT WAKE TURBULENCE?
9. DESCRIBE ANY VERTICAL ACCELERATION?
10. GIVE DETAILS OF PRECEDING AIRCRAFT (TYPE/CALL SIGN)
11. WERE YOU AWARE OF THE OTHER A/C BEFORE THE INCIDENT?

28. BIRD STRIKE

1. LOCATION ....
2. TYPE OF BIRDS ....
3. NR.SEEN 1 ☐ 2-10 ☐ 11-100 ☐ MORE ☐
4. NR STRUCK 1 ☐ 2-10 ☐ 11-100 ☐ MORE ☐
5. TIME DAWN ☐ DAY ☐ DUSK ☐ NIGHT ☐

DESCRIBE IMPACT POINT AND DAMAGE OVERLEAF

NAME OF REPORTER ....

RANK .... **DATE** ....

SIGNATURE ....

DISPOSAL INSTRUCTIONS

FAX COMPLETED FORM AS SOON AS POSSIBLE TO FLIGHT OPERATIONS CONTROL THEN RETURN ORIGINAL VIA COMPANY MAIL SYSTEM TO THE FLIGHT SAFETY MANAGER

Air Safety Report Sample 2

XYZ AIRLINES	AIR SAFETY REPORT	FOR OFFICE USE ONLY Number: ________ Date Received: ________

1. Type of Occurrence ➡	Airmiss	Birdstrike	Wake Turbulence	Technical	PED Interference	Other
	☐	☐	☐	☐	☐	

2. Aircraft Type	3. Engines Type	4. Registration	5. Crew	Capt.	F/O	Other Crew
________	________	________		________	________	________

6. Flight No.	7. From / To	8. Date	9. Time	10. Landing at/or Destination/
________	____ /____	________	____UTC/____ LT	Destination/________

11. Flight ➡ Phase	Parked	Push back	Taxi	Takeoff	Climb	Cruise	Descent	Holding	Approach	Landing
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

12. Flight ➡ Info:	Altitude	Speed	Flaps	Slats	Thrust EPR/NI	Gear Up/Down	A/pilot No ☐ Yes/n°	A/thrust No/Yes	Spoilers No/Yes	Etops No/Yes
	——FT	—— kts	—— °	——	——/——	☐ / ☐	☐ /——	☐ ☐	☐ ☐	☐ ☐

13. Weather ➡ Info:	IMC/VMC	Wind	Visibility A/thrust	Clouds No <4/8 >4/8	TEMP	QNH	PRECIPITATION Fg Dz Rn Sn Nil
	☐ / ☐	——°/——kts	————M	☐ ☐ ☐	—— °C	—— hp	☐ ☐ ☐ ☐ ☐

14. General ➡ Info:	A/C Weight	Crew/Pax	Tech. Log Ref Sheet/Item	Dr's Kit used No / Yes	Restraint Kit used No / Yes	Fuel Jettison No/Yes	Injuries Nil / N°
	———— kgs	—— /——	——/——	☐ ☐	☐ ☐	☐/—— kg	☐/ ——

15. Captain's Remarks:

____

____

____

____

____

____

____

____

____

____

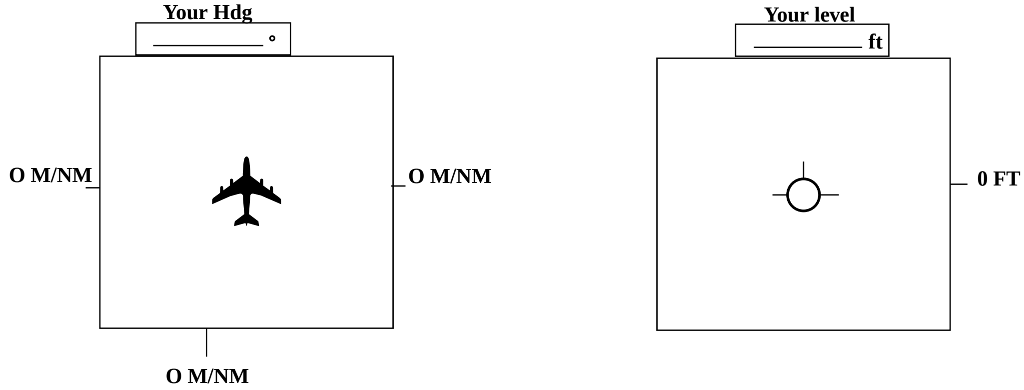
____

____

OPS. FORM No. 03 NOV. 98

Air Safety Report Sample 2 *(continued)*

16. AIRMISS: Pilot position of other aircraft relative to you assuming you are at the center of the rectangle at time of passage and write estimated minimum horizontal separation in Meters (M) or Nautical Miles (NM) and estimated minimum vertical separation in feet (FT).



Avoiding action	By whom	TCAS ALERT	Useful	TA / RA	Under Radar	ATC INST ISSUED	FREQ	126.9	Reptd to ATC by
Yes / No	You / Him	Yes / No	Yes / No		Yes / No	Yes / No		You / Him	You / Him
☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	_____	☐ ☐	☐ ☐

Risk Assessment	High	Med	Low	None	Other Aircraft:	Type	Color	Lights	Call sign	Strobe lights
	☐	☐	☐	☐		_____	_____	ON/OFF	_____	ON/OFF

17. Bird Strike	Size of Bird:	No of Birds:	1	2–10	11–100	More	Parts of aircraft:	Radome	Windshield	Nose	Eng	Wing	Gear	Others
Bird	☐ Small	Seen	☐	☐	☐	☐	Struck	☐	☐	☐	☐	☐	☐	☐
Species	☐ Medium	Struck	☐	☐	☐	☐	Damaged	☐	☐	☐	☐	☐	☐	☐
________	☐ Large													

18. Wake Turbulence	Turning	Buffet	Stick Shaker	Change in Attitude	Change in Altitude	Alerted by
Position	Yes / No	Yes / No	Yes / No	Pitch Roll Yaw		ATC Traffic Not
______________	☐ ☐	☐ ☐	☐ ☐	☐ ☐ ☐	________ ft	☐ ☐ ☐

19. Technical Hydraulic ☐ Electric ☐ Mechanic ☐ Instrument ☐ Airframe ☐ Engine No ________

Snag ____

____

____

____

20. PED ➡ Interference	PED Type	Manufacturer	Model	Seat Location	User Name	Address	Tel.	Action by Crew
						________	________	Yes / No
						________	________	☐ ☐
	________	________	_____	________	________	________	________	

Capt.'s Name:________________________ Signature: ________________________ Date: ________________

FILL AND RETURN TO THE OFFICE OF HEAD OF SAFETY IMMEDIATELY AFTER LANDING

Confidential Report Form Sample 1

CONFIDENTIAL REPORTING SCHEME

XYZ AIRLINES

MAY WE CONTACT YOU? If so, please provide your name and contact number:

Name ______________________________ Tel ____________

1. DATE OF OCCURRENCE DD MM YR	2. TIME LOCAL / UTC DAY / NIGHT	3. SERVICE NR./CALLSIGN	4. AIRCRAFT REGISTRATION

THE ABOVE INFORMATION IS CONFIDENTIAL. IT WILL BE REMOVED FROM THE REPORTING FORM AND RETURNED TO YOU
NO RECORD OF YOUR IDENTITY WILL BE KEPT

✂ -

5. A/C TYPE | 6. ROUTE: FROM TO DIVERTED TO | 7. NR. OF PASSENGERS/CREW | 8. ETOPS?

9. ALTITUDE FL ________ FT _________ | 10. NEAREST AIRPORT, NAVAID OR FIX | 11. ASR RAISED?

12. TECH LOG REF: SECTOR LOG REF ITEM No. | 13. MET: IMC VMC

14. SIGNIFICANT WX: MODERATE/SEVERE RAIN - SNOW - ICING - FOG - TURB - HAIL - STANDING WATER - WINDSHEAR

15. AIRCRAFT CONFIGURATION: AUTOPILOT AUTOTHRUST GEAR FLAP SLAT SPOILER

16. FLIGHT PHASE: TOWING - PARKED - PUSHBACK - TAXI OUT - TAKE-OFF - INITIAL CLIMB (below 1500 ft.) - CLIMB - CRUISE - DESCENT - HOLDING - APPROACH (below 1500 ft.) - LANDING - TAXI-IN

17. REPORTER:

CAPTAIN ____ PILOT FLYING ☐

F/O ____ PILOT NOT FLYING ☐

OTHER CREW MEMBER ☐

18. FLYING TIME:

TOTAL ______________ HRS

LAST 90 DAYS __________ HRS

TIME ON TYPE __________ HRS

WHAT HAPPENED? (Briefly describe the event, along with any contributing factors — e.g., weather, technical problems. SOPs, airfield facilities).

Confidential Report Form Sample 1 *(continued)*

WHY DID IT HAPPEN? (Describe the failure(s) that allowed the incident to happen — e.g., technical, training inadequacy, regulations, crew co-ordination.)
HOW WAS IT FIXED? (Describe the steps you took, from diagnosing the problem to recovery of the aircraft.)
SAFETY RECOMMENDATIONS: (Tell us what can be done [and by whom] to improve the safety response to a similar event. Within airline [e.g., training, standards, cabin, maintenance] or outside the airplane [regulator, manufacturer, other]).

Confidential Report Form Sample 2

XYZ AIRLINES **SAFETY DEPARTMENT**

CONFIDENTIAL REPORTING FORM

Event Date	Flight number	Name
Aircraft type	**Registration**	**Flight phase**

Should you desire to receive a personal reply or should you need more information to clarify the event, kindly specify the way you prefer us to contact you.

Telephone # ________________ E-mail ____________________________ Mailbox # __________ Other ____

- -

1. Briefly describe the event, along with any relevant external factors such as weather, ATC or airfield facilities.

2. How were you feeling and how were you getting on as a crew?

3. How did you and the crew respond to the event?

4. How did you establish what technical/operational and personal/crew issues were involved?

5. Did the drills and procedures work well in solving the problem and was all the technical information you required familiar and easily available? If not, please specify what could be improved.

6. How well did your training (technical/non-technical) prepare you for this situation? What training was particularly good and what could be improved?

7. What is in your opinion the most important lesson from this event?

8. Any other comments to improve the safety response for a similar event?

Confidential Report Form Sample 3

The information on this form will only be used for the purpose for which you have provided it. We will not use the information for any other purpose, and will not disclose it withour your consent.

ATSB Australian Transport Safety Bureau

Confidential Aviation Incident Report

Date of Incident | Local time | Location e.g. 27 NM west of Bowral, NSW (include latitude & longitude if possible)

Aircraft registration | Flight number | Aircraft manufacturer and model

Your position (e.g. pilot, ATS, LAME, FA) | Pilot. Your total hours | Non-pilot experience yr/mth

Aircraft operator e.g. company name | Aircraft owner | Aircraft hirer (if any)

Type of operation:

- ☐ Air transport – passenger
- ☐ Flying training – solo
- ☐ Businesses
- ☐ Gliding
- ☐ Sports aviation
- ☐ Air transport – cargo
- ☐ Flying training – dual
- ☐ Agricultural
- ☐ Private
- ☐ Military
- ☐ Charter
- ☐ Other

Flight rules: ☐ VFR ☐ IFR

Flight conditions: ☐ VMC ☐ IMC

Number of persons on board: ☐ Crew ☐ Passengers

Weather conditions:

Visibility | Wind | Cloud | Altitude of occurrence

Last departure point of flight | Time of departure (Local) | Next intended point of landing

Indicate the phase in which the occurrence happened:

☐ Aircraft standing ☐ Taxiing ☐ Takeoff ☐ En-route ☐ Maneuvering ☐ Approach ☐ Landing

Airspace designation

Please fully describe the occurrence:
All relevant documentation should be forwarded to CAIR. Include your suggestions on how to prevent similar occurrences.

Please enclose additional page/s as necessary

Your name | Date

Address

Telephone | Facsimile | Internet email

Sept 2000

Confidential Report Form Sample 4

DO NOT REPORT AIRCRAFT ACCIDENTS AND CRIMINAL ACTIVITIES ON THIS FORM.
ACCIDENTS AND CRIMINAL ACTIVITIES ARE NOT INCLUDED IN THE ASRS PROGRAM AND SHOULD NOT BE SUBMITTED TO NASA.
ALL IDENTITIES CONTAINED IN THIS REPORT WILL BE REMOVED TO ASSURE COMPLETE REPORTER ANONYMITY.

(SPACE BELOW RESERVED FOR ASRS DATE/TIME STAMP)

IDENTIFICATION STRIP: *Please fill in all blanks to ensure return of strip.*
NO RECORD WILL BE KEPT OF YOUR IDENTITY. This section will be returned to you.

TELEPHONE NUMBERS where we may reach you for further details of this occurrence:

HOME *Area* _______ *No.* _____________________ *Hours* _________________
WORK *Area* _______ *No.* _____________________ *Hours* _________________

NAME ____
ADDRESS/PO BOX _______________________________________
____
CITY ________________________ ***STATE*** _____ ***ZIP*** ___________

TYPE OF EVENT/SITUATION _______________
____
DATE OF OCCURRENCE __________________
LOCAL TIME (24 hr. clock) _________________

PLEASE FILL IN APPROPRIATE SPACES AND CHECK ALL ITEMS WHICH APPLY TO THIS EVENT OR SITUATION.

REPORTER	FLYING TIME	CERTIFICATES/RATINGS		ATC EXPERIENCE	
☐ Captain	total ____________ hrs.	☐ student	☐ private	☐ FPL	☐ Developmental
☐ First Officer		☐ commercial	☐ ATP	radar ______________ yrs.	
☐ pilot flying	last 90 days _______ hrs.	☐ instrument	☐ CFI	non-radar ____________ yrs.	
☐ pilot not flying		☐ multiengine	☐ F/E	supervisory ___________ yrs.	
☐ Other Crewmember	time in type _______ hrs.	☐ ____________________		military ______________ yrs.	
☐ _______________					

AIRSPACE		WEATHER		LIGHT/VISIBILITY		ATC/ADVISORY SERV.	
☐ Class A (PCA)	☐ Special Use Airspace	☐ VMC	☐ ice	☐ daylight	☐ night	☐ local	☐ center
☐ Class B (TCA)	☐ airway/route _________	☐ IMC	☐ snow	☐ dawn	☐ dusk	☐ ground	☐ FSS
☐ Class C (ARSA)	☐ unknown/other ________	☐ mixed	☐ turbulence	ceiling ________ feet		☐ apch	☐ UNICOM
☐ Class D (Control Zone/ATA)	________________	☐ marginal	☐ tstorm	visibility ______ miles		☐ dep	☐ CTAF
☐ Class E (General Controlled)	________________	☐ rain	☐ windshear	RVR ________ feet		Name of ATC Facility:	
☐ Class G (Uncontrolled)	________________	☐ fog	☐ _________			________________	

	AIRCRAFT 1			AIRCRAFT 2		
Type of Aircraft (Make/Model)	(Your Aircraft) _________________		☐ EFIS ☐ FMS/FMC	(Other Aircraft) _________________		☐ EFIS ☐ FMS/FMC
Operator	☐ air carrier ☐ commuter	☐ military ☐ private	☐ corporate ☐ other _________	☐ air carrier ☐ commuter	☐ military ☐ private	☐ corporate ☐ other _________
Mission	☐ passenger ☐ cargo	☐ training ☐ pleasure	☐ business ☐ unk/other _______	☐ passenger ☐ cargo	☐ training ☐ pleasure	☐ business ☐ unk/other _______
Flight plan	☐ VFR ☐ IFR	☐ SVFR ☐ DVFR	☐ none ☐ unknown	☐ VFR ☐ IFR	☐ SVFR ☐ DVFR	☐ none ☐ unknown
Flight phases at time of occurrence	☐ taxi ☐ takeoff ☐ climb	☐ cruise ☐ descent ☐ approach	☐ landing ☐ missed apch/GAR ☐ other _________	☐ taxi ☐ takeoff ☐ climb	☐ cruise ☐ descent ☐ approach	☐ landing ☐ missed apch/GAR ☐ other _________
Control status	☐ visual apch ☐ controlled ☐ no radio	☐ on vector ☐ none ☐ radar advisories	☐ on SID/STAR ☐ unknown	☐ visual apch ☐ controlled ☐ no radio	☐ on vector ☐ none ☐ radar advisories	☐ on SID/STAR ☐ unknown

If more than two aircraft were involved, please describe the additional aircraft in the "Describe Event/Situation" section.

LOCATION	CONFLICTS
Altitude ____________________ ☐ MSL ☐ AGL	Estimated miss distance in feet: horiz ______ vert _____
Distance and radial from airport, NAVAID, or other fix _________	Was evasive action taken? ☐ Yes ☐ No
______________________________________	Was TCAS a factor? ☐ TA ☐ RA ☐ No
Nearest City/State ___________________________	Did GPWS activate? ☐ Yes ☐ No

NASA ARC 277B (January 1994) **GENERAL FORM** Page 1 of 2

Confidential Report Form Sample 4 *(continued)*

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA has established an Aviation Safety Reporting System (ASRS) to identify issues in the aviation system which need to be addressed. The program of which this system is a part is described in detail in FAA Advisory Circular 00-46D. Your assistance in informing us about such issues is essential to the success of the program. Please fill out this form as completely as possible, enclose in an sealed envelope, affix proper postage, and and send it directly to us.

The information you provide on the identity strip will be used only if NASA determines that it is necessary to contact you for further information. THIS IDENTITY STRIP WILL BE RETURNED DIRECTLY TO YOU. The return of the identity strip assures your anonymity.

AVIATION SAFETY REPORTING SYSTEM

Section 91.25 of the Federal Aviation Regulations (14 CFR 91.25) prohibits reports filed with NASA from being used for FAA enforcement purposes. This report will not be made available to the FAA for civil penalty or certificate actions for violations of the Federal Air Regulations. Your identity strip, stamped by NASA, is proof that you have submitted a report to the Aviation Safety Reporting System. We can only return the strip to you, however, if you have provided a mailing address. Equally important, we can often obtain additional useful information if our safety analysts can talk with you directly by telephone. For this reason, we have requested telephone numbers where we may reach you.

Thank you for your contribution to aviation safety.

NOTE: *AIRCRAFT ACCIDENTS SHOULD NOT BE REPORTED ON THIS FORM. SUCH EVENTS SHOULD BE FILED WITH THE NATIONAL TRANSPORTATION SAFETY BOARD AS REQUIRED BY NTSB Regulation 830.5 (49CFR830.5).*

Please fold both pages (and additional pages if required), enclose in a sealed, stamped envelope, and mail to:

NASA AVIATION SAFETY REPORTING SYSTEM
POST OFFICE BOX 189
MOFFETT FIELD, CALIFORNIA 94035-0189

DESCRIBE EVENT/SITUATION

Keeping in mind the topics shown below, discuss those which you feel are relevant and anything else you think is important. Include what you believe really caused the problem, and what can be done to prevent a recurrence, or correct the situation. (USE ADDITIONAL PAPER IF NEEDED)

Page 2 of 2

CHAIN OF EVENTS

- How the problem arose
- How it was discovered
- Contributing factors
- Corrective actions

HUMAN PERFORMANCE CONSIDERATIONS

- Perceptions, judgments, decisions
- Actions or inactions
- Factors affecting the quality of human performance

Flight Crew Notice Sample

A340 | **XYZ AIRWAYS** | **A340**

FLIGHT CREW NOTICE

FLEET NOTICE: No. 99/99

APPLICABILITY: All A340 Pilots

Airbus Industrie has issued a Flight Operations Telex in connection with the following:

Subject: A330/A340 - ATA 22 - CONFLICTING FD INDICATIONS DURING TAKE-OFF

Two operators have reported that after take-off the crew noticed two different lateral commands from the left and right roll FD bars. Five different events have occurred: two on the same aircraft and for the same departure (RWY 09R/BPK 5J SID), two others on RWY 09R/BUZAD 3J with two different aircraft. One event occurred on departure from Athens.

The initial investigation shows that the events were due to a non- or late sequencing of the 'TO' waypoints by one FMS. In all the SIDS concerned there is a left turn after take-off. If the Flight Plan is correctly flown by the A/P (or by the crew) the aircraft will turn to the left. If the opposite FMS has not sequenced the waypoint (i.e. the left turn transition) it will continue to generate FD commands to continue the previous leg straight ahead and will thus command a right lateral FD order.

The above scenario is only a hypothesis but it can easily be confirmed by comparing the 'TO' waypoint displayed in the upper right corner of both navigation displays (ND) during the time the FD commands conflict.

Recommendations:

1. During pre-flight, review the SID and the associated turn direction. Once airborne, monitor the 'TO' waypoint on the ND. If the A/P F/D does not follow the intended flight path, select HDG on the FCU to track it.

2. If the same abnormality is encountered, make an appropriate tech log entry at the end of the flight.

3. Airbus would like a copy of the DFDR, a printout of the FM flight reports (from both FM) and a comprehensive crew report specifying the 'TO' waypoint identifier displayed on each ND and on each MCDU at the time of the occurrence.

APPROVED BY: ______________________ OPS ENGINEERING MANAGER

SIGNED: ____________________________

ISSUING AUTHORITY: _________________ HEAD OF FLIGHT CREW

SIGNED: ____________________________

DATE ISSUED: _______________________ REMOVAL DATE: __________________

Final Report Cover Sheet Sample

XYZ AIRLINES

CONFIDENTIAL

REPORT CONCERNING AN INCIDENT INVOLVING [A/C TYPE] [REGN]
AT________ ON ________

INVESTIGATING BOARD: (Member 1)
(Member 2)
(Member 3)

IN ATTENDANCE: (CM 1)
(CM 2)
(CM 3)

CONTENTS:

[DISTRIBUTION LIST]
1
2
3
4
5
6
7
8

Notification to Captain Form Sample

LOADING STATION

NOTIFICATION TO CAPTAIN

XYZ AIRLINES

Flight No.	Aircraft Reg'n	Date	Prepared by: (Signature)

DANGEROUS GOODS (COMPATIBILITY GROUP MUST BE SHOWN IN CLASS COLUMN)

Stn of Unloading	Air Waybill No. (last 4 digits)	No. of Pkgs	UN Number	Proper Shipping Name of Article	Class or Division	Subsidiary Risk	Net Qty or Transport Index per Package	Packing Group	Code (see below)	Loaded ULD or Position

ADDITIONAL INFORMATION

OTHER SPECIAL LOAD

Stn of Unloading	Air Waybill No. (last 4 digits)	No. of Pkgs	Description	Code (see below)	Loaded ULD or Position

CODE	Description
REX	Explosives
R	Explosives Category 1
RNG	Non-flam. compressed gas
RPG	Poisonous Gases
RFL	Flammable Liquids
RFS	Flammable Solids
RSC	Spontaneously Combustible
RFW	Dangerous When Wet
ROX	Oxidising Substances
ROP	Organic Peroxide
RPS	Poisonous Substances
RHF	Harmful
RIS	Infectious Substances
RRW	Radioactive Category 1
RRY	Radioactive Cat. 2/3
RCM	Corrosives
RMD	Misc. Dangerous Goods

I CONFIRM THAT THE ARTICLES LISTED ABOVE WERE LOADED AS SHOWN AND THAT THERE WAS NO EVIDENCE OF DAMAGED OR LEAKING

CAPTAIN'S SIGNATURE ____________________

OTHER SPECIAL LOADS

CODE	DESCRIPTION
AVI	Live Animals
CAO	Cargo Aircraft Only
HEA	Heavy Cargo
HUM	Human Remains
ICE	Dry Ice
PER	Perishable Cargo
VAL	Valuable Cargo

DISTRIBUTION: Original - Loading Station Pink - Captain Blue - Dispatch Yellow - Unloading Station

Hazard Report Form Sample

Hazard Reporting System

Existing Condition

Recommended Corrective Action

Please detail the existing condition and any recommended corrective action. Use additional sheets as necessary. Drop in any Safety Suggestion box or mail to the Flight Safety Office. If you would like an update on any action please provide your name and phone or address. Thank you for your interest in the Flight Safety Program.

Date:______ Organization:__________________ Name. (Optional)______________________

Location:________________________________

Flight Safety Only

Rcvd: ______ No: _______ Assigned to: ______________________

Appendix C
Analytical Methods and Tools

The information about analytical methods and tools provided in Issue 1 of the *Operator's Flight Safety Handbook* has been superseded by the Global Aviation Information Network (GAIN) Working Group B report *Guide to Methods & Tools for Airline Flight Safety Analysis*, published in December 2001. This report can be viewed or downloaded from the GAIN Web site at: <http://www.gainweb.org/Working%20Groups/WGB/working_group_b_.html>.

[FSF editorial note: GAIN Working Group B said that the report is not comprehensive but provides information on about 50 analytical methods and tools that airlines can use to obtain information from event reports and digital flight data to improve safety. The report comprises summaries of flight safety event reporting and analysis systems; general methods and tools for event analysis; and flight operational quality assurance (FOQA)/digital flight data analysis tools.

The following are excerpts from the report's summaries of flight safety event reporting and analysis systems:

- Aeronautical Events Reports Organizer (AERO) — A FileMaker database designed "to organize and manage incidents and irregularities in a reporting system, to provide graphs and reports, and to share information with other users";

- AIRSAFE — "An information tracking, analysis and distribution system [that] comprises three modules: one module for safety and risk management … ; one module maintains U.S. [Occupational Safety and Health Administration] reporting logs … ; and the third module provides for worker's compensation and employee injury claims tracking";

- Aviation Quality Database (AQD) — "A tool for implementing and managing comprehensive quality and safety systems," including "data gathering, analysis and planning for effective risk management";

- AVSiS — "A safety event logging, management and analysis tool for [Microsoft] Windows PCs (95, 98 or NT) [that records events as] happenings (which are noteworthy but not actual incidents) and incidents";

- British Airways Safety Information System (BASIS) — Designed "to gather and analyze air and ground safety incident reports and other information, to help manage reported incidents and to assist those involved with safety to answer questions like 'How safe are we?' 'Can we prove it?' and 'Where should we put our resources to become even safer?'"; and,

- INDICATE Safety Program — Developed by the Australian Transport Safety Bureau to provide a "simple, cost-effective and reliable means of capturing, maintaining, monitoring and reporting information about safety hazards."

The report groups tools and methods for event analysis in six categories. The following are excerpts from the summaries:

- Descriptive statistics and trend analysis:

  - Microsoft Excel — A "general-purpose spreadsheet program that provides a wide range of capabilities to manage, analyze and chart data";

  - Statgraphics Plus — A "statistical analysis package that provides a wide variety of analysis procedures and capabilities, ranging from basic statistics to highly advanced and sophisticated techniques"; and,

  - Characterization/Trend/Threshold Analysis — A method to "characterize data, trend it over time to establish a baseline and then, by expert judgment or statistical inference, establish thresholds or control points that, when exceeded, indicate a significant change in the performance of what is being monitored";

- Risk analysis:

  - @Risk — Designed "to provide risk analysis and simulation add-ins for [Microsoft Excel or Lotus 1-2-3] spreadsheet models," the program "recalculates spreadsheets hundreds of times, each time selecting random numbers from the @Risk functions entered";

  - Fault Tree+ (Event Tree Module) — Designed to "organize, characterize and quantify potential accidents in a methodical manner by modeling the sequence of events leading to the potential accident that results from a single initiating cause";

  - Fault Tree+ (Fault Tree Module) — Designed to "assess a system by identifying a postulated undesirable end event and examining the range of potential events that could lead to that state or condition";

– FaultrEASE — Designed to "facilitate creation, calculation and display of fault trees, which are a graphical method commonly used in reliability engineering and systems safety engineering"; and,

– Probabilistic Risk Assessment (PRA) — A method designed to "quantify the probabilities and consequences associated with accidents and malfunctions by applying probability and statistical techniques, as well as various consequence-evaluation methods";

- Text/data mining and data visualization:

  – Aviation Safety Data Mining Workbench — Developed by MITRE Corp. "to provide a software application that an aviation safety officer can use to search a collection of incidents or aviation-related events to find those most similar to a selected event, to find subsets of data that have interesting correlations and to determine the distribution of selected incident/event attributes";

  – FERRET Q — "Reads electronic files in a wide variety of formats (e.g., [Microsoft] Word, Excel, Access, PDF) and identifies IOV [information of value] using a network of concepts constructed to simulate human understanding";

  – NetOwl — "Analyzes the important events expressed in free text [in newspapers or in database records], including such facts as the time of an event, its cause and other important information";

  – QUORUM — "A suite of text-processing tools [developed by the U.S. National Aeronautics and Space Administration (NASA)] designed to analyze a large amount of textual data organized in a structured database and identify relevant records [in response] to a specific query"; and,

  – SPOTFIRE — "A data retrieval, visualization and analysis software package [that] allows the user to select combinations of various data elements for analysis to quickly reveal trends, patterns and relationships";

- Occurrence investigation and analysis:

  – TapRooT — Designed to "facilitate collection of incident information, identify root causes, provide a standard incident report, trend incident information and track corrective action";

  – Integrated Safety Investigation Methodology (ISIM) — Developed by the Transportation Safety Board of Canada to "provide a standardized and comprehensive methodology to support the investigation/analysis of multi-modal occurrences in the transportation sector"; and,

  – Multilinear Events Sequencing (MES) — A method for "diagramming (flow-charting) sequences of events leading to a mishap";

- Human factors analysis:

  – Aircrew Incident Reporting System (AIRS) — "A confidential human factors reporting system [developed by Airbus] that provides airlines with the necessary tools to set up an in-house human performance analysis system";

  – Computer-Assisted Debriefing System (CADS) — Provides "automated capabilities to replay flight information [flight data, cockpit video and audio data] collected during flight simulation training as a means of analyzing human performance";

  – Human Factors Analysis and Classification System (HFACS) — Developed by the U.S. Federal Aviation Administration Civil Aerospace Medical Institute "to identify causal factors that underlie joint human-system failures and breakdowns in order to better understand their role in incidents/accidents, to better detect their presence and to mitigate the consequences of those factors before an incident/accident occurs";

  – Integrated Process for Investigating Human Factors — Developed by the Transportation Safety Board of Canada, "this tool provides a step-by-step systematic [process for] the investigation of human factors";

  – Procedural Event Analysis Tool (PEAT) — Developed under the leadership of The Boeing Co. "to identify the key underlying cognitive factors that contribute to procedural noncompliance and to help the airline industry manage safety risks associated with flight crew procedural deviations," PEAT "contains more than 200 analysis elements that enable the user to conduct an in-depth investigation, summarize findings and integrate them across various events";

  – Line Operations Assessment System (LOAS) — A method developed by Airbus for "quantifying line observations that, when combined with critiques of dispatch and line maintenance operations, as well as airport and airway facilities, can provide an operator with a systematic overview of [its] operating network"; and,

  – Reason Model — "James Reason's model of accident causation is intended as [a method for] understanding incidents and accidents, and their underlying or contributing factors, [and is based on the premise] that human error is a consequence rather than a cause and should be the starting point for further investigation rather than the end of the search for incident or accident causes”;

- Cost-benefit analysis:
  - Airbus Service Bulletin Cost Benefit Model — Applicable only to maintenance-cost tracking, “this tool [assists operators of Airbus aircraft] in the decision to apply or not apply a service bulletin on a given fleet of aircraft. Only the economic parameters are taken into account”; and,
  - Boeing Digital Technologies Cost Model — By quantifying “the financial impact [on airlines] of delays and cancellations due to accidents and incidents,” this model “helps flight safety managers to justify enhancements to safety programs, as well as defining actual costs of accidents and incidents to airline senior management.”

The report said that FOQA programs “generally involve systems that capture flight data, transform the data into an appropriate format for analysis and generate reports and visualization to assist personnel in analyzing the data.”

The report includes summaries of the following FOQA/digital flight data analysis tools:

- SFIM’s Analysis Ground Station (AGS);
- NASA’s Aviation Performance Measuring System (APMS);
- Avionica’s AVSCAN.flight;
- BASIS Flight Data Tools;
- Austin Digital’s Event Measurement System (EMS);
- Teledyne Corp.’s Flight Event Analysis Program (FEAP) and Flight Data Replay and Analysis System (FLIDRAS);
- SimAuthor’s FlightViz;
- Sight Sound and Motion’s FltMaster;
- Spirent Systems’ Ground Recovery and Analysis Facility (GRAF), and GRAF-VISION Flight Data Animator;
- Airbus Line Operations Monitoring System (LOMS);
- Flightscape’s Recovery, Analysis and Presentation System (RAPS); and,
- Veesem Raytech Aerospace’s Software Analysis for Flight Exceedance (SAFE).

The 134-page report contains illustrations and appendixes. GAIN Working Group B said that the report will be updated periodically.]♦

Appendix D
Safety Surveys and Audits

This appendix contains sample checklists and surveys. Please tailor these documents to fit your specific organization.

Contents

Safety Surveys

A safety culture survey should be undertaken to “benchmark” the company safety culture immediately before an aviation safety management system is introduced and again about 12 months later to measure the improvements in culture resulting from the use of the system.

The survey, using the questionnaire in this section, will reveal three major facets of the company and how it behaves:

- The difference (if any) in the way managers and workers see the culture;
- Targets for resources (any one or two answers); and,
- A benchmark to measure any changes to procedures against a later survey.

Airline Safety Culture Index

All employees of an airline, irrespective of the section in which they work, contribute to safety and are personally responsible for ensuring a positive safety culture. The purpose of this questionnaire is to obtain your opinions about safety within the airline. It would be appreciated if you would answer all of the questions as honestly as possible. Give your own answers, not those of other employees.

You are required to give your name so we can contact you for clarification if necessary, but all of your answers will be kept confidential and your reply will be de-identified.

Please complete the following section to best identify your position and job description, and indicate your base.

Name ____

Phone ____

Grade (if known) ______________________________________

Job Title ____

Work Area____

Base ____

Please send this cover sheet and the completed questionnaire forms to: (address).

Note: This form will be destroyed as soon as data is recorded in the database.

Individual Safety Survey Sample 1

Circle the appropriate number (1 to 5) in its box for each of the 25 questions. If you strongly disagree with the statement, circle 1. If you strongly agree, circle 5. If your opinion is somewhere in between these extremes, circle 2, 3 or 4 (for disagree, unsure or agree).

Please respond to every question. Adding all the responses gives a safety culture score for the company, which is checked against known benchmarks.

Question Number	Statement	Company Rating				
		Strongly Disagree				Strongly Agree
1	Employees are given enough training to do their tasks safely.	1	2	3	4	5
2	Managers get personally involved in safety enhancement activities.	1	2	3	4	5
3	There are procedures to follow in the event of an emergency in my work area.	1	2	3	4	5
4	Managers often discuss safety issues with employees.	1	2	3	4	5
5	Employees do all they can to prevent accidents.	1	2	3	4	5
6	Everyone is given sufficient opportunity to make suggestions regarding safety issues.	1	2	3	4	5
7	Employees often encourage each other to work safely.	1	2	3	4	5
8	Managers are aware of the main safety problems in the workplace.	1	2	3	4	5
9	All new employees are provided with sufficient safety training before commencing work.	1	2	3	4	5
10	Managers often praise employees they see working safely.	1	2	3	4	5
11	Everyone is kept informed of any changes which may affect safety.	1	2	3	4	5
12	Employees follow safety rules almost all of the time.	1	2	3	4	5
13	Safety within this company is better than in other companies.	1	2	3	4	5
14	Managers do all they can to prevent accidents.	1	2	3	4	5
15	Accident investigations attempt to find the real causes of accidents, rather than just blame the people involved.	1	2	3	4	5
16	Managers recognize when employees are working unsafely.	1	2	3	4	5
17	Any defects or hazards that are reported are rectified promptly.	1	2	3	4	5
18	There are mechanisms in place in my work area for me to report safety deficiencies.	1	2	3	4	5
19	Managers stop unsafe operations or activities.	1	2	3	4	5
20	After an accident has occurred, appropriate actions are usually taken to reduce the chance of recurrence.	1	2	3	4	5
21	Everyone is given sufficient feedback regarding this company's safety performance.	1	2	3	4	5
22	Managers regard safety to be a very important part of all work activities.	1	2	3	4	5
23	Safety audits are carried out frequently.	1	2	3	4	5
24	Safety within this company is generally well controlled.	1	2	3	4	5
25	Employees usually report any dangerous work practices they see.	1	2	3	4	5
	Safety Culture Total:					

Notes for flight safety officers:

- Several separate results are obtained from a safety culture survey using this form:
  - A "benchmark" safety culture score that can be compared with similar companies worldwide;
  - A means of comparing the views of management with those of staff regarding the company's safety culture;

- A means of evaluating the results of any changes made to the company's safety management system when a follow-up survey is carried out.

- Identification of areas of concern, indicated by "1" and "2" responses, which can assist in the allocation of safety resources; and,

- A means of comparing the safety culture of different departments and/or operational bases;

• The higher the value, the better the safety culture rating. Use the following as a guide only. An average company safety culture score of 93 is considered a minimum; anything less would suggest that improvements are needed:

  - Poor safety culture, 25–58;
  - Bureaucratic safety culture, 59–92; and,
  - Positive safety culture, 93–125;

• Organizations with a poor safety culture treat safety information in the following way:

  - Information is hidden;
  - Messengers are shot;
  - Responsibility is avoided;
  - Dissemination is discouraged;
  - Failure is covered up; and,
  - New ideas are crushed;

• Organizations with a bureaucratic safety culture treat safety information in the following way:

  - Information may be ignored;
  - Messengers are tolerated;
  - Responsibility is compartmentalized;
  - Dissemination is allowed but discouraged;
  - Failure leads to local repairs; and,
  - New ideas present problems;

• Organizations with a positive safety culture treat safety information in the following way:

  - Information is actively sought;
  - Messengers are trained;
  - Responsibility is shared;
  - Dissemination is rewarded;
  - Failure leads to inquiries and reforms; and,
  - New ideas are welcomed.

Safety Management System Monitoring

Implementation and Evaluation Checklist

The key elements of a safety management system can be measured. The following checklist will assist in identifying areas (questions answered "no") that must be addressed.

		Factor	Company Response	
Management	1	Is senior management committed to the aviation safety management program?	Yes	No
	2	Is there a written aviation safety policy signed by the CEO?	Yes	No
	3	Has a safety manager been appointed?	Yes	No
	4	Is the safety reporting chain appropriate?	Yes	No
	5	Is the safety manager sufficiently supported within the organization?	Yes	No
	6	Is there a safety committee?	Yes	No
	7	Is the safety manager credible?	Yes	No
	8	Is the safety manager an enthusiast for his or her job?	Yes	No
	9	Are the roles and responsibilities of the personnel in the aviation safety management system documented?	Yes	No
	10	Are the values of management identified as being safety oriented?	Yes	No
	11	Are sufficient resources (financial, human, hardware) made available for the aviation safety management system?	Yes	No
	12	Are there appropriate safeguards in place to ensure that the aviation safety management system itself is properly evaluated?	Yes	No
	13	Have appropriate standards been documented?	Yes	No
	14	Is there an appropriate emergency response plan?	Yes	No
Hazard Assessment Procedures	15	Is there an effective ongoing hazard identification program?	Yes	No
	16	Does the hazard identification program include a confidential reporting system?	Yes	No
	17	Are confidential reports properly de-identified?	Yes	No
	18	Are hazards associated with contracted agencies included in the hazard reporting system?	Yes	No
	19	Is there a procedure established for acknowledging safety-related reports?	Yes	No
	20	Is there a process whereby the hazards are continuously assessed for their risk potential (likelihood and severity)?	Yes	No
	21	Are the defenses against the hazards identified?	Yes	No
	22	Does the process include the identification of the need for further defenses or for hazard avoidance?	Yes	No
Communication With Management	23	Is there an effective mechanism by which the safety manager or the safety committee reports to the CEO and can make recommendations for change or action?	Yes	No
	24	Is there an obligation on the part of the CEO to give formal response to any safety-related recommendations?	Yes	No
	25	In the event that the CEO makes an unfavorable response to a safety recommendation, is there a procedure whereby the matter is monitored by the safety manager or safety committee until a resolution is reached?	Yes	No
Feedback	26	Are the results of hazard reports and safety suggestions made available to the initiator?	Yes	No
	27	Are the results of hazard reports and safety suggestions made widely available within the company?	Yes	No
Documentation	28	Is the process for risk assessment and management fully documented?	Yes	No
	29	Does the aviation management system require the recording of identified hazards and defenses?	Yes	No
Safety-Related Literature, Courses and Seminars	30	Is there a supply of safety-related literature (e.g., periodicals, magazines, books, articles, posters, videos) readily available to all employees who have safety responsibilities?	Yes	No
	31	Are employees encouraged and assisted in attending training courses and seminars related to safety?	Yes	No
	32	Are employees trained in the procedures and policy of the aviation safety management system?	Yes	No
Safety Induction and Continuous Training	33	Are new employees given sufficient training and checking in their technical duties prior to being permitted to operate either supervised or unsupervised?	Yes	No
	34	Is the continuation of training and checking of all employees adequate?	Yes	No
	35	Are employees given sufficient training in new procedures?	Yes	No
	36	Are trainers and checkers adequately trained and checked, both for competence and standardization?	Yes	No

Individual Safety Survey Sample 2

Please answer the following questions.

1. Experience

   Time in company:

Flight Crew	_____ 0–1 year	_____ 5–9 years
Ground Crew	_____ 2–4 years	_____ 10 or more years

   Time in present position: ______ years.

2. What, in your opinion, will cause the next accident? Listed below are some reasons taken from last year's survey to help you think of an answer for this question. Please consider them and choose the appropriate answer(s). Please explain your choice in a sentence or two.
   - Complacency;
   - Violation of rules;
   - Mechanical problems/equipment;
   - Pilot/crew error;
   - Fatigue or other physical factors;
   - Working conditions;
   - Procedures on the ground or in the air;
   - Other.
3. What are the shortcomings of our accident prevention program as it now exists? Listed below are some of the reasons taken from last year's survey to help you think of an answer for this question. Please consider them and choose the appropriate answer(s). Please explain your choice in a sentence or two.
   - Lack of discussion about procedures;
   - Safety publications;
   - Dissemination of information;
   - Standardization, training;
   - Lack of support or participation;
   - Communication;
   - Suggestions, surveys, etc.;
   - Other.
4. What "close-call" experiences have you had in the last six months?
5. What do you like about the safety program?
6. What ideas, comments or recommendations do you have about improving the safety program in general?
7. When was the last time you had a night training flight?
8. What other comments do you have?
9. Are there jobs that you do on a fairly routine basis for which you don't have suitable tools/equipment or you have to "jury rig" gear? Give specifics.
10. Have you received the amount of training you feel you need to do your job well and safely? What additional training would you have wanted? What additional training do you still want?
11. Are there work routines/schedules that you would like to see changed? How?
12. Are there ground safety hazards on the station that "we live with" or have come to overlook that ought to be corrected? Please name.
13. Are there ground or flight procedures in use which, in your opinion, ought to be changed to enhance safety? Please name them.

Independent Safety Program Audit Checklist Sample

1. Is the supervisor/senior manager involved in the flight safety program and supporting it?
2. Have all parts of the company safety program been implemented in this organization?
3. Is this organization getting adequate guidance and assistance from the flight safety office?
4. What training is provided to the flight safety officer? Is it adequate?
5. Does the flight safety officer have adequate staff?
6. What is the quality, depth and effectiveness of the safety inspection program? Is it doing any good?
7. What is the quality and depth of incident investigations?
8. Are recommendations resulting from accidents and incidents being followed?
9. Is the hazard report program effective? Is anyone using it? Is it doing any good?
10. Is flight safety information being distributed to those who need it?
11. Is there a flight safety committee? Is it effective?
12. Is there a plan for accident notification and investigation?
13. Are all reportable incidents being reported and investigated?
14. Do the people in this organization understand the company safety policy?
15. Do the pilots support the company flight safety program?
16. Are new personnel receiving safety training?

Operations Audit Checklist (Internal) Sample

1. Does this organization have an appointed safety committee member?
2. Are the pilots receiving the safety material that is sent to them?
3. Is there an effective pilot reading file?
4. Are pilots receiving safety information during briefings?
5. Is there a flight safety bulletin board?
6. Are the pilots familiar with the company safety policy and the company flight safety program?
7. Are they using the hazard reporting system?
8. Are they aware of recent aircraft accidents?
9. Are they familiar with current company flight safety standards?
10. Do new pilots receive safety orientation and training?
11. Are records of their currency in various types of operations maintained?
12. Does their schedule provide adequate crew rest?
13. Do they have adequate opportunity for meals?
14. Do they have adequate personal equipment?
15. Do they have access to medical personnel?
16. Do they know what to do in case of an accident (to them or within the company)?
17. Are accident/incident/injury records kept in this organization?
18. Does this organization have regular flying safety meetings?
19. Are all company aviation safety standards being met?

Safety Audits

Management and Organization

Management Structure

- Does the company have a formal, written statement of corporate safety policies and objectives?
- Are these adequately disseminated throughout the company? Is there visible senior management support for these safety policies?
- Does the company have a flight safety department or a designated flight safety officer?
- Is this department or safety officer effective?
- Does the department/safety officer report directly to senior corporate management, to the CEO or the board of directors?
- Does the company support periodic publication of a safety report or newsletter?
- Does the company distribute safety reports or newsletters from other sources?
- Is there a formal system for regular communication of safety information between management and employees?
- Are there periodic companywide safety meetings?
- Does the company actively participate in industry safety activities, such as those sponsored by Flight Safety Foundation (FSF), International Air Transport Association (IATA) and others?
- Does the company actively and formally investigate incidents and accidents? Are the results of these investigations disseminated to other managers? To other operating personnel?
- Does the company have a confidential, nonpunitive incident-reporting program?
- Does the company maintain an incident database?
- Is the incident database routinely analyzed to determine trends?
- Does the company use outside resources to conduct safety reviews or audits?
- Does the company actively solicit and encourage input from aircraft manufacturers' product-support groups?

Management and Corporate Stability

- Have there been significant or frequent changes in ownership or senior management within the past three years?
- Have there been significant or frequent changes in the leadership of operational divisions within the company in the past three years?
- Have any managers of operational divisions resigned from the company because of disputes about safety matters, operating procedures or practices?

Financial Stability of the Company

- Has the company recently experienced financial instability, a merger, an acquisition or major reorganization?
- Was explicit consideration given to safety matters during and following the period of instability, merger, acquisition or reorganization?

- Are safety-related technological advances implemented before they are dictated by regulatory requirement (i.e., is the company proactive in using technology to meet safety objectives)?

Management Selection and Training

- Is there a formal management-selection process?
- Are there well-defined management-selection criteria?
- Is management selected from inside or outside the company?
- Is operational background and experience a formal requirement in the selection of management personnel?
- Are first-line operations managers selected from the most operationally qualified candidates?
- Do new management personnel receive formal safety indoctrination or training?
- Is there a well-defined career path for operations managers?
- Is there a formal process for the annual evaluation of managers?
- Is the implementation of safety programs a specific management objective considered in the evaluation?

Work Force

- Have there been recent layoffs by the company?
- Are a large number of personnel employed on a part-time or contract basis?
- Does the company have formal rules or policies to manage the use of contract personnel?
- Is there open communication between employees and management?
- Is there a formal means of communication among management, the work force and labor unions about safety issues?
- Is there a high rate of personnel turnover in operations and maintenance?
- Is the overall experience level of operations and maintenance personnel low or declining?
- Is the distribution of age or experience level within the company considered in long-term company plans?
- Are the professional skills of candidates for operations and maintenance positions evaluated formally in an operational environment during the selection process?
- Are multicultural processes and issues considered during employee selection and training?
- Is special attention given to safety issues during periods of labor-management disagreements or disputes?
- Are the safety implications of deteriorating morale considered during the planning and implementation of reduction in work force or other destabilizing actions?
- Have there been recent major changes in wages or work rules?
- Does the company have a companywide employee health maintenance program that includes annual medical examinations?
- Does the company have an employee-assistance program that includes treatment for drug and alcohol abuse?

Fleet Stability and Standardization

- Is there a company policy concerning cockpit standardization within the company's fleet?
- Do pilots/flight-operations personnel participate in fleet-acquisition decisions?

Relationship With the Regulatory Authority

- Are company safety standards set primarily by the company or by the appropriate regulatory authority?
- Does the company set higher safety standards than those required by the regulatory authority?
- Do the company's safety standards meet or exceed U.S. Federal Aviation Regulations (FARs)/European Joint Aviation Requirements (JARs) criteria?
- Does the company have a constructive, cooperative relationship with the regulatory authority?
- Has the company been subject to recent safety-enforcement action by the regulatory authority?
- Does the regulatory authority refuse to recognize the licenses issued by some other countries?
- Does the company evaluate the licensing requirements of other countries when deciding whether to hire personnel who hold licenses issued by those countries?
- Does the company consider the differing experience levels and other licensing standards of other countries when reviewing applications for employment?
- Does the regulatory authority routinely evaluate the company's compliance with required safety standards?

Operations Specifications

- Does the company have formal flight-operations control (e.g., dispatch or flight following)?
- Does the company have special dispatch requirements for extended-range twin-engine operations (ETOPS)?
- Are fuel/route requirements determined by the regulatory authority?
- If not, what criteria does the company use?
- Does each crewmember get copies of the pertinent operations specifications?

Operations and Maintenance Training — Training and Checking Standards

- Does the company have written standards for satisfactory performance?
- Does the company have a defined policy for dealing with unsatisfactory performance?
- Does the company maintain a statistical database of trainee performance?
- Is this database periodically reviewed for trends?
- Is there a periodic review of training and checking records for quality control?
- Are check pilots periodically trained and evaluated?
- Does the company have established criteria for instructor/check-pilot qualification?

- Does the company provide specialized training for instructors/check pilots?
- Are identical performance standards applied to captains and first officers?
- Are training and checking performed by formally organized, independent departments?
- How effective is the coordination among flight operations, flight training and flight standards?

Operations Training

- Does the company have a formal program for training and checking instructors?
- Is there a recurrent training and checking program for instructors?
- Does the company have required training and checking syllabi?
- Does this training include:
  - Line-oriented flight training (LOFT)?
  - Crew resource management (CRM)?
  - Human factors?
  - Wind shear?
  - Hazardous materials?
  - Security?
  - Adverse weather operations?
  - Altitude and terrain awareness?
  - Aircraft performance?
  - Rejected takeoffs?
  - ETOPS?
  - Instrument landing system (ILS) Category II and Category III approaches?
  - Emergency procedures training, including pilot/flight attendant interaction?
  - International navigation and operational procedures?
  - Standard International Civil Aviation Organization (ICAO) radiotelephone phraseology?
  - Volcanic-ash avoidance/encounters?
- If a ground-proximity warning system (GPWS), traffic-alert and collision avoidance system (TCAS) and other special systems are installed, is specific training provided for their use? Are there clearly established policies for their use?
- Are English-language skills evaluated during training and checking?
- Is English-language training provided?

- At a minimum, are the procedures contained in the manufacturer's aircraft operations manual covered in the training program?

- Is initial operating experience (IOE) mandated?

- Is first/second officer IOE required to be conducted "in seat" rather than in the observer's seat?

- Are there formal means for modification of training programs as a result of incidents, accidents or other relevant operational information?

Training Devices

- Are approved simulators available and used for all required training?

- Is most of the company's training performed in the simulator?

- Do the simulators include GPWS, TCAS, background communications and other advanced features?

- Are simulators and/or training devices configuration-controlled?

- Has the company established a simulator/training device quality-assurance program to ensure that these devices are maintained to acceptable standards?

- Does the regulatory authority formally evaluate and certify simulators?

Flight Attendant Training

- Do flight attendants receive comprehensive initial and recurrent safety training?

- Does this training include hands-on use of all required emergency and safety equipment?

- Is the safety training of flight attendants conducted jointly with pilots?

- Does this training establish policies and procedures for communication between cockpit and cabin crew?

- Are evacuation mock-up trainers that replicate emergency exits available for flight attendant training?

Maintenance Procedures, Policies and Training

- Does the regulatory agency require licensing of all maintenance personnel?

- Is formal maintenance training provided by the company for all maintenance personnel? Is such training done on a recurrent basis? How is new equipment introduced?

- Does the company have a maintenance quality assurance program?

- If contract maintenance is used, is it included in the quality assurance program?

- Is hands-on training required for maintenance personnel?

- Does the company use a minimum equipment list (MEL)?

- Does the company's MEL meet or exceed the master MEL?

- Does the company have a formal procedure covering communication between maintenance and flight personnel?

- Are "inoperative" placards used to indicate deferred-maintenance items? Is clear guidance provided for operations with deferred-maintenance items?
- Are designated individuals responsible for monitoring fleet health?
- Does the company have an aging-aircraft maintenance program?
- Is there open communication between the maintenance organization and other operational organizations, such as dispatch? How effective is this communication?
- Does the company use a formal, scheduled maintenance program?
- Are policies established for flight and/or maintenance personnel to ground an aircraft for maintenance?
- Are flight crewmembers ever pressured to accept an aircraft that they believe must be grounded?
- Are flight crews authorized to ground an aircraft for maintenance?

Scheduling Practices

- Are there flight- and duty-time limits for pilots?
- Are there flight- and duty-time limits for flight attendants?
- Do the flight- and duty-time limits meet or exceed FARs/JARs requirements?
- Do flight- and duty-time limits apply regardless of the type of operation (e.g., cargo, passenger, ferry and charter)?
- Does the company train flight crewmembers to understand fatigue, circadian rhythms and other factors that affect crew performance?
- Does the company allow napping in the cockpit?
- Are on-board crew-rest facilities provided or required?
- Are there minimum standards for the quality of layover rest facilities?
- Does the company have a system for tracking flight- and duty-time limits?
- Has the company established minimum crew-rest requirements?
- Are augmented crews used for long-haul flights?
- Are circadian rhythms considered in constructing flight crew schedules?
- Are there duty-time limits and rest requirements for maintenance personnel?

Crew Qualifications

- Does the company have a system to record and monitor flight crew currency?
- Does the record-keeping system include initial qualification, proficiency checks and recurrent training, special airport qualifications, line-check observations and IOE observations for:
  - Pilots in command?

- Seconds in command?
- Flight engineers?
- Instructors and check pilots?
- Flight attendants?

- Does the regulatory authority provide qualified oversight of instructor and check-pilot qualification?
- Are the company's simulator instructors line-qualified pilots?
- Does the company permit multiple aircraft qualification for line pilots?
- Do company check pilots have complete authority over line-pilot qualification without interference from management?
- If the company operates long-haul flights, does it have an established policy for pilot currency, including instrument approaches and landings?
- Does the company have specific requirements for pilot-in-command and second-in-command experience in type for crew scheduling?

Publications, Manuals and Procedures

- Are all flight crewmembers issued personal copies of their type operations manuals/flight crew operating manual (FCOM) and any other controlled publications?
- How are revisions distributed?
- How is the issue and receipt of revisions recorded?
- Does the company have an airline operations manual?
- Is the airline operations manual provided to each crewmember?
- Is the airline operations manual periodically updated?
- Does the airline operations manual define:
  - Minimum numbers of flight crewmembers?
  - Pilot and dispatcher responsibilities?
  - Procedures for exchanging control of the aircraft?
  - Stabilized-approach criteria?
  - Hazardous-materials procedures?
  - Required crew briefings for selected operations, including cockpit and cabin crewmembers?
  - Specific pre-departure briefings for flights in areas of high terrain or obstacles?
  - Sterile-cockpit procedures?
  - Requirements for use of oxygen?

- Access to cockpit by non-flight crewmembers?
  - Company communications?
  - Controlled flight into terrain (CFIT)-avoidance procedures?
  - Procedures for operational emergencies, including medical emergencies, and bomb threats?
  - Aircraft deicing procedures?
  - Procedures for handling hijacking and disruptive passengers?
  - Company policy specifying that there will be no negative consequences for go-arounds and diversions when required operationally?
  - The scope of the captain's authority?
  - A procedure for independent verification of key flight-planning and load information?
  - Weather minimums, maximum crosswind and tail-wind components?
  - Special minimums for low-time captains?
- Are emergency escape routes developed and published for flights in areas of high terrain?
- Are all manuals and charts subject to a review and revision schedule?
- Does the company have a system for distributing time-critical information to the personnel who need it?
- Is there a company manual specifying emergency-response procedures?
- Does the company conduct periodic emergency-response drills?
- Are airport-facility inspections mandated by the company?
- Do airport-facility inspections include reviews of notices to airmen (NOTAMs)?
  - Signage and lighting?
  - Runway condition, such as reverted-rubber accumulations, foreign object damage (FOD), etc.?
  - Crash, fire and rescue availability? Navigational aids (navaids)?
  - Fuel quality?

Dispatch, Flight Following and Flight Control

- Does initial/recurrent dispatcher training meet or exceed FARs/JARs requirements?
- Are operations during periods of reduced crash, fire and rescue (CFR) equipment availability covered in the company flight operations manual?
- Do dispatchers/flight followers have duty-time limitations?
- Are computer-generated flight plans used?
- Are ETOPS alternates specified?♦

Appendix E
Risk Management Process

Contents

E.1 General

E.1.1 This section is an overview of risk management theory. It is intended as a treatise to provide the background material necessary to understand the risk management process. This section does not necessarily describe how to implement a risk management program.

E.1.2 There will always be hazards associated with the operation of any aircraft. Technical, operational and human errors induce the hazards. Hazards are the contributors to accidents. Accidents are the result of many contributors. Risk is the likelihood and severity of the specific potential accident. The aim of every flight safety program therefore is to identify, eliminate and control risks and associated hazards. This is achieved by hazard analysis and the careful recording and monitoring of safety-related occurrences for adverse trends in order to prevent the recurrence of similar incidents which could lead to an aircraft accident.

E.1.3 Hazard analysis is the application of methods to identify hazards and evaluate associated risks. The functions, operations, tasks, steps and criteria for design are evaluated to identify hazards and their risks.

E.1.4 The purpose of internal feedback and trend monitoring programs is to allow managers to assess the risks involved in the operations and to determine logical approaches to counteract them. There will always be risks in aviation operations. Some risks can be accepted. Some, but not all, can be eliminated. Others can be reduced to the point where they are acceptable. Decisions on risk are managerial; hence, the term "risk management."

E.1.5 Risk management decisions follow a logical pattern. The first step is to accurately identify the hazards. The second step is to assess the hazards in the order of their risk potential and determine whether the organization is prepared to accept that risk. The crucial points are the will to use all available information and the accuracy of the information about the hazards, because no decision can be better than the information on which it is based. The third step is to find and identify the defenses that exist to protect against or control the hazards or even eliminate them. Step four is to assess the defenses for their effectiveness and consequences. Finally, in step five, each set of hazards needs to be critically examined to determine whether the risk is appropriately managed and controlled. The objective is to reduce the probability that a particular hazard will occur or reduce the severity of the effects if it does occur. In some cases, the risk can be reduced by developing means to cope safely with the associated hazards.

E.1.6 In large organizations such as airlines, the costs associated with loss of human life and physical resources mean that risk management is essential. To produce recommendations that coincide with the objectives of the organization, a systems approach to risk management must be followed. Such an approach, in which all aspects of the organization's objectives and available resources are analyzed, offers the best option for ensuring that recommendations concerning risk management are realistic.

E.1.7 The system approach to risk management is known as system safety. It is the application of engineering and management principles, criteria and techniques to optimize safety within the constraints of operational effectiveness, time and cost throughout all phases of the system life cycle. A system could be any entity, at any level of complexity of personnel, procedures, materials, tools, equipment, facilities, aircraft, and software.

E.2 Hazard Identification and Analysis

E.2.1 The objective of the hazard identification and risk analysis process is to provide the company with a technique for early identification of the risks to which it is exposed. The technique should initially be applied retroactively throughout the company and then during the early stages of any new venture undertaken to provide essential information for project development decisions. By this process, safer and more efficient options can be adopted from the outset, minimizing the later exposure to litigation, disruption and increased costs.

The benefits include:

- Opportunity to identify specific hazards and risks within a project's life cycle;
- Potential to review operating philosophies at an early stage, before significant financial commitments are made;
- Identifying differences from the level of standardization already established;
- Enhancing the existing procedures by identifying their latent risks; and,
- Targeting expenditure in a structured way to improve safety and efficiency.

E.2.2 The technique can also be used within the financial arena to concentrate expenditure in the areas designated as providing maximum benefit, in accordance with the company philosophy and requirements. At times of expansion, these requirements and priorities may be vastly different to those at times of recession.

E.2.3 An effective hazard identification system is characterized as being nonpunitive, confidential, simple, direct and convenient. It should have an identifiable process for both action and feedback.

E.2.3 A hazard can be defined as the potential for harm, including unsafe acts and/or conditions that can result in accidents. There can be many contributory hazards associated with a potential accident or a specific risk.

E.2.5 The degree of risk is based on the likelihood that damage or harm will result from the associated hazards and the severity of the consequences.

E.2.6 Hazard identification and risk management should be undertaken:

- During implementation of the safety program and then on a frequent basis depending on the complexity of operations and associated risks;
- When changes are planned; and,
- If the organization is undergoing rapid change, such as rapid growth and expansion, new route structures or acquisition of other aircraft types or new systems.

E.3 Risk Management Process

The process of risk management can be divided into the following five steps:

E.3.1.1 Identify the Hazards

There are many ways of identifying hazards and quantifying risks, but success requires lateral thinking by people who are unencumbered by past ideas and experiences. The hazards of an operation may be obvious, such as lack of training, or they may be subtle, such as the insidious effects of long-term fatigue.

Each hazard, once identified, should be recorded without fear or favor.

Depending on the size and complexity of the operation, there are several useful methods of identifying hazards:

- Brainstorming — small discussion groups meet to generate ideas in a nonjudgmental way;
- Formal review of standards, procedures and systems;
- Staff surveys or questionnaires;
- One person standing back from the operation and critically watching;
- Internally or externally conducted safety assessments; and,
- Confidential reporting systems.

Formal methods and techniques can be applied, such as system safety analysis, job safety analysis, energy trace and barrier analysis, procedure analysis checklists and task analysis. There are a number of appropriate references for sources of analysis methods and techniques.[1]

Small operator:

The small noncommercial operator simply needs to apply discipline and allocate time to critically look at all facets of the company's operations and systems, and identify the hazards. The company needs to take action to either eliminate the hazards where possible, vary the operation or change a design in some practical way that will offer protection from the hazards and their associated risks in order to ensure acceptable risk.

Medium–large operator/airline:

Establishing discussion groups with as many staff and line managers as practical is a good method to identify hazards. The group discussions will also encourage staff to become more actively involved in establishing the safety program.

The purpose of the discussion groups is to provide a structured method of identifying those hazards and risks which are most likely to cause injury or damage. The number of participants will depend on the size of the organization, probably three or four people for a medium company and up to eight people for a regional airline.

It is a good idea to have a number of groups representing the various functional areas (i.e., flight operations, ground crew, maintenance and engineering, pilots and cabin crew). Each group should have participants from the same functional area (e.g., all pilots or all engineers, etc.).

One example of a system for proactively identifying hazards is the Australian Transport Safety Bureau (ATSB) INDICATE program. It describes how to set up groups and conduct a basic process for identifying safety hazards by following five simple steps:

- Identify potential airline hazards that may threaten the safety of passengers;
- Rank the severity of hazards;
- Identify current defenses;
- Evaluate the effectiveness of each defense; and,
- Identify additional defenses.

E.3.1.2 Assess the Hazards

The next step in the risk management process is to critically assess the hazards and to rank risks. Factors to consider are the likelihood of the occurrence and the severity of the consequences.

For example, an extensive in-flight fire may be an unlikely occurrence which would be catastrophic if it were to occur. It would rank above a bird strike which, although much more likely to occur, may be less severe. There are various ways of doing this type of assessment. They range from the subjective to the very analytical and objective.

E.3.1.3 Identify the Defenses

Once the hazards are identified and their risks approximately ranked, the defenses (hazard controls) which exist to protect against the hazards should be identified.

Examples:

- A defense against an in-flight fire may be a fire extinguisher;
- A defense against particular hazards would be to ensure that operating procedures are properly documented and implemented with compliance; and,
- Automated caution and warning systems and contingency response.

E.3.1.3 Assess the Defenses

The appropriateness of hazard controls is then assessed. How effective are the hazard controls? Would they prevent the occurrence (i.e., do they remove the hazard), or do they minimize the likelihood or the consequence? If the latter, to what extent is this true? An example of determining the effectiveness of a hazard control is to ask the questions: Does the crew know how to use the fire extinguishers and are the extinguishers correctly maintained?

E.3.1.5 Identify the Need for Hazard Elimination and Avoidance or for Further Defenses

Finally, each hazard and its hazard control needs to be critically examined to determine whether the risk is appropriately managed or controlled. If it is, the operation may continue. If not, then steps should be taken to improve the hazard control or to remove or avoid the hazard. For example, an operator may provide recurrent training for crew in the correct use of fire extinguishers. In some instances, a range of solutions to a risk may be available. Some are typically engineering solutions (e.g., redesign), which are generally the most effective but may be expensive. Others involve control (e.g., operating procedures) and personnel (e.g., training), and may be less costly. In practice, a balance needs to be found between the cost and practicality of the various solutions.

At this point, all the flight safety officer or the safety action group may be able to do is to recommend change or action to the CEO. Whether or not the recommendation is acted upon needs to be monitored and a further cycle of risk management carried out.

E.3.2 Understanding System Complexities

E.3.2.1 Within the past few years, complex systems have evolved into sophisticated automated systems with many interactions and interfaces. These systems can be composed of vast subsystems of hardware, firmware (i.e., hard-wired software), software, electronics, avionics, hydraulics, pneumatics, biomechanics, ergonomics, and human factors. There are further complications involving other considerations, such as the potential for management oversight and the perception of risk. A more complete paradigm of a system risk should consider all of these complexities.

E.3.3 System Risks

E.3.3.1 Consider a system as a composite, at any level of complexity. The elements of this composite entity are used together in an intended environment to perform a specific objective. There can be risks associated with any system, and complex technical systems are everywhere within today's modern society. They are part of everyday life in transportation, medical science, utility, nuclear power, general industry, military, and aerospace. These systems may have extensive human interaction, complicated machines and environmental exposures. Humans have to monitor systems, pilot aircraft, operate medical devices and conduct design, maintenance, assembly and installation efforts. The automation can be composed of extensive hardware, software and firmware. There are monitors, instruments and controls. Environmental considerations can be extreme (e.g., harsh climates, outer space and ambient radiation). If automation is not appropriately designed, potentially unacceptable system risks or system accidents can result.

E.3.3 System Accidents

E.3.3.1 System accidents may not be the result of a simple single failure, a deviation or a single error. Although simple adverse events still do occur, system accidents are the result of many contributors, combinations of errors, failures and malfunctions. It is not easy to see the system picture or to "connect the dots" while evaluating multi-contributors within adverse events, identifying initial events and subsequent events to the final outcome. System risks can be unique, undetectable, not perceived, not apparent and very unusual. A novice investigator, analyst or outside party can question the credibility of such diverse events.

E.3.3.2 Determining potential event propagation through a complex system can involve extensive analysis. Specific reliability and system safety methods such as software hazard analysis, failure modes and effects analysis, human interface analysis, scenario analysis and modeling techniques can be applied to determine system risks, which can be the inappropriate interaction of software, human, machine and environment.

E.3.5 Risk Identification

E.3.5.1 The overall system objective should be to design a complex system with acceptable risks. Since reliability is the probability that a system will perform its intended function satisfactorily, these criteria should also address the safety-related risks which directly equate to failures or the unreliability of the system. This consideration includes hardware, firmware, software, humans and environmental conditions.

E.3.5.2 From a system safety view, the problem of risk identification becomes even more complex, in that the dynamics of a potential system accident are also evaluated. When considering multi-event logic, determining quantitative probability of an event becomes extensive, laborious and possibly inconclusive. The model of adverse events in Figure 1 represents a convention (an estimation) of a potential system accident with the associated top

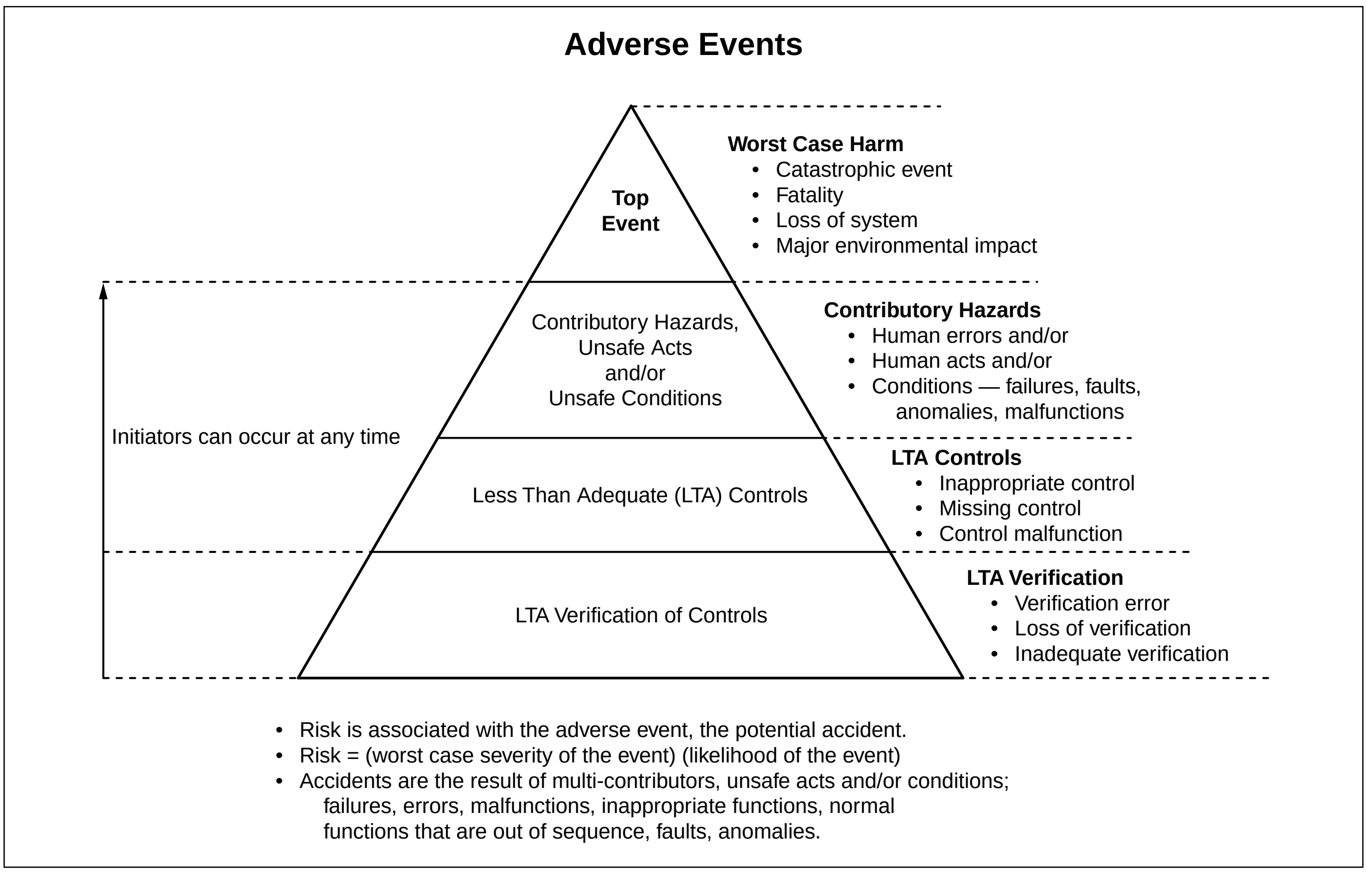


Figure 1

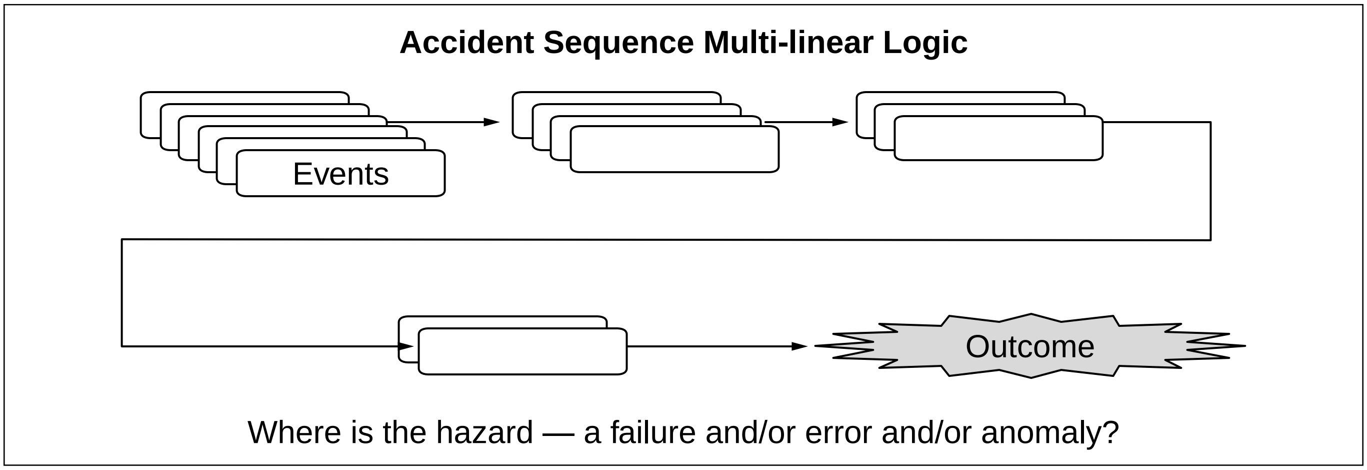


Figure 2

event — the harm expected, contributory hazards, less-than-adequate controls and possibly less-than-adequate verification. The particular potential accident has a specific initial risk and residual risk.

E.3.5.3 Risk is an expression of probable loss over a specific period of time or over a number of operational cycles. Risk is composed of two major potential accident variables: loss and likelihood. The loss relates to harm, severity or consequence. Likelihood is more of a qualitative estimate of loss. Likelihood estimates can be inappropriate since specific quantitative methods can be questionable considering mathematical debate and the lack of relative appropriate data. There are further contradictions which add to complexity when multi-event logic is considered. This logic includes event flow, initiation, verification/control/hazard interaction, human response and software error.

E.3.5.4 The overall intent of system safety is to prevent potential system accidents by the proactive elimination of associated risk or by controlling the risk to an acceptable level. One point is that reliance on probability as the total means of controlling risk can be inappropriate.

Figure 2 illustrates multi-event logic.

E.3.6 Risk Control

E.3.6.1 The concept of controlling risk is not new. Lowrance discussed the topic in 1935.[2] It has been stated that "a thing is safe if the risks are judged to be acceptable." The discussion recently has been expanded to the risk associated with potential system accidents — system risks. Since risk is an expression of probable loss over a specific period of time, two potential accident variables — loss and likelihood — can be considered the parameters of control. To control risk, either the potential loss (severity or consequence) or its likelihood is controlled. A reduction of severity or likelihood will reduce associated risk. Both variables can be reduced or either variable can be reduced, thereby resulting in a reduction of risk.

E.3.6.2 The model of adverse events (Figure 1) is used to illustrate the concept of risk control. For example, consider a potential system accident where reliability, system safety design and administrative controls are applied to reduce system risk. There is a top event, contributory hazards, less-than-adequate controls and less-than-adequate verification. Controls can reduce the severity and/or likelihood of the adverse event.

E.3.6.3 For discussion, consider the potential loss of a single-engine aircraft due to engine failure. Simple linear logic would indicate that a failure of the aircraft's engine during flight would result in possible uncontrolled flight into terrain. Further multi-event logic which can define a potential system accident would indicate additional complexities, such as loss of aircraft control due to inappropriate human reaction, deviation from emergency landing procedures, less-than-adequate altitude and/or less-than-adequate glide ratio. The reliability-related engineering controls in this situation would be just as appropriate to system safety. Consider the overall reliability of the engine, fuel subsystems and the reliable aerodynamics of the aircraft. The system safety related controls would further consider other contributory hazards, such as inappropriate human reaction and deviation from emergency procedures. The additional controls are administrative in nature and include the design of emergency procedures, training, human response, communication procedures and recovery procedures.

E.3.6.4 In this example, the controls above would decrease the likelihood of the event and possibly the severity. The severity would decrease as a result of a successful emergency landing procedure, where the pilot walks away and there is minimal damage to the aircraft.

E.3.6.5 This has been a review of a somewhat complex potential system accident. The hardware, the human and the environment were evaluated. There would be additional complexity if software were included in the example — for example, the aircraft could have been equipped with a fly-by-wire flight control system or an automated fuel system.

E.3.6.6 A number of examples are provided in Figure 3, Figure 4 and Figure 5 (page 97). Each illustration shows an actual system accident that has occurred. Their initiating hazards, contributory hazards and primary hazards are indicated along with appropriate controls. These sorts of flow diagrams are helpful in conducting hazard analysis or accident reconstruction.

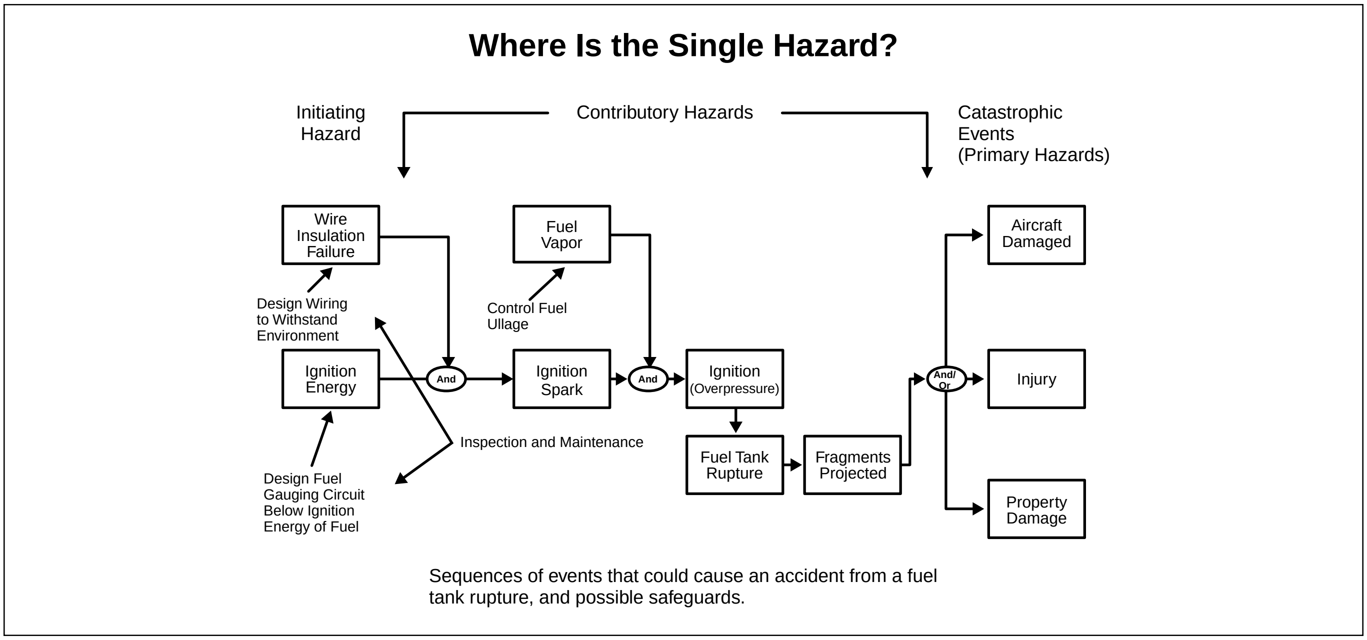


Figure 3

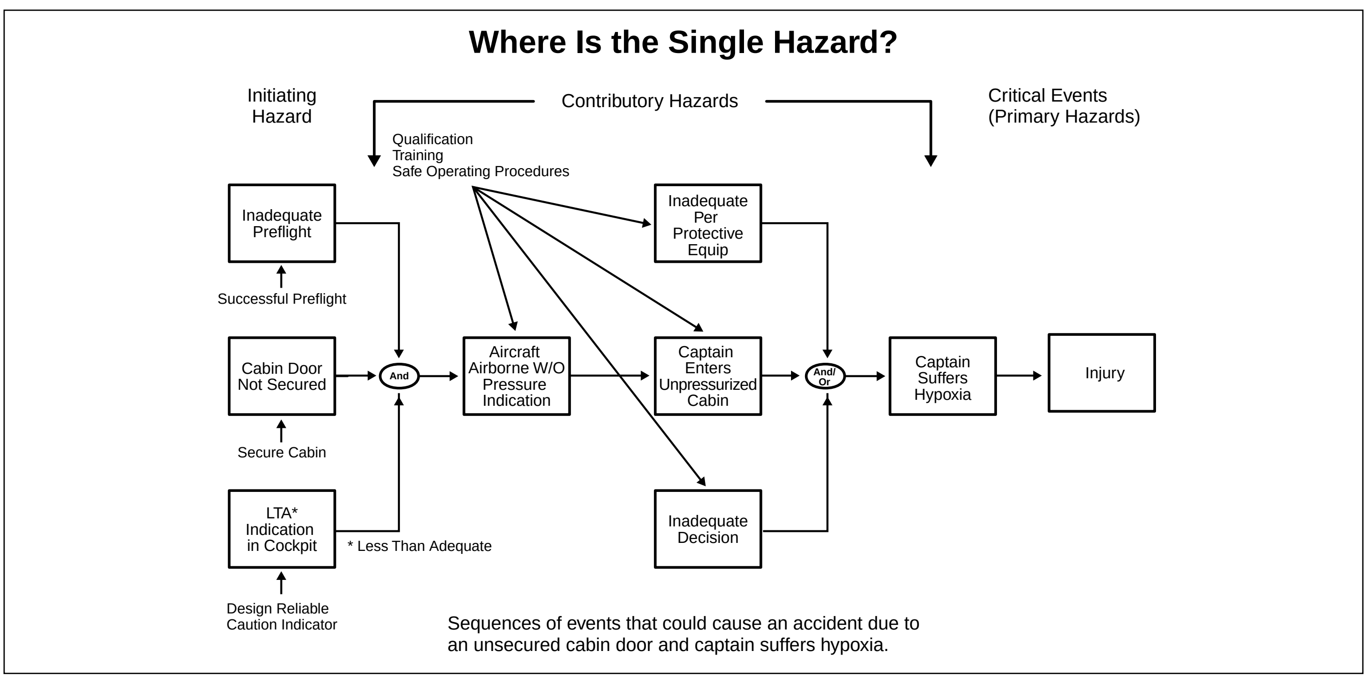


Figure 4

Where Is the Single Hazard?

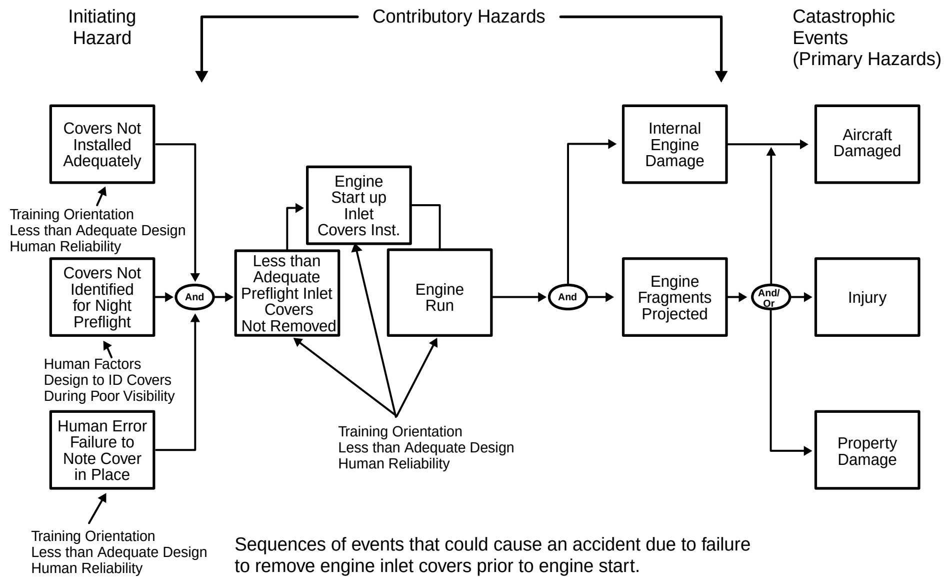


Figure 5

E.3.7 Risk Analysis Matrix

Using the risk analysis matrix (Figure 6), it is possible to standardize the qualitative risk assessments and categorize the hazards using the criteria the company considers important. The matrix axes, consistent with the definition of risk, are consequences and probability. The consequences are ranked in increasing severity from 0 to 5 in the categories considered to be important to the company, and the probability is ranked in increasing probability from A to E.

The risk analysis matrix places the five categories at different levels of severity and in various degrees of probability because it relates to the probability of the estimated potential consequences occurring. The degree of severity can also be set to reflect different requirements, such as company strategy and policy (Figure 7, page 98) or incident

Risk Analysis Matrix

Severity	Consequence					Increasing Probability				
	People	On Time Dep.	Assets	Environment	Reputation	A	B	C	D	E
	P	**T**	**A**	**E**	**R**	Never heard of in the industry	Has occurred in the industry	Has occurred in BM	Has occurred several times in the industry	Has occurred several times in BM
0	No injury	No delay	No damage	No effect	No impact					
1	Slight injury	Less than 15 minutes	Slight damage	Slight effect	Slight impact		**Low**			
2	Minor injury	15 to 30 minutes	Minor damage	Minor effect	Limited impact					
3	Major injury	30 minutes to 2 hours	Major damage	Localized effect	Considerable impact			**Medium**		
4	Single fatality	2 to 4 hours	Extensive damage	Major effect	National impact					
5	Multiple fatalities	Over 4 hours	Massive damage	Massive effect	International impact					**High**

Figure 6

investigation and follow-up requirements (Figure 8).

E.3.8 Safety Precedence Sequence

E.3.8.1 A fundamental concept of hazard control is the safety precedence sequence. The most effective way to control identified hazards is to eliminate them through design or engineering changes. If this is not possible or practical, the next course of action should be to use physical guards or barriers to separate potential unwanted energy flows or other hazards from potential targets. Warning devices should next be applied to any remaining hazards. As a last resort, after other methods have been exhausted, procedures and training should be used.♦

Notes

1. *Hazard Analysis Handbook*, International System Safety Society, second edition.

2. Lowrance, William W. *Of Acceptable Risk — Science and the Determination of Safety*, 1935, copyright 1967 by William Kaufmann.

Company Strategy and Policy

Severity	Consequence					Increasing Probability				
	People **P**	On Time Dep. **T**	Assets **A**	Environment **E**	Reputation **R**	A Never heard of in the industry	B Has occurred in the industry	C Has occurred in BM	D Has occurred several times in the industry	E Has occurred several times in BM
0	No injury	No delay	No damage	No effect	No impact					
1	Slight injury	Less than 15 minutes	Slight damage	Slight effect	Slight impact	**Manage for continuous improvement**				
2	Minor injury	15 to 30 minutes	Minor damage	Minor effect	Limited impact					
3	Major injury	30 minutes to 2 hours	Major damage	Localized effect	Considerable impact			**Reduce Risk**		
4	Single fatality	2 to 4 hours	Extensive damage	Major effect	National impact		**Demonstrate ALARP**			
5	Multiple fatalities	Over 4 hours	Massive damage	Massive effect	International impact				**Intolerable**	

Figure 7

Incident Investigation and Follow up

Severity	Consequence					Increasing Probability				
	People **P**	On Time Dep. **T**	Assets **A**	Environment **E**	Reputation **R**	A Never heard of in the industry	B Has occurred in the industry	C Has occurred in BM	D Has occurred several times in the industry	E Has occurred several times in BM
0	No injury	No delay	No damage	No effect	No impact					
1	Slight injury	Less than 15 minutes	Slight damage	Slight effect	Slight impact	**Investigate and discuss**				
2	Minor injury	15 to 30 minutes	Minor damage	Minor effect	Limited impact					
3	Major injury	30 minutes to 2 hours	Major damage	Localized effect	Considerable impact			**In depth analysis**		
4	Single fatality	2 to 4 hours	Extensive damage	Major effect	National impact		**Discussion at management level**		**In depth analysis**	
5	Multiple fatalities	Over 4 hours	Massive damage	Massive effect	International impact				**Management involvement**	

Figure 8

Appendix F
Corporate Aviation Department Accident Response Team Guideline Example: CARE

There are many examples of accident response checklists available for use by the operator. One example is covered here to illustrate the basic requirements for response. It uses the acronym CARE, for confirm, alert, record, employees.

C — Confirm

- Get the name, telephone number, fax number and address of the person calling in the report;
- Try to make certain the caller is not perpetrating a hoax by calling him/her back. If necessary, verify the caller's phone number with telephone-information service;
- Assume that anonymous calls regarding threats of sabotage or hostages are genuine. Try to record the exact words of the caller. Listen for identifiable background noise;
- If the call is from a foreign country, verify the caller's identity with the respective embassy of that country;
- Note the date and time of the accident/occurrence and the time you received notification; and,
- Obtain as much information from the caller as possible. For example:
  - Make and model of aircraft;
  - Aircraft registration number;
  - Location of the accident or occurrence;
  - Medical condition of persons involved;
  - Names of the health care facilities providing treatment;
  - Extent of damage to the aircraft;
  - Whether police, fire, rescue or regulatory authorities are en route or on the scene; and,
  - Whether other government agencies have been notified.

A — Alert

- Assess whether the accident or occurrence requires activating the complete response plan:
  - Refer to investigative authority recommendations (e.g., National Transportation Safety Board [NTSB] Part 830);
  - Refer to any applicable corporate policies;
  - Refer to your aircraft insurance policy;
- Consider possible modifications to this plan to meet the needs of the situation;
- Call the next primary or alternate member (the senior executive) of your response team;
- You will receive a confirmation call from the last team member informing you of the name and phone number of each team member notified;
- Instruct switchboard operators to direct incoming phone calls related to the accident to your location. Calls from the media should be directed to the senior executive or public relations representative;
- Notify the regulatory and investigative authorities. For criminal acts such as sabotage, hostages or a bomb threat, notify the criminal authorities;
- Simply give the facts. Do not speculate or draw your own conclusions to explain anything;
- Contact law enforcement officials at the scene and, if necessary, authorize use of off-duty police for site security;
- Confirm the passenger/crew manifest. Obtain an accurate list of passengers and crewmembers involved in the accident from the team leader or flight department scheduler. Verify exact names, employers and contact telephone numbers;
- The risk manager will receive notification of the accident through this plan. If your company does not have a risk manager, notify your aviation insurance broker and the field claims office nearest the accident site;
- Carefully consider the advice of your aviation insurance claims professional;
- Contact those individuals who were to meet the aircraft at its intended destination. If the aircraft's destination was home base, coordinate with your human resources specialist for family notification and arrangements;

- Make arrangements for the preservation of any wreckage;

- If you contract with an in-flight medical service, have them contact the hospital with passenger and crew medical histories; and,

- Ensure that crewmembers involved in the accident or occurrence receive medical evaluations as soon as possible and be sure a physician documents their condition.

R — Record

- Retrieve the following original records, make copies for your own purposes and store the originals in a secure place for future reference or use by the regulatory or investigative authorities:

  – Weather reports for the airports closest to the location of the occurrence (e.g., METARs [aviation routine weather reports], terminal forecasts, airmets [airman's meteorological information], sigmets [significant meteorological information] and NOTAMs [notices to airmen]);

  – All trip papers related to the aircraft and its flight, including weight and balance calculations;

  – All personnel and training records for crewmembers involved, including pilot duty and rest records; and,

  – All maintenance records, including airframe and engine logs and aircraft maintenance log sheets; and,

- Have the fixed-base operator (FBO) who last refueled the aircraft collect a fuel sample.

E — Employees

- Inform flight department employees in person, if possible. If expedience is necessary, inform them via telephone. Do not leave a message other than for a return call;

- Do not inform other flight crews while they are flying. Wait until they arrive at their next destination;

- Advise employees not to discuss the accident with anyone outside the company, including the regulatory and investigative authorities or law enforcement, unless directed to do so by a company superior;

- Consider having the flight department "stand down" by giving employees one or more days off. This time off may help employees with their emotional state;

- Assure employees this is not a disciplinary measure but is standard procedure for situations like this;

- Use this time to evaluate whether a company flight or maintenance procedure might have contributed to the cause of the accident;

- Use airlines or charters for flight schedules during this time;

- Consider sending a specially trained company representative to the accident site. (Note: In the United States, it is within the discretion of the NTSB investigator-in-charge to allow participation in the field investigation by the companies whose employees, functions, activities or products were involved in the accident or incident and who can provide suitable qualified technical personnel to assist in the field investigation [NTSB Part 831.11].) Dispatch that individual to the accident site. Have that person inform the local law enforcement, regulatory and investigative authorities and your aviation insurance claims specialist that he or she is on-scene as your company representative;

- If permitted by the investigator-in-charge, photograph the damaged aircraft and the scene; and,

- Keep your team's legal representative informed on the status of your actions.♦

Data for Worldwide Airline Operations Show Fatal Accidents in 2001 Below 10-year Average

Data showed that 33 fatal accidents and 778 fatalities occurred during airline operations worldwide in 2001.

—

FSF Editorial Staff

The number of fatal accidents and the number of fatalities that occurred in 2001 during airline operations were below the averages recorded during the 10-year period from 1992 through 2001, according to data presented by David Learmount, operations and safety editor of *Flight International* magazine, during the 14th European Aviation Safety Seminar (EASS), presented by Flight Safety Foundation with the European Regions Airline Association March 11–13, 2002, in Budapest, Hungary.

The data included passenger-carrying airline operations and non-passenger-carrying airline operations (e.g., freight, ferry and positioning flights) worldwide. The data did not include the four airline aircraft destroyed and the thousands of fatalities caused by terrorist attacks in the United States on Sept. 11, 2001.

Learmount said that 33 fatal accidents and 778 fatalities occurred in 2001 (see Figure 1, page 102). The number of fatal accidents in 2001 was the lowest during the 10-year period, and the number of fatalities was lower than every year but 1999, when 730 people were killed in airline accidents.

The number of fatal accidents and the number of fatalities in 2001 were below the averages during the 10-year period of 47 fatal accidents and 1,215 fatalities.

"The trends look pretty good," Learmount said. "Overall, based on what we would genuinely refer to as accidents, the industry has done well. [These data] are accidents; they do not include the events of Sept. 11.

"2001 is the year which would have been recognized as the best ever [in terms of commercial aviation safety], but 11 September meant that there would be no celebrating. The industry has been reminded that security disasters are inseparable — in passenger perception — from safety disasters."

Learmount said that recommendations to improve aviation security that were made in 1997 by the U.S. White House Commission on Aviation Safety and Security were not implemented in the United States.[1]

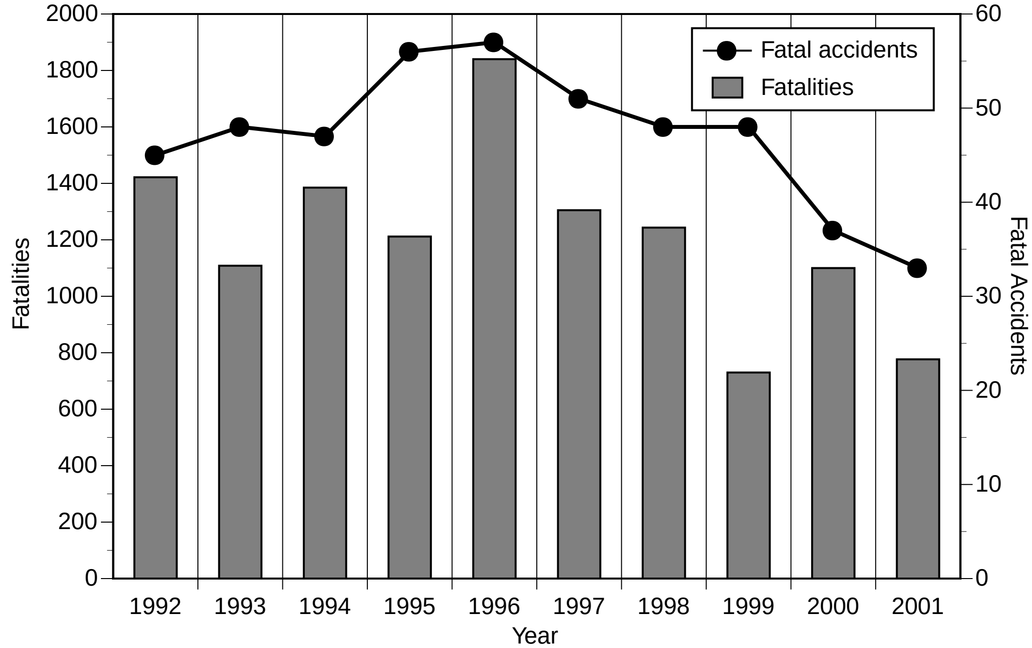
"There is no guarantee that European security systems would have denied boarding to people carrying the 'weapons' these terrorists used [in the Sept. 11 attacks]," he said. "The world — and, specifically, the crews — were not ready for this kind of hijacking. If they had been, they might have stopped it, even without [the assistance] of sky marshals.

"Aviation security is not good enough yet and has to be global to be effective."

Learmount presented data compiled by the International Civil Aviation Organization (ICAO) on fatal accidents and fatalities that occurred during scheduled passenger operations conducted in 1981 through 1999 by aircraft with maximum

Continued on page 103

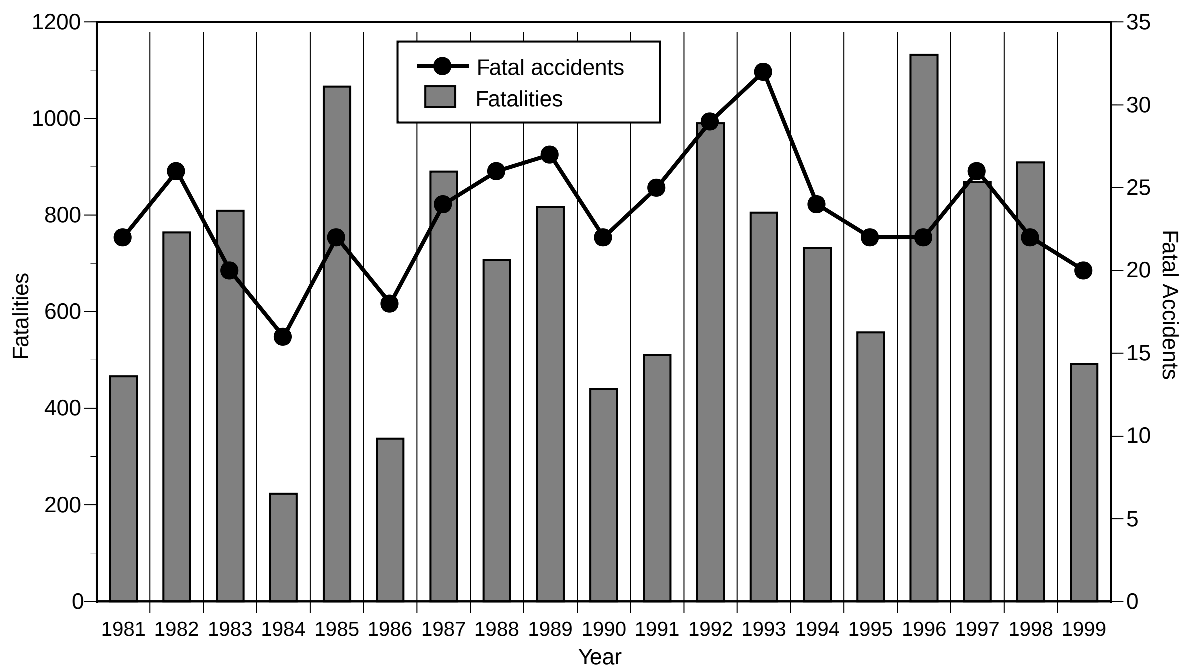
Fatal Accidents and Fatalities During Passenger and Non-passenger Airline Operations, 1992–2001



Source: David Learmount, from *Flight International* data.

Figure 1

Fatal Accidents and Fatalities During Scheduled Passenger Service,* 1981–1999



*Aircraft with maximum takeoff weights exceeding 2,250 kilograms/5,000 pounds. Data do not include the former Union of Soviet Socialist Republics or the Commonwealth of Independent States.

Source: David Learmount, from International Civil Aviation Organization data

Figure 2

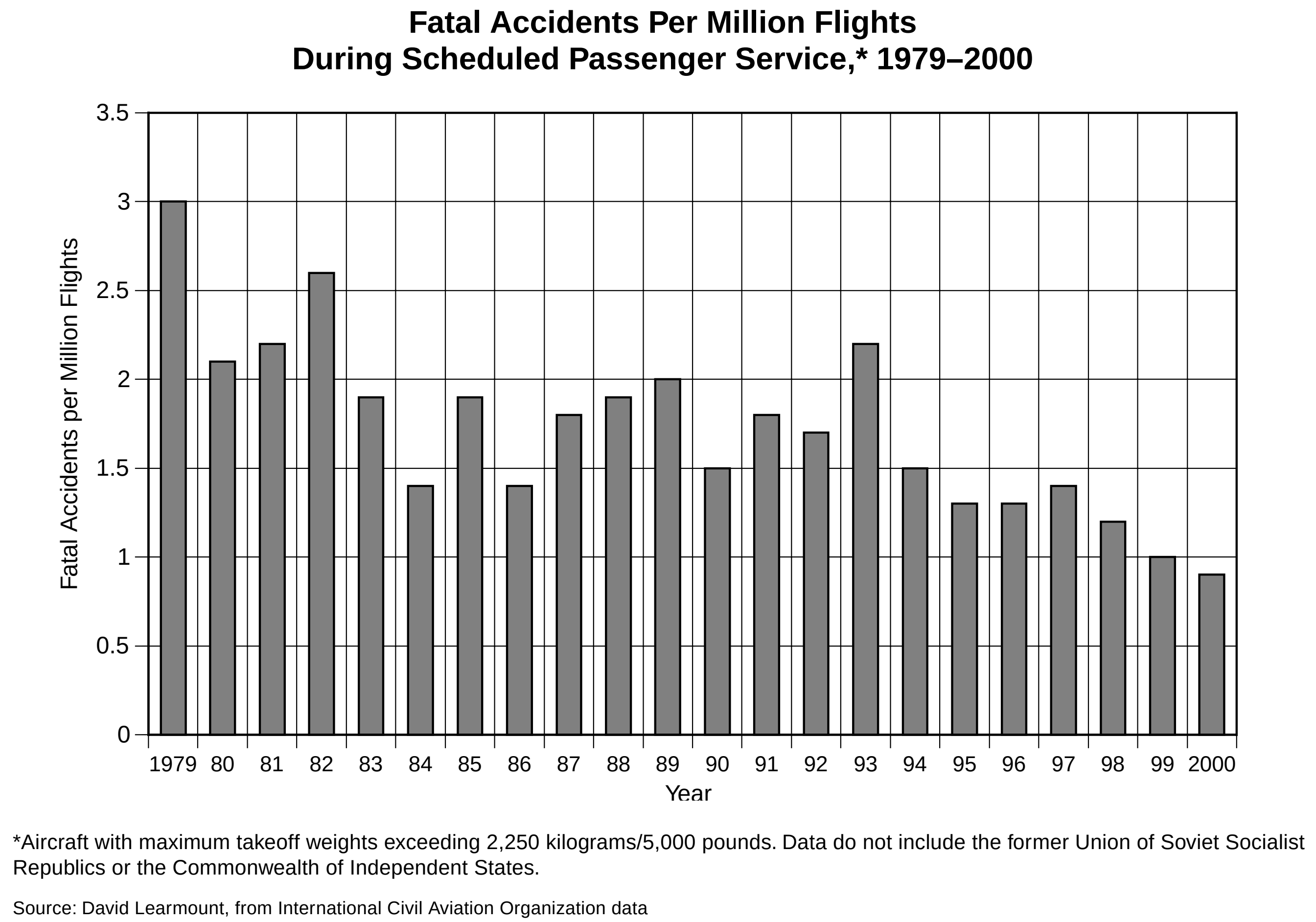


Figure 3

takeoff weights exceeding 2,250 kilograms/5,000 pounds (see Figure 2, page 102). The data did not include fatal accidents and fatalities that occurred in the former Union of Soviet Socialist Republics and the Commonwealth of Independent States.

The ICAO data showed that 20 fatal accidents and 492 fatalities occurred in 1999. The number of fatal accidents and fatalities in 1999 were below the averages for the 19-year period of 23 fatal accidents and 711 fatalities.

"ICAO's figures don't show such a downward trend, in simple numbers, as the more comprehensive *Flight International* figures do," Learmount said. "The actual numbers of fatal accidents and fatalities are really not going down very much. There is not really a trend in either direction.

"So, let's have a look at the truth. The truth is the *rates* — ICAO figures again." Learmount presented ICAO data showing fatal accident rates per million flights during the 22-year period from 1979 through 2000 (see Figure 3).

"Look at what the industry has achieved: a continuous, quite steep downward trend," he said. "In 1979, there were three fatal accidents every million flights. In the year 2000, the last one on the chart, we got down to less than one fatal accident per million flights [i.e., 0.9 fatal accident per million flights; the average rate for the period was 1.7]. All the signs are that during the year 2001 we did even better."♦

Note

1. In its discussion of key recommendations in the *Final Report to President [William J.] Clinton*, on Feb. 12, 1997, the White House Commission on Aviation Safety and Security said, "In the area of security, the Commission believes that the threat against civil aviation is changing and growing, and that the federal government must lead the fight against it. The Commission recommends that the federal government commit greater resources to improving aviation security and work more cooperatively with the private sector and local authorities in carrying out security responsibilities."

Publications Received at FSF Jerry Lederer Aviation Safety Library

Study Examines Planning Activities of Air Traffic Controllers

The U.S. Federal Aviation Administration researchers observed en route air traffic controllers as they developed plans to control traffic and explained those plans to other controllers.

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FSF Library Staff

Reports

Planning in Air Traffic Control. Gronlund, S.D.; Dougherty, M.R.P.; Durso, F.T.; Canning, J.M.; Mills, S.H. U.S. Federal Aviation Administration (FAA) Office of Aerospace Medicine (OAM). DOT/FAA/AM-01/16. October 2001. 25 pp. Figures, tables, references. Available through NTIS.*

The authors conducted an experiment to examine the planning activities of en route air traffic controllers who are responsible for providing air traffic control (ATC) services to high-altitude, high-speed portions of flights.

Air traffic controllers function in an environment that is complex and changing. Certain information may be unavailable to them or may be ambiguous, thus requiring them to search for more information and to keep one or more changing entities under control. Each changing entity has several variables, and the air traffic controller is required to process multiple tasks simultaneously. Anticipating all possible situations is impossible; therefore, the controller must adapt his or her behavior within a changing environment.

In the study, en route air traffic controllers with an average of 6.3 years experience were asked to describe their plans for controlling traffic to tacticians (other controllers), who then implemented the plans. Researchers observed methods of plan management and problem-solving techniques. Results of the study helped the authors gain an understanding of controller planning activities that will be used in the development of computer tools to aid ATC planning.

Business Wings: 30 Years of the Canadian Business Aircraft Association. Hotson, F.W. Ontario, Canada: Canadian Business Aircraft Association (CBAA). 1991. 48 pp. Photos. Available from CBAA.**

The CBAA has re-released a 1991 report about the development of business flying that led to the formation of the CBAA and about the growth and changes that had occurred from 1960 through 1990 in Canadian aviation. This report discusses the influences on Canadian aviation of geography, population spread, rail services and business opportunities.

Books

My God! It's a Woman. Walton, N.B. Sydney, Australia: HarperCollins Publishers, 2002. 216 pp. Photos, bibliography.

Nancy Bird Walton learned to fly at age 17 during the 1930s, when aviation had captured the imagination of people around the world. The book's title was taken from Walton's telephone conversation with a man who had been asked to give landing instructions to the pilot of the aircraft that was being sent to rescue him from flooded grazing land in Queensland, Australia. At the time, Walton was the only charter pilot in Cunnamulla, Queensland. Walton writes about her experiences as one of the pioneers of aviation, flying in the Australian outback and traveling in Europe and the United States. She was awarded the Order of Australia in 1990 in recognition of her significant contribution to aviation and her courageous work in the outback.

Attitude or Latitude: Australian Safety Study. Braithwaite, G.R. Aldershot, England: Ashgate Publishing, 2001. 295 pp. Figures, tables, references.

This book is part of the series "Studies in Aviation Psychology and Human Factors" and was written as a reference text for those who work in the aviation industry and transportation industry. The book may be of interest to those who work in safety management, risk management and operations management and in safety and human factors training. A product of the author's doctoral research into good safety practices, the book is based on Australia's "enviable record for airline safety."

The author looks at aviation as a system and examines the ways components interact within the context of safety. Included is a major survey of pilot and air traffic controller perceptions.

Ground Studies for Pilots: Navigation. Underdown, R.B.; Palmer, T. Ames, Iowa, U.S.: Iowa State University Press, Sixth Edition, 2001. 336 pp. Figures, charts.

This book is one in a series of books for pilots seeking commercial pilot licenses and airline transport pilot licenses. The book has been revised to include information that conforms to the European Joint Aviation Requirements (JARs) Flight Crew Licensing Learning Objectives.

The book includes a discussion of navigation procedures, use of navigation computers and navigation charts. Many chapters contain examples of examination questions (with answers) that are based on the JARs syllabus.

Facts About Spins. DeLacerda, F.G. Ames, Iowa, U.S.: Iowa State University Press, Second Edition, 2002. 140 pp. Figures, tables, bibliography, appendix.

The author describes a spin as a complex aspect of flight and says that, because of its complexity, the spin remains a mystery to the average pilot who has not mastered theoretical knowledge of spins. This author includes factual information that has been extracted from research data about normal upright spins of modern, light, general aviation, single-engine airplanes. The book, which is written for flight instructors and students, includes a discussion of human elements that lead to spin accidents, typical human behavior during spins and training techniques.

Regulatory Materials

Air Carrier Operational Approval and Use of TCAS II. U.S. Federal Aviation Administration (FAA) Advisory Circular (AC) 120-55B. Oct. 22, 2001. 43 pp. Appendixes. Available from GPO.***

The AC describes an acceptable method for addressing issues related to installation and use of the traffic-alert and collision avoidance system (TCAS) II. Included is a description of the TCAS operational approval process, TCAS training methods, maintenance programs, operational policies for TCAS use, appropriate actions in the event of a TCAS occurrence and criteria for foreign operator use of TCAS in U.S. airspace.

This AC applies to air carriers operating under U.S. Federal Aviation Regulations Part 121, organizations conducting training under Part 121, operators conducting business under Part 125 and non-U.S. air carriers conducting operations in U.S. airspace under Part 129. Principles described by the AC also may be applied to U.S. air carriers operating under Part 135 and Part 91.

[This AC cancels AC 120-55A, *Air Carrier Operational Approval and Use of TCAS II*, Aug. 27, 1993.]

Pilot Records Improvement Act of 1996, as Amended. U.S. Federal Aviation Administration (FAA) Advisory Circular (AC) 120-68B. March 22, 2002. 28 pp. Figures, appendixes. Available from GPO.***

The Pilot Records Improvement Act (PRIA) was enacted by the U.S. Congress in response to airline accidents attributed to pilot error and in which employers of the pilots had not investigated the pilots' performance histories and background information. PRIA requires an employer to request and receive certain information about a pilot from FAA, other air carriers or individuals and the U.S. National Driver Register before allowing a pilot to begin flight duty. [The National Driver Register (NDR) is a computerized database of information about drivers who have had their licenses revoked or suspended, or who have been convicted of serious traffic violations such as driving while impaired by alcohol or drugs.]

This AC provides guidance to air carriers hiring an individual as a pilot, to air carriers and other individuals or organizations that have employed an individual pilot as a pilot of a civil aircraft or a public aircraft during the five years before the date of the individual's employment application to an air carrier; and to any individual applying for a position as a pilot with an air carrier who has been employed as a pilot of a civil aircraft or public aircraft during the five years before the date of that individual's employment application to an air carrier. The AC updates and clarifies the section of the law related to employment records of pilot applicants.

[This AC cancels AC 120-68A, *Pilot Records Improvement Act of 1996, as Amended*, Sept. 20, 2001.]♦

Sources

* National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161 U.S.
Internet: <http://www.ntis.gov>

** Canadian Business Aircraft Association (CBAA)
50 O'Connor St., Suite 1421
Ottawa, Ontario K1P 6L2 Canada

*** Superintendent of Documents
U.S. Government Printing Office (GPO)
Washington, DC 20402 U.S.
Internet: <http://www.access.gpo.gov>

MD-82 Receives Substantial Damage During Ground Collision With Taxiing MD-11

The MD-82 was being pushed back from the gate when its rudder was struck by the right winglet of the MD-11; the taxiing airplane was not damaged.

FSF Editorial Staff

The following information provides an awareness of problems through which such occurrences may be prevented in the future. Accident/incident briefs are based on preliminary information from government agencies, aviation organizations, press information and other sources. This information may not be entirely accurate.

Air Carrier

Accident Occurred During Night Snowstorm

McDonnell Douglas MD-82. Substantial damage. No injuries. McDonnell Douglas MD-11. No damage. No injuries.

Heavy snow and night instrument meteorological conditions with visibility of 0.25 statute mile (0.40 kilometer) prevailed at an airport in the United States as a McDonnell Douglas MD-82 was being pushed back from the gate area and an MD-11 was being taxied to parking. The MD-82 captain said that air traffic control (ATC) had told him to remain clear of Taxiway Kilo, which was adjacent to the ramp area, during push-back. The captain said that he had told the tug driver about the ATC instructions, and the tug driver had acknowledged them.

About eight inches (20 centimeters) of snow were on the ground in the ramp area, and the tug driver was unable to maintain directional control of the airplane's nosewheel when he began the push-back. The nosewheel slid left. The tug driver pulled the airplane back to the gate and began another push-back attempt.

"During the second push-back attempt, the tug driver positioned the tug so he was pushing the airplane straight back, which helped keep the nosewheel from sliding," the report said. "The captain said as the push-back proceeded away from the gate, the tug driver stopped the airplane for about 20 seconds, followed by the tug driver reporting to the captain that a taxiing MD-11 had just struck the tail of his airplane."

The captain said that he had been unaware of the collision, but a flight attendant seated in the rear of the airplane had heard a loud bang after the airplane stopped moving. The captain reported the collision to ATC, then told the tug driver to tow the airplane back to the gate.

The captain of the MD-11 said that he kept the nosewheel over the taxiway centerline and that the first officer stood as the airplane approached the MD-82 to observe the clearance distance between the MD-11's right wingtip and the MD-82's tail. An accumulation of snow on the right side window limited the first officer's view, however. The MD-11 crew observed the ground handlers' red flashlights but did not observe a signal to stop, so they proceeded along the taxiway until the right winglet collided with the upper portion of the MD-82 rudder assembly. The MD-82's rudder received substantial damage; the MD-11 received no damage.

Ice Jams Controls Near End of 10-hour Flight

Boeing 767-300. No damage. No injuries.

During a flight from Mexico, the crew observed that the airplane would not react to autopilot commands as they began a descent to an airport in Switzerland. The crew disconnected the autopilot and observed that pitch-control forces were greater than normal. They conducted a go-around and flew the airplane to a holding pattern for further analysis of the problem.

The incident report said that the captain applied increased force to the control column and after a "jerk-type motion," the controls operated normally. The airplane was flown to the destination airport and was landed normally.

Subsequent examination of the airplane indicated that water and ice had accumulated on the elevator-control-system components in the empennage during the 10-hour flight. The crew said that they had flown the airplane through rain in Mexico but that there were few clouds and no precipitation en route to Switzerland.

A similar problem on a Boeing 767 operated by another air carrier had been reported the previous month during a flight to Paris, and an ice buildup had been blamed.

Smoking Luggage Removed From Airplane

Airbus A320. No damage. No injuries.

After a flight from Canada to the Bahamas, baggage handlers found a bag that was smoking and hot to touch. A subsequent inspection by customs officials found that the bag contained a wire wisk and a metal grater but no source of combustion. Maintenance personnel inspected the cargo area, which the incident report described as "clean and cool."

The airplane was flown back to Canada with the cargo area empty. Another inspection at an airport in Canada found no fault in the cargo area.

Air Taxi Commuter

Rudder Locks During Takeoff Ground Roll

Shorts Brothers Shorts 360. No damage. No injuries.

Night instrument meteorological conditions prevailed for the takeoff from an airport in Sweden. The captain taxied the airplane to the runway for takeoff, then transferred control to the first officer.

As the airplane accelerated toward V_1 (takeoff decision speed), the first officer observed that he was unable to control movement of the rudder. The airplane drifted toward the left edge of the runway, and when the first officer could not steer toward the center, he pulled the control column aft. The airplane lifted off. The first officer flew the airplane a few feet above the ground, then turned the airplane back toward the runway. He landed the airplane on the runway and applied full wheel braking. The airplane stopped and was taxied to the terminal.

An investigation revealed no technical problem with the airplane. Nevertheless, the report by the Swedish Board of Accident Investigation said that the location of the control-lock handle was inadequate.

"Both the pilots recall that the control lock was disengaged and that … rudder-control freedom was checked prior to the takeoff," the report said. "This is attested to by the fact that the [first officer] did not experience anything abnormal concerning aircraft maneuverability during the initial portion of the takeoff run."

The report said that findings of the investigation included the fact that "the rudder became spontaneously locked during the ground run during takeoff."

After the incident, the company added an item to the pre-takeoff checklist to require that the position of the control-lock handle be checked.

Dislodged Cargo-door Seal Blamed for Two Depressurization Incidents

Embraer EMB-120ER Brasilia. No damage. No injuries.

The airplane was being flown at Flight Level (FL) 210 (approximately 21,000 feet) on a morning flight from East

Timor to Australia when the flight crew observed that cabin altitude pressure was increasing at more than 2,000 feet per minute. The crew began a high-speed descent and monitored the cabin-altitude indicator. They did not don oxygen masks.

The airplane master-caution-warning chime and the cabin-altitude-warning chime sounded when the cabin altitude exceeded 10,000 feet.

The incident report said, "At that stage, the aircraft was passing FL 140 and continuing to descend at about 3,000 feet per minute. With approximately one minute remaining before reaching 10,000 feet, the crew again decided against using the supplemental oxygen masks."

The crew switched from automatic pressurization to the manual pressurization controller to maintain cabin altitude at about 8,000 feet. They flew the airplane at 11,200 feet, which was the lowest safe altitude for the route segment, and landed the airplane at the destination.

Maintenance personnel inspected the airplane and replaced the pressurization controller. The system functioned normally during the next scheduled flight.

On the following flight, however, the pressurization system again malfunctioned. After the airplane was leveled at FL 230 during a late-night flight from East Timor to Australia, the flight crew observed that the cabin rate-of-climb indicator showed that cabin altitude was increasing 500 feet per minute. Switching to the manual pressurization controller did not correct the problem, so the crew began a descent. During the descent, the cabin altitude rate of climb increased to 1,000 feet per minute, but because the rate of pressure loss was not uncomfortable and because the airplane was nearing FL 140, the crew did not don oxygen masks.

An investigation revealed that, after the first incident, maintenance personnel did not correctly identify the reason for the failure of the pressurization system. The report said that the cause of the loss of cabin pressure probably was a dislodged rear-cargo-door seal.

The report on the second incident said that cabin altitude had been "potentially critical in terms of possible hypoxia."

Nevertheless, because the crew did not know the nature of the pressurization problem, they were "unaware of the possibility that the remaining cabin pressure could suddenly be lost," the report said.

Reports on both incidents included the following:

> Due to the insidious nature of hypoxia and the potentially rapid onset of symptoms, any depressurization event could be critical for flight safety and could result in crew incapacitation. In such circumstances, the precautionary use of supplemental oxygen is essential.

Cabin Airstair Door Opens at 14,000 Feet

Beech King Air 200. Minor damage. No injuries.

The airplane was being flown through 14,000 feet after departure from an airport in Canada when the cabin airstair door opened and rotated outward. The flight crew declared an emergency and flew the airplane to the departure airport. The airstair door was damaged when it struck the runway during landing.

The airstair door was sent to the operator's base for examination, which revealed that the door-latching mechanism had been intact before the incident. Investigation of the incident was continuing.

Corporate
Business

Airplane Strikes Terrain After Engine Failure During Instrument Approach

Cessna 340. Destroyed. Four fatalities.

Instrument meteorological conditions prevailed for the late-afternoon flight to an airport in the United States, and an instrument flight rules flight plan had been filed. The air traffic controller in the airport control tower said that the pilot had received a landing clearance and that about 90 seconds later, the pilot told the controller that one of his airplane's engines had failed.

Radar data showed that the airplane turned left 180 degrees to a southerly heading. Radar contact then was lost, and the airplane struck the ground.

Damaged Compressor Blade Prompts Return to Airport

Israel Aircraft Industries 1125 Astra. Minor damage. No injuries.

After takeoff for a midmorning flight from an airport in Canada, the crew heard a bang from the right engine, and a vibration was felt in the cabin. The crew moved the right-engine throttle lever to idle and flew the airplane to the departure airport.

During a subsequent inspection of the right engine, metal was found in the tail pipe. The engine was removed for a borescope inspection, which revealed compressor-blade damage.

Other General Aviation

Airplane Strikes Ground During Aerobatic Practice

Pitts S-1E Special. Destroyed. One fatality.

The airplane was being flown for aerobatic practice near an airport in Australia. The practice area was bisected by a high-tension power line; on the north side of the power line, the trees had been cleared, and on the south side, there was a pine forest. The pilot said that he would fly his airplane on the north side while a friend flew another aerobatic airplane on the south side of the power line.

After the friend had completed his practice session, he tried to contact the pilot of the Pitts by radio but received no response. When he flew closer to the power line, he observed a fire and realized that the Pitts had struck terrain. A witness said that the Pitts had been flying straight, with the wings perpendicular to the ground, in a "knife-edge" maneuver with the upper side of the airplane away from the power line; the airplane appeared to have been descending before it disappeared from sight behind a ridge.

An investigation revealed that the airplane struck the ground in a wings-level attitude at more than 100 knots. The report said that the airplane had been descending, with a pitch attitude of about 30 degrees nose-down and low gravity loading. The engine had been operating at low power to moderate power.

The report said that the airplane probably was less than 300 feet above ground level when it disappeared from the witness' sight. The accident site contained no prominent visual indicators to aid the pilot in judging the airplane's height above the ground.

The report said that investigators could not determine why the airplane struck the ground, but that the pilot had worn a new, four-centimeter (1.6-inch) thick parachute pack for the first time.

"The pilot's new parachute pack would have changed his position relative to the cockpit controls," the report said. "A possible consequence was that, if the pilot used that relationship as a reference during maneuvers, without adjusting for the parachute pack, the position of the flight-control surfaces would also have changed, when compared with previous flights performing the same maneuvers. That could have resulted in the aircraft being operated outside the parameters previously established by the pilot for particular maneuvers, such as by descending unintentionally."

Although the witness said that the airplane was tracking to the southeast, the airplane struck the ground while tracking to the northwest. The report said that the pilot could have discontinued the knife-edge maneuver and reversed the direction of flight while the airplane was behind the ridge and was not seen by the witness.

The pilot of the other aerobatic airplane said that the temperature during the flight was about 35 degrees Celsius (95 degrees Fahrenheit), and the report said that "oppressive" conditions in the Pitts cockpit might have affected the pilot's performance.

Tow Damage Prevents Extension of Nose-landing Gear

Piper PA-34-200-2 Seneca. Minor damage. No injuries.

The airplane was being flown on a training flight from an airport in England. After departure, when the landing gear lever was moved to retract the landing gear, the "GEAR IN TRANSIT/UNSAFE" light remained on. When the landing gear lever was moved to extend the landing gear, there was no indication that the nose landing gear was down and locked. From an external mirror, the instructor and student observed that the nosewheel was about halfway down.

After alternative procedures to lower the nose-landing gear failed, the instructor and student flew the airplane back to the airport.

The report said, "The instructor asked the student to move to a rear seat in order to move the center of gravity rearwards. During the downwind leg, he feathered one propeller, and, when on short final and confident of landing on the runway, he feathered the other [propeller]. A flapless landing was made to keep the nose as high as possible after landing, and the pilot was able to keep the nose off the ground until the aircraft was traveling at about 20 knots. When the nose sank onto the grass runway, the underside of the nosecone suffered minor damage, but the propellers were undamaged."

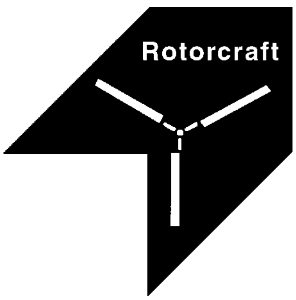
An investigation revealed that the roller on the nosewheel-steering arm had been subjected to a lateral overload and was out of its track; the attachment bolt also was bent. As a result, the nosewheel-steering mechanism was not centered. When the landing gear was retracted, the nosewheel-steering mechanism became jammed and prevented the nose gear from being retracted or being extended. Maintenance personnel determined that the airplane had been towed by a tug and that during the tow, the airplane's steering limits had been exceeded. After the accident, the maintenance organization increased the visibility of the steering-limit marks on the fuselage nose so that turning limits could be observed more easily during ground operations.

Change in Winds Cited in Landing Accident

Bellanca 7GCBC Citabria. Substantial damage. No injuries.

The airplane was being flown on approach to land at an airport in Canada. The airplane was on a northerly heading with winds gusting from the north.

When the airplane descended below treetop level, the winds diminished. The airplane then descended, struck the ground and flipped to an inverted position.



Fuel-flow Cutoff Cited in Engine Failure

Schweizer 269CB. No damage. No injuries.

The helicopter was in cruise on a repositioning flight in Australia when the engine misfired and stopped. The pilot conducted a power-off autorotation onto the wall of a nearby dam.

Later, when rapid accelerations were conducted to observe operation of the accelerator pump, no fuel was observed flowing from the accelerator-pump discharge tube in the carburetor venturi. An investigation revealed that the accelerator-pump plunger mechanism was disconnected at a point on the plunger that would have caused insufficient fuel availability during rapid high-power requirements. The investigation did not establish the reason for disconnection of the accelerator-pump plunger mechanism.

Turbulence Results in Uncontrolled Descent in Mountainous Area

Bell 206B JetRanger III. Destroyed. No injuries.

Visual meteorological conditions prevailed for the afternoon power-line patrol flight in the United States. The pilot said that the helicopter entered turbulence over mountainous terrain and that he was unable to stop the helicopter from descending. Just before the helicopter struck the ground, the low-rotor revolutions-per-minute warning sounded.

Helicopter Strikes Ground After Cyclic Control Becomes Difficult to Move

Eurocopter AS 350B2. Substantial damage. No injuries.

Visual meteorological conditions prevailed as the helicopter was being flown from a helipad in the United States to pick up skiers from a nearby mountain pass. The pilot said that, during a descent from 4,000 feet, the hydraulic-pressure warning horn sounded and the hydraulic warning light illuminated.

Because he knew that he would be unable to fly the helicopter back to an altitude high enough for a return to the helipad, he planned a landing on a road. As he flew the helicopter in a landing pattern, the cyclic control became stiff and difficult to move. He brought the helicopter to a hover four feet above the ground, and the cyclic control stuck in the full-aft left position. The helicopter rolled over and struck the ground.

Helicopter Sinks as Pilot Tries to Change Landing Position on Dock

Agusta-Bell 204B. Substantial damage. One fatality.

The pilot landed the helicopter on a concrete boat pier in Sweden, reduced engine power to idle, locked the flight controls and exited the helicopter to help his nine passengers deplane. After five passengers had deplaned, the pilot believed that the helicopter was bouncing, so he told the four other passengers to remain in the helicopter. He returned to his seat, applied full engine power and attempted to lift the collective, but the helicopter tipped backward over the edge of the pier and the tail rotor contacted the water.

The pilot flew the helicopter a few feet into the air before the helicopter uncontrollably rotated right. The pilot landed the helicopter on the water, and the helicopter sank. The pilot and three passengers in the aft section of the helicopter escaped, but one passenger remained in the left-front seat of the helicopter. The pilot made several dives in an unsuccessful attempt to rescue the passenger, whose body later was recovered by search-and-rescue divers who arrived 20 minutes after the accident.

The accident report said that the accident was caused "by the pilot leaving the cockpit with the engine running while the helicopter was parked with too little margin to the edge of the [pier]."

The report also said that the landing site on the pier did not conform to the requirement that takeoff areas and landing areas for private flights must have dimensions of at least 26 meters by 17 meters (85 feet by 56 feet).♦

Call for Nominations

Flight Safety Foundation Heroism Award

The **FSF Heroism Award** was established by the Foundation in 1968 to recognize civil aircraft crewmembers or ground personnel whose heroic actions exceeded the requirements of their jobs and, as a result, saved lives or property. Selection of award recipients is determined by the degree of personal risk involved in the heroic act; the nature of the courage, perseverance and other personal characteristics that were displayed; and the degree to which the heroism was outside normal levels of duty and ability.

The award is presented only in years in which a nominee clearly meets the award's standard for heroism.

Since 1978, the award has been sponsored by the company now known as Kidde Aerospace and Defense; in that same year, Wilkinson Sword Ltd. was commissioned to craft a permanent symbol of the award — The Graviner Sword, a 4.2-foot (1.3-meter) Scottish highland clan broadsword, modeled after a 15th-century two-handed battle sword. The award includes a miniature replica of The Graviner Sword, US$1,000 and a handsome, wood-framed, hand-lettered citation.

The nominating deadline is July 31, 2002; the award is presented at the FSF International Air Safety Seminar (IASS).

FLIGHT SAFETY FOUNDATION
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Submit your nomination(s) via our Internet site.
Go to http://www.flightsafety.org/hero.html

For more information, contact Kim Granados, membership manager,
by e-mail: granados@flightsafety.org or by telephone: +1 (703) 739-6700, ext. 126.

Want more information about Flight Safety Foundation?

Contact Ann Hill, director, membership and development
by e-mail: hill@flightsafety.org or by telephone: +1 (703) 739-6700, ext. 105.

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