AVIATION SAFETY MANAGEMENT

An operator’s guide to building a safety program

How to take a leadership role in safety management.

How to involve your staff in monitoring, reporting and acting on errors and hazards.

A guide suitable for:
- Small GA companies
- Medium-sized GA charter operations
- Low Capacity Regular Public Transport operations.
The operator’s legal responsibility

A common theme that has emerged from recent inquiries into civil aviation has been that airline management must take full responsibility for safety, and that both the aviation industry and aviation authorities must be more proactive in identifying safety deficiencies, so that the potential for accidents is reduced.

The Civil Aviation Act, 1988:

Section 28BE.

(1) The holder of an AOC must at all times take all reasonable steps to ensure that every activity covered by the AOC, and everything done in connection with such an activity, is done with a reasonable degree of care and diligence.

(2) If the holder is a body having legal personality, each of its directors must also take the steps specified in subsection (1).

(3) It is evidence of a failure by a body and its directors to comply with this section if an act covered by this section is done without a reasonable degree of care and diligence mainly because of:
   (a) inadequate corporate management, control or supervision of the conduct of any of the body’s directors, servants or agents; or
   (b) failure to provide adequate systems for communicating relevant information to relevant people in the body.

This means the holder of the AOC—and any company directors—carry the main responsibility for the safety of their operation.

Clearly, management can no longer remain aloof from the actions of employees.

One proven way of improving safety—and meeting the requirements of Section 28BE of the Act—is for operators to take a leadership role in building their own safety program.

A good safety program will reduce costs as well as improve safety.

‘... there is now a developing risk that the State may take a hand by prosecuting where a management failure [results in death or injury], and that failure constitutes conduct falling far below what can reasonably be expected ...’

— Peter Martin

‘Corporate Killing— A New Hazard for Civil Aviation’
A safety program is an investment with a high return over the long term. I urge you to consider adopting such a program to manage safety in your organisation.

Responsibility for aviation safety begins at the top of an organisation.

As Director, Chief Executive or Operations Manager, you are accountable for how risk is managed in your operation.

The Civil Aviation Act, 1988 places the responsibility for safety management on the holder of the Air Operator Certificate (AOC), associated directors and managers (see extract opposite page).

Good safety management is more than just a legal and moral requirement. Around the world, there is a growing recognition that safety programs can improve a company’s operating performance and profits as well as its safety defences.

A safety program identifies and monitors operational hazards and faults. This provides for the effective management of risk. In other words, the aim of a safety program is to ensure that there are no holes in the safety net.

Safety programs are not just for the major airlines. They can be tailored to meet the needs of all operators—regardless of size, complexity or type of operation.

This Guide is intended as an introductory resource, providing you with the information you need to make a safety program work for you.

A safety program is an investment with a high return over the long term. I urge you to consider adopting such a program to manage safety in your organisation.

John Pike

A/Director of Aviation Safety

Civil Aviation Safety Authority, Australia (CASA)
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This guide was prepared by the Safety Program for Commercial Operators (SAPCOM) project team, which included representatives from the Civil Aviation Safety Authority (CASA), the insurance industry, the aviation industry, consumers and an observer from the Bureau of Air Safety Investigation (BASI).

The members of the team were:

Bob Allan       District Administrator, Wagga Wagga District Office, CASA
Hilary Caldwell Consumer representative
Neville Dickson Manager Flight Safety, Qantas Airways Ltd
Bob Dodd        General Manager, Aviation Safety Promotion Branch, CASA
Graham Edkins   Manager Aviation Psychology Services, Qantas Airways Ltd (formerly from BASI)
Alan Hobbs      Air Safety Investigator, Safety Programs, BASI (observer status)
Don Kendell     Formerly, Managing Director, Kendell Airlines
Marcia Kimball  General Manager, Human Resource Management Branch, CASA
Jim Marcolin    Training Officer, Training & Development Section, CASA
Bill Mattes     Development Manager: Victoria, Australian Aviation Underwriting Pool Pty Ltd
Allister Polkinghorne Safety Education Officer, Aviation Safety Promotion Branch, CASA
Bill Riceman    Flying Operations Inspector, Adelaide District Office, CASA
John Williams   Senior Airworthiness Inspector, Perth District Office, CASA
Mark Wolff      Senior Specialist (Communications), Aviation Safety Promotion Branch, CASA.

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On 2 October 1994, VH-SVQ, an Aero Commander 690B operated by Seaview Air, crashed into the Pacific Ocean killing all nine people on board. An extensive air and sea search failed to locate the aircraft or its occupants.

Even though the direct cause of the crash could not be determined, many factors relating to the operation of Seaview Air, and its oversight by the regulator, were identified.

Problems within Seaview Air included:
- The company was not licensed to operate Regular Public Transport (RPT) services on the route in question
- There was little evidence of compliance with the recording and processing of defects
- Evasion of regulations was common—as admitted by several previous Chief Pilots.

Deficiencies on the part of the Civil Aviation Authority included:
- Lack of effective procedures to review the issue of Air Operator Certificates
- Poor operator surveillance
- Inadequate follow-up of safety hazards identified in Seaview Air's operation.
What is a SAFETY PROGRAM?

Overview

A safety program is essentially a coherent and integrated set of procedures for effectively managing the safety of your operation. It is more than just safe operating practices. It is a total management program.

The outcome of a safety program is an improvement in your company’s ability to identify and track hazards and get something done about them before they do any harm. Regardless of the size of the operation, all safety programs have four general requirements.

1. Top management sets the safety standards

Chief Executives or managers should:
- Specify the company’s standards
- Ensure that everyone knows the standards and accepts them
- Make sure there is a system in place so that deviations from the standards are recognised and reported.

2. The company maintains its standards

To maintain your standards, you need the support of your staff. This requires:
- The right staff are involved in developing the standards
- Responsibilities are made clear
- All staff consistently work to the standards.

3. Hazards are reported in a timely manner

You need an efficient and effective hazard reporting system. This means:
- All staff are encouraged to report hazards and safety concerns
- Procedures are in place to track significant events, and detect unexplained increases in safety related events
- There are processes to regularly review the effectiveness of your reporting system.

4. Action is taken to resolve hazards

Once you have identified the hazard, you need to take action to defend your operation from the risk involved. You can do this in three ways:
- Eliminate the hazard completely—this is the most effective defence, but is sometimes not practical
- Change your operational procedures to work around the hazard
- Warn people about the hazard—by itself, this is the least effective action.
On 11 June 1993, VH-NDU, a Piper PA31-350 Navajo Chieftain operated by Monarch Airlines, was on a landing approach to Young Aerodrome, NSW, in conditions of low cloud and darkness.

It struck trees, crashed, and was destroyed by impact forces and post-crash fire. All seven occupants were fatally injured.

A combination of local and organisational failures led to the accident. The weather conditions were poor, and there were inadequate visual cues available to the handling pilot. The pilot had a high workload, made worse by aircraft equipment deficiencies and inadequate procedures.

Deficiencies were identified within the regulator and the operator.

Organisational failures on the part of the operator included:

- Poor training of flight crew
- Poor control of the safety of flight operations
- Inadequate supervision of maintenance
- Inadequate resources allocated to safety.

These failures were made worse because staff felt unable to discuss safety concerns with management.
How to build your own
SAFETY PROGRAM

There are 12 elements that should be considered in building your safety program:

1. Senior management commitment
2. Appointment of a Safety Officer (for larger organisations) or appointment of an existing manager to take on responsibility for the safety program
3. Establishment of a safety action group (for larger organisations) or incorporation of discussion of the safety program into existing regular meetings
4. Hazard identification and risk management
5. Ongoing hazard reporting system
6. Encouragement of a positive safety culture
7. Safety induction and recurrent training
8. Safety audit/assessment
9. Accident and incident reporting and investigation
10. Regular evaluation and ongoing fine tuning of the program
11. Emergency response plan
12. Documentation.

Each element is briefly described below along with—where relevant—a series of questions and examples to enable you to design a safety program which suits your operation.

1. Senior management commitment

The ultimate responsibility for safety rests with the directors and management of the company. The whole ethos of a 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, there is no doubt that top management determines the company’s safety culture. Without your wholehearted commitment, any safety program will be ineffective.
The Safety Officer—responsibilities must be clear

The appointment of a Safety Officer or Safety Manager does not relieve the organisation’s ‘key personnel’ (i.e., Directors, Chief Executive, Chief Pilot or the head of operations, the head of training and checking and the head of maintenance) from their legal obligations under the Act.

The Safety Officer is not a statutory position. However, Civil Aviation Order (CAO) 82.0 gives the Chief Pilot responsibility for matters affecting the safety of the flying operations. The Safety Officer is appointed to administer the safety program. The responsibilities include the identification and reporting of safety hazards, but may not include operational authority.

The responsibilities and authority of the Safety Officer and the Chief Pilot must be clear and understood to prevent conflict. The Safety Officer should report directly to the Chief Executive. However, it is essential that the Chief Pilot’s position is not undermined in the process. On the other hand, if the Chief Pilot were to be the cause of a safety problem, the Safety Officer must be in a position to report the hazard. Top level management needs to identify the potential problem and promulgate clear policy to maintain the integrity of the Safety Program and avert any conflict.

One solution might be to have the Safety Officer report to the Chief Pilot (Figure 2) with a formal communication line to the Chief Executive. A downside to this structure is the possibility of inappropriate filtering of the information reaching the Chief Executive.

Alternatively, the Safety Officer could report directly to the Chief Executive (Figure 1) with a formal communication line to the Chief Pilot. The Chief Pilot would receive copies of all safety-related information and reports. This is the preferred option.

Safety officer reporting lines

**FIGURE 1**

- Safety Officer
- Chief Pilot
- CHIEF EXECUTIVE

**FIGURE 2**

- Safety Officer
- CHIEF EXECUTIVE
- Chief Pilot

Note: For smaller organisations, the Safety Officer’s role may be part of the duties of the Operations Manager, Chief Pilot or other line manager.
What public commitment to safety have you made?

eg.  ■ A written safety policy signed by the Chief Executive
     ■ There is an appropriate reporting chain for safety issues, and
       reports are encouraged.

Outcome—You are confident your staff understand and accept that they
must perform their roles in the company's safety program.

2. Responsibility for the safety program

There needs to be one person within the organisation who is responsible for
managing the safety program. For convenience, let's call this person the
'Safety Officer'. Larger organisations may have a Director of Safety or a Safety
Manager. The point is, there must be someone appropriately tasked to run the
safety program.

Ideally, Safety Officers should report directly to the Chief Executive on safety
matters, because in this way the safety reports and recommendations can be
assured of the proper level of study, assessment and implementation. The Safety
Officer needs to have the Chief Executive's respect in order to discuss safety
problems without fear of retribution.

Depending on the size of the organisation, the responsibilities of the Safety Officer
may require a full-time appointment, or they may be added to someone's normal
duties. In a large organisation, the Safety Officer may require the assistance of
other people dedicated to the task.

The Safety Officer should be technically competent in one or more of the
functional areas of the company's operations. He or she could be, for example, a
senior pilot or engineer. Experience has shown that the most effective Safety
Officer is interested in the task and is enthusiastic about the role.

Who is responsible for managing the safety program?

Small GA operator

eg.  ■ Operations Manager
     ■ Chief Pilot or other senior pilot.

Medium-large GA operator/Airline

eg.  ■ Safety Manager/Director of Safety
     This person needs to be respected throughout the organisation,
     enthusiastic and have the Chief Executive's full support.

The Safety Manager is responsible for (among other things):

■ Maintenance, review and revision of the safety program
■ Timely advice and assistance on safety matters to managers at all levels
■ A reporting system for hazards
A safety group may or may not be appropriate. It will depend on the size and structure of your operation.

How do your staff know their safety program responsibilities?

**eg.** Roles and responsibilities of staff in the safety program are documented
- Staff have been given appropriate briefings or training.

**Outcome**—Everyone knows who is responsible for managing the safety program. All staff involved in your safety program know and accept their responsibilities.

### 3. Establishment of a safety action group

Depending on the size of the organisation, the Safety Officer may be supported by a safety action group. The role of the safety action group could include:

- Act as a source of expertise and advice
- Encourage lateral thinking about safety issues
- Help identify hazards and defences
- Make safety recommendations
- Prepare and review reports to the Chief Executive.

An active safety group or committee is invaluable in creating and fostering a positive ‘safety culture’—that is, the behaviour and attitudes that company management and staff have about safety.

**Do you need to set up a safety action group?**

**Small GA operator**

For smaller organisations, you don't need a formal safety action group. However, you do need to discuss safety issues with staff in a timely manner.

**eg.**
- Genuine open door policy. Staff are made to feel comfortable raising safety concerns
- Allocate a regular timeslot to meet with staff to discuss safety matters.

**Medium-large GA operator/Airline**

A safety action group may or may not be appropriate. It will depend on the size and structure of your operation.

**eg.**
- An organisation with 20 staff operating in one location, and with open and effective communication lines between all staff, could manage a safety program well without a formal action group. On the other hand, an organisation with 20-30 staff operating from 4 locations, with communications often ‘filtered’ between locations, would benefit greatly from establishing a safety action group.
- A safety action group is recommended for larger operations.
Who should be on a safety action group?

Medium-large GA operator/Airline

eg. The group should comprise line staff from flight operations and representatives from maintenance and dispatch/ground handling areas. The group should be chaired by a line manager.

The Safety Officer/Manager would coordinate activities, set meeting agendas, keep records and minutes of meetings, and so on. The membership of the action group might be periodically rotated between staff from all operational areas.

What are the safety action group’s functions?

Medium-large GA operator/Airline

eg. Review status of incidents/accidents, and review actions taken
    Review status of hazard/risk reports, and review actions taken
    Review internal audit reports (if applicable)
    Review and approve audit response and actions taken
    Review and resolve any safety matters which are brought before the group.

How will the safety action group be structured?

Medium-large GA operator/Airline

eg. Sample safety action group: There will be a safety action group comprising representatives from flight operations, maintenance and engineering and other functional areas. The group should be chaired, preferably, by a senior manager.

The membership will be appointed by the General Manager, Aviation Services. The Safety Officer will keep all records for the group and will prepare agendas and minutes in cooperation with the chair. The action group will meet at the call of the chair, but in any case not less than quarterly.

The group may approve, reject or recommend action on any matter brought before it. Review of the minutes and signature by the General Manager, Aviation Services, constitutes approval. The minutes then become directive.

Safety action group records will be maintained by the Safety Officer. Agendas and minutes will be kept for three years.

Outcome—Staff become stakeholders in your safety program, ensuring its success.
4. Hazard identification and risk management

An effective hazard identification system is characterised as being non-punitive, confidential, simple, direct and convenient. It should have an identifiable process for both action and feedback.

A HAZARD CAN BE DEFINED AS: An event or situation which has the potential to result in damage or injury.

THE DEGREE OF RISK IS BASED ON: The likelihood that damage or harm will result from the hazard and the severity of the consequences.

Hazard identification and risk management should be undertaken:

- During implementation of the safety program and then annually
- When major operational changes are planned
- If the organisation is undergoing rapid change, such as rapid growth and expansion, new route structures or acquisition of other aircraft types.

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

Step 1: Identify the hazards

There are many ways of identifying hazards, 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 favour.

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

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

Small GA operator

The small GA operator simply needs to apply discipline and allocate time to critically look at all facets of the company's operations and identify the dangers and hazards. You need to take action to either eliminate the hazards where possible, or vary the operation in some practical way that will offer protection from the hazards in order to increase the safety margin.
Assess the hazards and rank them, as far as possible, in order of their risk potential. Factors to consider are the likelihood of the occurrence and the severity of the consequences.

**Medium-large GA 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 your safety program.

The purpose of the discussion groups is to provide a structured method of identifying those hazards which are most likely to cause injury or damage. The number of participants will depend on the size of the organisation, probably three or four for a medium GA company and up to eight people for a regional airline. It is a good idea to have a number of groups each representing the various functional areas, i.e. flight operations, ground crew, maintenance and engineering, pilots and cabin crew. Each group should run with participants from the same functional area, e.g. all pilots or all engineers, and so on.

**eg.** The BASI-INDICATE program offers an excellent example of a system for proactively identifying safety hazards.

The BASI-INDICATE program describes how to set up groups and conduct a basic process for identifying safety hazards by following five simple steps:

- Identify potential airline safety hazards that may threaten the safety of passengers
- Rank the severity of hazards
- Identify current defences
- Evaluate the effectiveness of each defence
- Identify additional defences.

Discussion groups have several main advantages. They can:

- Provide the airline with a current assessment of its safety performance
- Encourage staff to report safety problems
- Encourage staff participation in safety management
- Reaffirm that the company is committed to safety
- Make staff more aware of the safety implications of their jobs.

**Step 2: Assess the hazards**

The next step in the process is to critically assess the hazards and rank them, as far as possible, in order of their risk potential. Factors to consider are the likelihood of the occurrence and the severity of the consequences.

**eg.** An 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, is much less severe. There are various ways of doing this type of assessment. They range from the subjective to the very analytical and objective. Some possible methods may be found in the safety programs reviewed in Section 4 of this Guide.
Finally, each hazard and its defences need 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 increase the defences or to remove or avoid the hazard.

**Step 3: Identify the defences**

Once the hazards are identified and approximately ranked, the defences which exist to protect against the hazards should be identified.

**eg.**
- A defence against an in-flight fire may be a fire extinguisher.
- A defence against particular hazards would be to ensure that operating procedures are properly documented and implemented and to insist on compliance.

**How will you identify the defences?**

**eg.**
- Group discussions which include representatives from the relevant areas.

**Step 4: Assess the defences**

The defences to each of the identified hazards are then assessed. How effective are they? Would they prevent the occurrence (ie. do they remove the hazard), or do they minimise the likelihood or the consequence? If the latter, to what extent is this true? An example of determining the effectiveness of a defence is to ask the question: Do the crew know how to use the fire extinguishers, and are the extinguishers correctly maintained?

**Step 5: Identify the need for hazard avoidance or for further defences**

Finally, each hazard and its defences need 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 increase the defences 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 hazard problem may be available. Some are typically engineering solutions (eg. redesign) which are generally the most effective, but may be expensive; others involve control (eg. operating procedures) and personnel (eg. 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 Safety Officer or the safety action group may be able to do is to recommend change or action to the Chief Executive. Whether or not the recommendation is acted upon needs to be monitored and a further cycle of risk management carried out.

**Outcome—** A good hazard identification and risk management system will provide a mechanism to highlight the hazards associated with the operation, and will provide information which will enable strategies to be developed to prevent harm or damage resulting from the hazards.
5. Ongoing hazard reporting system

Staff must be able to report hazards or safety concerns as they become aware of them. Like the hazard identification system, the ongoing hazard reporting system should be non-punitive, confidential, simple, direct and convenient.

Once hazards are reported they must be acknowledged and investigated. Recommendations and actions must also follow to address the safety issues.

There are many such systems in use. The reporting form for the BASI Confidential Aviation Incident Reporting (CAIR) system could be adapted for this purpose.

Ensuring a confidential and non-punitive 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.

This hazard reporting system should not be used to report incidents and accidents that are required to be reported to BASI.

What hazards should staff report?

Any hazard which has the potential to cause damage or injury.

**eg.**
- High workload during passenger boarding
- Poor communication between operational areas
- Flight crew rushing flight checks/ inadequate checklists
- Poor communication from Air Traffic Services
- Flight crew stress
- Failure to follow standard procedures
- Information overload from NOTAMs
- In-flight turbulence
- Unsafe ground traffic movements
- Failure of passengers to listen to and follow instructions
- Lack of LAME retraining
- Poor communication within the maintenance department/contractor
- Time pressure
- Poor work continuity
- Lack of up-to-date maintenance manuals
- Poor cross-checking
- Lack of emergency equipment, procedures and training

All staff should know what hazards you require them to report.
How will staff report hazards?

You 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.

Small GA operator

In a small organisation 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.

eg. ■ Pilot’s report
     ■ Hazard/safety report form.

Medium-large GA operator/Airline

The reporting system should maintain confidentiality between the person reporting the hazard and the Safety Officer or Manager. Any safety information distributed widely as a result of a hazard report must be de-identified.

Your system should include procedures such as:

eg. ■ All safety reports go to the Safety Officer
     ■ The Safety Officer is responsible for investigation of the report and for maintenance of the confidentiality of reports
     ■ While maintaining confidentiality, the Safety Officer must be able to follow-up on a report to clarify the details and the nature of the problem
     ■ Anyone submitting a safety report must receive acknowledgment and feedback
     ■ After investigation, the de-identified safety report and recommendations should be made widely available for the benefit of all staff
     ■ Guarantee confidentiality by destroying the original report. This will help maintain staff confidence in the system.

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

eg. ■ The person responsible for managing your safety program
     ■ The safety action group (if applicable).

Outcome—Staff have a mechanism to report hazards, and those reports are acted upon.
6. Establishing and maintaining a positive safety culture

An organisation’s safety culture can be defined as the behaviour and attitudes that the people in the organisation show about safety. It is “how things are done around here”. A safety culture is very slow to mature and difficult to change. It cannot be changed simply by company directives, so instructions like ‘you will operate safely’ will not, of themselves, change the safety culture.

Some key aspects of safety culture are:

Does management practice what it preaches?

The values and expectations of management—created and communicated over time—most strongly affect the safety culture. Actions speak louder than words.

Do you allocate sufficient resources?

Safety measures need not be expensive, but they do require the allocation of sufficient resources—even if it is only in employees’ time. There are also likely to be costs in record keeping and safety related literature. The extent to which you are prepared to allocate appropriate resources to establish and maintain a safety program will have a direct impact on its effectiveness and, ultimately, on your company’s safety culture.

Do you give staff access to safety information and training?

The safety health of an organisation is enhanced by the availability and distribution of safety-related literature, magazines, periodicals, textbooks, posters and memos, as well as the provision of safety courses, seminars and crew resource management training.

Are suggestions acknowledged and decisions communicated?

The transparency of the work of the Safety Officer and the safety group is a vital factor in establishing a good safety culture. Safety suggestions and initiatives arising from any level within the company should be acknowledged. Any decision made in relation to them, even if the decision is to do nothing, should be widely communicated and explained. Feedback must be clear, timely and relevant.

Outcome—Safer practices are adopted as a normal way of doing business. Staff support the safety program.

7. Safety induction and recurrent training

New employees of an organisation should be trained in the operation of its safety program and encouraged to adopt the safety practices and philosophy of the company.

Regardless of the regulatory requirements imposed on some classes of operations for specific training and checks, ongoing technical training in the employee’s own
discipline should be accorded a high priority. The commitment to provide both relevant induction training and ongoing refresher training and checking to all staff is an essential element of any safety program.

**Small GA operator**

Small operators need to outline the safety program to all new staff. You should let new staff know what is required of them and how the safety program functions. If any changes are made to the safety program, then all staff must be informed.

*eg.*

- Personal briefings
- Memos.

**Medium-large GA operator/ Airline**

*eg.*

- The Safety Officer/Manager develops a training course on the safety program for all new staff. This could be part of existing induction programs or given separately by the Safety Officer/Manager or other safety specialists. Records of participation must be maintained.

**Outcome**—All staff understand how the safety program operates, and are aware of what part they are expected to play.

### 8. Safety audit/assessment

Internal safety audits/assessments should be carried out as part of your safety program. These assessments check that correct procedures are being followed, and resolve any problems.

Any safety assessment should also include the activities of contracting agencies employed by the operator where these might affect the safety of your operation (eg. maintenance organisations, persons accepting cargo on behalf of the operator, aerodrome operators).

**Who carries out an audit/assessment?**

*eg.*

- Safety Officer
- Representative of the safety action group
- An external safety consultant.

**How should the audit/assessment be done?**

*eg.*

- Annual assessment plan for all functional areas
- Checklists are used
- Reports are sent to appropriate line managers and the Chief Executive.
- There is a check on follow-up action.

**Small GA operator**

Obviously, the small operator doesn't need a quality or inspection department to plan and conduct regular internal audits. You do, however, need to constantly
know what is going on in your operation. Are your staff following procedures, particularly when you are not around? If not, why not?

**Medium-large GA operator/airline**

- The Safety Officer/Manager is responsible for planning and conducting regular safety audits/assessments
- The quality/inspection department is responsible for planning and conducting audits
- Each functional area will receive a safety audit/assessment at least annually.

**Outcome—A system exists to check and report on whether company activities are being performed as required.**

9. Accident and incident reporting and investigation

Legislation already requires incidents and accidents to be reported to BASI. While BASI and CASA conduct accident and incident investigations, it is clearly in the interests of the operator to do so as well. Fortunately accidents occur infrequently; however, incidents are much more common. Any incident reported should be investigated by a responsible and technically competent person from within the company, and a report furnished to the Safety Officer and the Chief Executive. Incidents not formally investigated by BASI or CASA should get special attention.

**Outcome—Your company learns from investigating incidents and is able to remove hazards or strengthen defences as required.**

10. Safety program review and evaluation

It is likely that a new safety program will begin with enthusiasm. However, once the initial interest has worn off, the program may begin to wind down.

It is the joint responsibility of the Chief Executive and the Safety Officer—if you have one—to ensure that this doesn’t happen. The Chief Executive, in particular, needs to ensure that the program has both the status and the resources required for it to continue. The Chief Executive and the Safety Officer should also take steps to ensure that the work of the program is properly evaluated at regular intervals.

As part of any evaluation you should provide some kind of opportunity for staff to request changes to the safety program.

This Guide includes a checklist (see insert, back cover) for implementing and evaluating a safety program. You may also wish to consult the 1998 BASI report, An evaluation of the BASI INDICATE safety program (see references).

**Outcome—Regular review of the safety program will ensure that the program remains effective and relevant to your operation.**
11. Emergency response plan

Fortunately, the aviation accident rate in Australia is low. Unfortunately, one result of this is that very few organisations are prepared for an accident should one occur. Whether a company survives can depend on how it handles the first few hours and days following an accident.

An emergency response plan outlines in writing what should be done after an accident occurs, and who is responsible for each action. When the plan is first released, relevant staff should be briefed about the plan. Appropriate staff should receive training in emergency response procedures.

The plan should be readily available and a copy of it should be next to the work station of the person who answers the company's telephone, as this person is most likely to be the first notified of the event.

The plan should:
- Be relevant and useful for the people who are likely to be on duty at the time of an accident
- Include checklists and quick reference contact details of relevant personnel
- Be updated when contact details change.

Who should be notified?
Specify who in the company will be notified of an accident, and who will make external notifications. Consider the notification needs of:

eg.  
- Search and rescue authorities, ambulance, police, as appropriate
- The Bureau of Air Safety Investigation and the nearest district office of the Civil Aviation Safety Authority
- The Chief Pilot, chief maintenance engineer and management team
- Relatives of victims—a sensitive issue that may better be handled by police
- Legal and accounting advisers
- Insurance company
- All company staff.

Who will take charge in an emergency?
One person should be responsible. This could be:

eg.  
- Operational manager
- Chief Pilot.

Who will talk to the media?

eg.  
- Chief Executive, manager or owner
- Public relations manager, for large organisations.
How will the events be logged?

**eg.**
- Secure all records relevant to the aircraft, the flight crew and the mission.
- Someone must be responsible for interviewing those associated with the event in order to record an account of the events.
- Consider the need for photographic recording.

Who will represent the company at the accident site?

**eg.**
- For smaller operations, the owner or operational manager.
- For larger organisations, a senior manager should be nominated.

What assistance should be provided for staff involved in an accident?

**eg.**
- Post-accident medical support.
- Psychological counselling.

**Outcome—** Your staff will know what to do in the event of an accident.

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### 12. Documentation

The safety program should be formally documented in appropriate policy and procedures manuals. You should include:

- A policy statement by the Chief Executive
- The reporting chain and responsibilities of the Safety Officer
- The reporting chain and responsibilities of the safety action group, if you have one
- The company’s hazard identification and risk management system
- Any other activities of the program.

**A record should be kept of:**

- All activities involving the identification and assessment of hazards and their defences, including accidents and incidents.
- Any reports issued or received.
- Any safety recommendations.
- Management action.

The recording procedures need to be tailored to the needs of the company.

One method, using a computer database, is set out in BASI’s INDICATE program, which is described in Section 4 of this Guide.
Small GA operators

Smaller operators may find it more appropriate to document the safety program within an existing manual, such as the operations manual.

Medium-large GA operators/Airlines

Larger operators may find it better to document their safety program as a dedicated manual or document.

Outcome—Safety policy, responsibilities and procedures of your safety program are comprehensively documented.
Why bother?

Safety makes economic sense

Few organisations can survive the economic consequences of a major accident. Hence, there is a strong economic case for safety.

Safety programs require energy and persistence, but not a large budget.

There are three types of costs associated with an accident or incident: direct, indirect and industry/social costs.

Direct costs

These are the obvious on-the-spot costs which are easily measured. They mostly relate to physical damage, and include rectifying, replacing or compensating for injuries, aircraft equipment and property damage.

Indirect costs

Indirect costs are usually much higher than the direct costs resulting from an accident, but are sometimes not as obvious and are often delayed. Even a minor accident will incur a range of indirect costs:

eg. Loss of business and damage to the reputation of the organisation. Many large organisations will not charter an aircraft from an operator with a questionable safety record.

Legal action and damages claims. While it is possible to take out insurance for public liability, it is virtually impossible to cover the cost of lost time taken up handling legal action and damages claims. You must take action to protect your interests, and to do so will cost you time as well as money.

Surplus spares, tools and training. If you have a spares inventory and people specially trained for a one-of-a-kind aircraft which is involved in a serious accident, the spares and training become surplus overnight. In many cases, this is a substantial cost, particularly because the sale value of the spares is often below the original purchase cost.

Increased insurance premiums. An accident will push you into a higher risk category for insurance purposes, and therefore could result in increased premiums. By the same token, the implementation of a safety program could help you to negotiate a lower premium.

Loss of staff productivity. If people are injured in an accident, and are unable to work, under Australian law they must be paid. Also, they will need to be replaced in the short term - again a substantial cost in terms of wages (and possibly training) as well as management time.

Aircraft recovery and clean-up. This is usually an uninsured cost and has to be met by the operator.
Wheels-up landing

Consider the situation of a five-seat, twin-engine aircraft like the Cessna 310 involved in a minor accident.

Let's assume that the aircraft's value is $190,000 and it is insured for charter category. Again, let us assume that the aircraft is doing 500-600 hours per year. At a charter rate of, say, $350 per hour, the organisation may make about $60 per hour if it is very well organised. For, say, 550 hours per year, the annual profit might be around $33,000.

With just a minor accident, such as a wheels-up landing, the annual profit could be wiped out completely. Consider some of the uninsured costs resulting from an actual wheels-up accident which resulted in two damaged propellers and minor damage to the underside of the aeroplane. These costs are set out in the accompanying table.

Looking at each of these items:

- **Item 1** is the excess which must be paid in the case of any claim—the actual amount will depend, of course, on your negotiated insurance agreement.
- **Item 2** is the difference between what the insurance company is prepared to pay and the repair job you are prepared to settle for—usually insurance companies will take the cheapest quote, and you may not wish to settle for what could be an inferior job.
- **Item 3** is the loss of profit based on having the aircraft out of the air for eight weeks for repairs.
- **Item 4** is the loss of no-claim bonus which will occur if there is any claim on the insurance.
- **Item 5** is the time which otherwise would be charged out for company employees.
- **Items 6 and 7** result from inconveniencing passengers—to maintain continuity of business, it is important to complete the charter and ensure that clients are happy in the meantime.
- **Item 8** takes into account that whenever an aircraft has an accident, its value is decreased because it has an accident history.
- **Item 9** is the estimated cost of cleaning up the accident site.

Not included in this calculation is the fact that, in many instances, an insurance company will only pay the cost of propellers on a pro-rata basis; that is, they will only pay the cost of the remaining life in the propeller blades. For example, if the propeller blades have a 2,000 hour life and the accident occurs 1,000 hours into that life, the insurance company may only pay for half the cost of the new blades. That's a cost you may not have budgeted for. The immediate costs for items 1-9 total $47,036. Add to this the pro-rata cost of the propellers of around $10,000 (say mid-life), and the total becomes $57,036—around one-and-a-half year's profit.
Industry/social costs

The Bureau of Transport and Communications Economics (BTCE) has shown the industry/social cost of aviation accidents in Australia in 1993 to be $76 million. Over one-third of this cost is made up of the loss of productive capacity of the victims of aviation accidents. Another 22 per cent is damage to aircraft, and 21 per cent relates to family and community loss.

Who pays?

The insurance company? Maybe. But often the insurance excess is greater than the cost of the damage. In other words, the operator often bears most of the costs.

The excess on an insurance policy for a $2 million commuter aircraft is usually between one and two per cent of the hull value. This could mean that the operator pays the first $20,000-$40,000. Add to this the indirect costs resulting from an event, and an organisation could very easily get into financial difficulties.

That makes the investment of maintaining an effective safety program very good value.
On 10 March 1989, a Fokker F28 1000 initiated take-off from Runway 29 at the small provincial airport of Dryden, Ontario, Canada.

After a longer-than-normal take-off roll, the aircraft rotated, lifted off slightly, and began to shudder before it settled back on the runway. It rotated a second time, then finally lifted off at the 5,700ft point of the 6,000ft runway. The aircraft flew briefly, but failed to gain altitude and mushed in a nose high attitude. A kilometre from the end of the runway the aircraft struck trees and then crashed into the ground, killing 21 passengers and three crew members.

Wet snow and ice on the wings of the aircraft inhibited their lifting capabilities. The aircraft stalled after lifting off, and did not recover.

An inquiry determined that the accident was the result of a combination of failures within the Canadian aviation system.

Organisational failures on the part of the airline and Transport Canada included:

- Inadequate management of change
- Poor communication between management and staff
- Deficient inspection and control
- Poor monitoring and auditing
- Inadequate safety management
- Poor allocation of resources to safety.

Workplace failures included job instability resulting from two regional commuter companies merging, different corporate cultures, high employee turnover and low morale.

Human failures included the decision of the crew not to de-ice or conduct a walk-around and failure of the cabin crew to adequately communicate.

Failures on the part of the operator included:

- Lack of a process to report risks and errors
- Non-standardised manuals and procedures
- Poor guidelines on de-icing procedures
- Inadequate crew co-ordination.

The investigation report acknowledged that the accident was the end result of flaws which had existed undetected in the aviation system for some time. The lesson in this case for operators everywhere is that when systems and management are both deficient at the same time, an accident is waiting to happen.
A marketing edge

It is a fact of life that aviation accidents are newsworthy. Public awareness of aviation safety is high.

The high standards placed on the aviation transportation system for design, manufacture and operation have made flying a comparatively safe form of transport.

If you can demonstrate to your customers that your company is working to enhance safety, then you should get more business, not less.
**Scenario Air** is a country charter operator with a small fleet of light piston twins. Following several difficult years of ad hoc VFR and IFR charter operations, including a seasonal daytime scenic operation into nearby Hopeful Valley, the company recently was awarded a contract with a construction company for a weekly crew change flight between Hopeful Valley and the company's base. The operation involves an early evening flight to Hopeful Valley, arriving shortly after dark in the winter months, with a night return flight to base.

The weather at Hopeful Valley in the Winter months is variable, often characterised by strong gusty winds, broken low cloud and rain showers.

Prior to the commencement of the crew contract the previous Autumn, the Chief Pilot of Scenario Air reviewed the company's procedures for operations at Hopeful Valley and arranged for each of the company's pilots to receive a route training flight. This flight included a practice of the Hopeful Valley NDB approach with a circling approach to land. The daytime training flights were done over a two-day period with scenic passengers who had been offered a 'Hopeful Valley Special' for the purpose.

The operation began, as scheduled, at the beginning of Winter. A month later, after the fourth flight, the Safety Officer met with all the pilots to review the new operation.

### The risk management system at work

1. **Identify the safety hazards.** At the safety meeting, the pilots discussed the operation and identified the circling approach conducted at night at Hopeful Valley as a safety hazard. The training procedures had included a circling approach. However, until the commencement of the crew change contract, the pilots had only experienced the procedure at Hopeful Valley in daylight hours.

2. **Assess the hazards.** The lack of ground lighting, the occasional car headlights shining over a nearby hill line, the variable and often unfavourable weather with low, broken clouds and rain, and the lack of experience at this manoeuvre by night, were all identified as significant factors which increased the risks associated with this procedure. Although the likelihood of an accident resulting from this procedure was remote, the result of such an accident would be catastrophic. Therefore the risk of such a manoeuvre was assessed as 'high'.

3. **Identify the defences.** The Safety Officer decided to review the company's safety defences in relation to this activity. There were several, including the training which the pilots had received, by day, in this manoeuvre and the procedures and limitations promulgated in the company Operations Manual in relation to this manoeuvre.

4. **Assess the defences.** The defences, although significant, were considered to be inadequate because they failed to address the specific perceptual and orientation problems associated with night circling approaches.

5. **Identify the need for hazard avoidance or for further defences.** Following the meeting, the Safety Officer forwarded a number of recommendations to the Managing Director with a copy to the Chief Pilot. These were:
   - All company pilots should receive training in the visual illusions which are common in night flight
   - All company pilots should be given training in circling approaches at night at Hopeful Valley
   - Until the completion of this training, the crew change flights should be rescheduled to daylight hours
   - Recurrent training should be given in circling manoeuvres at night at intervals not exceeding six months
   - The company should ask the aerodrome operator to install a VASI system.

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**CASE STUDY**

Scenario Air
Most safety programs can be adapted to suit different sized operations—from the small GA company to a large airline.

Examples of safety programs

Whatever option you choose, knowing the pros and cons of some of the existing safety programs will give you a better understanding. This Section reviews a variety of programs:

- The **INDICATE Proactive Safety Program**, produced by BASI
- The **Boeing Safety Program Model**
- **Managing Engineering Safety Health (MESH)**, used at British Airways.

Guidance material that is useful for safety program design is also briefly described:

- **Aviation Safety Programs**, management handbook by Richard Wood
- **Accident Prevention Manual**, produced by ICAO
- **Risk Management**, a joint effort by the Australian/New Zealand Standards Association
- **Safety Management**, a policy on safety programs by NAV CANADA
- **Aviation Quality Database**, a safety database produced by Superstructure NZ.

**INDICATE**

BASI’s Identifying Needed Defences In the Civil Aviation Transport Environment (INDICATE) is a proactive safety program that has been developed in consultation with the Australian regional airline industry. It is easily tailored to the varying requirements of different sizes of operation.

The program provides a simple and structured process to encourage staff to report safety hazards and deficiencies within their work area. Also, senior management regularly meet with safety staff to determine what to do about identified hazards.

The program is designed to minimise communication difficulties between staff and management and provides a practical framework to regularly distribute consistent and high quality safety feedback to all staff. This is achieved by utilising any number of the following six safety activities:

- Appointment of an operational Safety Manager or Safety Officer who is available to staff as a confidante for safety related issues
- A regular series of staff meetings to identify safety hazards within the operation
- A confidential safety hazard reporting system
- Monthly safety meetings with management
- A safety information database
- Safety information regularly distributed to all staff.

The safety information database and software allows management to address all safety related concerns. A response must be provided in order for the item to be
On 16 September 1995, a Fairchild Metro III aircraft crashed during a night training exercise. Shortly after the aircraft became airborne, the left engine power lever was retarded to ‘flight idle’. This action simulated failure of the left engine immediately after lift-off, which was part of the exercise. The aircraft failed to climb, struck the crown of a tree, and then hit the ground. It caught fire and the co-pilot and trainee on board were killed, while the training and check pilot was seriously injured.

The main problems were:

- An inadequate Metro III endorsement training syllabus in the company Operations Manual
- Inadequate assessments of the risks involved in night engine failure simulation methods
- Assigning the training and check pilot a task for which he did not have adequate experience, knowledge or skills.

The investigation also found that there was a wide variation in procedures used by other operators of Metros (and other aircraft with similar airframe/engine combinations), and a lack of industry understanding of the effects of engine flight idle on aircraft control and performance.

The accident may have been prevented if the operator had a safety program in place. A good safety program would most likely have identified safety hazards within the training and checking system.
cleared from the agenda. However, this does not mean that every item can be rectified—there are monetary and practical issues to consider.

A comprehensive trial of the program within Kendell Airlines shows that the INDICATE program can have a positive influence on airline safety performance. INDICATE can improve:

- Staff confidence in how safety is managed
- Staff willingness to report safety hazards and incidents
- Safety communication between departments and between management and staff
- Communication between the operator and safety authorities.

**How does the program work?**

- Within the company there is a Co-ordinator or Safety Officer who is responsible for running the program. Depending on the size of the operation, this function may be part of someone’s existing duties, or be the responsibility of a dedicated position.

- Approximately every month a safety meeting is conducted with the managers from each section (technical crew, cabin crew, maintenance crew, ground crew, operations and union/association groups). At these meetings safety issues raised by staff or management, at any level, are discussed.

INDICATE provides a computer program to assist the company in detailing all reported concerns. The software program:

- Records the nature of each safety hazard
- Records any action (or lack of action) taken on each hazard
- Maintains the confidentiality of the reporter
- Generates a recommendation for either:
  - A departmental manager
  - Senior management
  - Appropriate aviation authorities.

Where the information on the hazard is sent depends on the nature of the hazard and who is best equipped to assist in rectifying an identified problem.

The INDICATE program has been successfully adopted by a number of Australian low capacity passenger carrying operators of varying size as well as some international airlines. It is also suitable for smaller operators.

This program is readily available from your local BASI field office or by contacting BASI, PO Box 967, Civic Square, ACT 2608. Phone 02 6257 4150.
The Boeing Safety Program is a comprehensive program designed to introduce both the reasons for having effective safety programs, and the tools for running them.

The Boeing program is approached from an organisational standpoint, covering management’s involvement and support for the program through the development of integrated mission and policy statements. The model describes different ways the safety function can be linked within an operation.

The safety process begins with some of the traditional safety program elements. These are:
- Information gathering
- Investigation
- Evaluation
- Change.

The rest of the process outlines how information gathered from the safety program is managed. Discussion includes:
- Investigative techniques
- Depth of inquiry of investigation
- Error types
- Corrective action
- Philosophies.

The program also includes two separate sections on the products of a safety program and resources available to the Safety Officer/Manager. Products include such things as newsletters, bulletins and other forms of communication within the organisation. The section on resources identifies some organisations that are dedicated to safety, various training institutions that offer safety related training and a basic bibliography.

The program is presented by Boeing as a two-day training course and is useful for ramp, maintenance and flight operations.

The Boeing manual provides many useful checklists. It also gives anecdotal coverage of incidents to show how pre-emptive actions could have prevented the occurrences. However it was developed for larger airline operations and much of it would probably be superfluous to the smaller passenger carrying operator. It is still worth reading for the valuable information it contains.

The Boeing Program manual can be borrowed from the Aviation Information Centre, Airservices Australia, GPO Box 367, Canberra ACT 2601. Phone 1300 300 719.
Managing Engineering Safety Health (MESH) is a proactive safety program that was developed by Professor James Reason. The program, or one of its derivatives, is in use in several industries around the world. For example, Shell International use a similar method in their tanker and exploration operations in the form of Tripod-DELTA. Likewise, British Rail currently employ a proactive instrument called REVIEW, which has also been used at West Australian Railways.

Designed to assess the safety health of an organisation, MESH is a system of measuring a number of local and organisational factors and the interplay between them. The program identifies three basic groups into which accident producing factors fall. These are:

- Human fallibility (at the organisational and workplace levels)
- Technical and procedural shortcomings
- Local hazards.

MESH samples a range of selected ‘ingredient factors’ in each area. The sampling is carried out by randomly selecting assessors from each work area and having them grade, from one to five, the ingredients nominated. The results are then projected graphically on an x and y axis, with the x axis being the factors and the y axis being the extent of the problem. The factors identified as most in need of remedial action are then acted upon, and tracked to assess the effects of resultant changes.

Like INDICATE, MESH also has a computer program into which all the gathered information and sample results are fed and then tracked.

The advantages of the system are that it helps to:

- Involve the staff in safety
- Direct safety resources where they are most needed
- Encourage better communications between management and staff.

MESH employs a systems approach to safety management and is readily adapted to a range of industries and disciplines.

MESH has never been applied by low capacity aircraft operators, and would be beyond the resources of most smaller operators. In addition, MESH has not been expanded outside the engineering function within British Airways, and has not achieved the significant improvements in safety performance that were originally expected. To date, the program has not been widely adopted by other airlines, although one recent exception is Singapore Airlines. Due to its limited success, a number of improvements and modifications are currently being made. Time will tell whether a new version of MESH can achieve better results. Some elements of the current system are, however, very useful.

For more information about MESH contact the Aviation Information Centre, Airservices Australia, GPO Box 367, Canberra ACT 2601. Phone 1300 300 719. The Centre can also provide copies of: Reason, J (1994) Comprehensive error management in aircraft engineering and Maurino, DE et al (1995) Beyond Aviation Human Factors.
Aviation Safety Programs: A Management Handbook, by Richard H. Wood. ‘Dick’ Wood has 25 years experience in the aviation industry as a professional pilot, manager of aviation safety programs, investigator of aircraft accidents and lecturer in those subjects at university and aviation safety seminars around the world. He is a former Chief of Safety for the US Air Force.

The introduction puts into perspective some of the reasons for having an aviation safety program.

The book proposes a safety system for companies to follow, gives examples of safety audit checklists, and provides advice on how to initiate and manage a safety program, including:

- Establishment of high standards
- Implementation of the standards
- Identifying hazards
- Resolving hazards
- Making the program work
- Measuring safety.

All the elements of a ‘safety management program’ are identified and explained in simple terms that may be used as a guide and adapted to any size of organisation. This handbook would not be out of place on any aviation company book shelf.

The book may be purchased, or accessed at libraries.


The International Civil Aviation Organization’s (ICAO) Accident Prevention Manual is aimed at aviation authorities of member States. Its purpose is to provide guidance material for aviation authorities in setting up strategies for accident prevention. It gives background material, and outlines roles and responsibilities, accident prevention concepts (‘safety theory’) and strategies.

One such strategy is for aviation organisations to adopt their own accident prevention program or safety program. Methods for doing this are discussed.

The Manual is well set out, has a good paragraph numbering system, is very ‘readable’ and is illustrated with some amusing cartoons and quips which lighten the delivery. It examines a number of issues about the collection, evaluation and dissemination of safety information and presents a strong case for having a safety program within an organisation. The document also gives some advice on who should drive the program and how safety programs can be implemented. Several useful checklists (eg. attributes of risk assessment, matters to be examined in safety audits, etc.) are also outlined. Although written in 1984, the Manual identifies many of the elements of a safety program that are applicable today.

The ICAO Accident Prevention Manual may be accessed from the Aviation Information Centre, Airservices Australia, GPO Box 367, Canberra ACT 2601. Phone 1300 300 719.
The Risk Management Standard, published jointly by Standards Australia and Standards New Zealand, is a very useful document when determining how to go about structuring a safety program.

Many of the elements of a program are identifiable with the business practice of ‘risk management’ to ensure efficient economic outcomes. By utilising these elements in a safety program, operators are well on the way to ensuring safety outcomes.

Common elements are:
- The importance of management involvement
- Establishing clear policy and procedures
- Identifying risks
- Analysing risks
- Assessing risks
- Treating the risks
- Monitoring and review
- Documenting the process.

All the above processes and methods are well defined and easy to understand.

The Risk Management Standard (AS/NZS 4360) may be purchased from Standards Australia. Phone 1300 654 646.

Nav Canada, Canada’s air navigation service provider, have produced a safety management program to proactively identify hazards and develop risk management strategies to satisfy the requirements of the Canadian Aviation Regulations. Although the system is only relatively new in development, Nav Canada has made a serious senior management commitment to safety management by adopting a strategy which reflects extensive research into different safety programs and risk management ideas that have emerged from various industries internationally. Nav Canada have gone beyond the regulatory requirements and have prepared a safety manual featuring six essential components:
- A detailed company safety policy
- The integration of risk management principles, procedures and techniques into company operations
- Giving ownership of the safety management system to management and staff, and making them responsible and accountable for risk management
- The systematic planning and reporting of risk management activities
- The ongoing assessment and evaluation of the effectiveness of the planned risk management
- The measurement of risk management activities.

In this program Nav Canada have chosen to have the oversight performed by a separate group close to the Chief Executive, while the day-to-day risk management system is run by the department managers.

The program, while aviation related, is not designed for aircraft operators.
In May 1996 VH-JSI suffered significant damage due to a 10kg bird and rabbit strike (the large bird was carrying the rabbit at the time) while on descent to Broome with three crew and 14 passengers on board. There were no injuries, however the aircraft required repairs.

Following completion of the repairs, the aircraft underwent a test flight. Problems were experienced with the nose undercarriage during the test flight, which resulted in the aircraft landing with the nose gear retracted. The aircraft sustained considerable damage.

The investigation found that the nose gear was jammed up due to insufficient clearance between the boltheads securing a cover plate on the nose leg and the upper drag strut. During the process of carrying out repairs to the bird strike damage, the nose leg was removed from VH-JSI to rectify a fault in another aircraft.

Later the engineers fitting another nose leg to VH-JSI noticed that a cover plate, which protected micro-switches, was missing. Even though retraction tests were successfully carried out without it, a new plate was sought. However, there were none available at the time, so a substitute was made without prior approval. It was fitted using spacers and hex head bolts. A further retraction check on the ground was not thought to be necessary because the part was considered to be 'a non-structural cover plate'.

It was revealed after the accident that the bolt heads protruded 8.5mm beyond the normal position of the original countersunk screw heads, which only had 5.0mm clearance. This 3.5mm protrusion was enough to cause jamming of the nose gear in the 'up' position, although it allowed the nose gear to retract after take-off.

The investigation found three main organisational failures:

- Inadequate repair project management
- Stress and fatigue of engineers
- Misplaced loyalty and motivation of the engineers.

Several manufacturer and company staff were involved in the repair project, but nobody on site was given formal project management authority.

The company management had set a deadline for completion of the repair, which resulted in the engineers working unusually long shifts (often 15 and up to 28.5 hours at a time) to try to meet the schedule and carry out their normal maintenance tasks.

The engineers did not have enough time to design the substitute cover plate, despite a company requirement to do so. The loyalty and motivation of staff trying to meet deadlines were commendable, however this ‘get the job done’ culture led to incorrect practices that contributed to the accident. The final defence procedure, a retraction check of the completely assembled undercarriage system, was not followed.

The operator has since taken action to rectify system deficiencies.

Clearly, safety programs are equally important and economically beneficial for ‘maintenance providers’ as they are for the operations environment.
However it does demonstrate the principles that are common to other programs already mentioned, such as the importance of:

- Management commitment
- Clear risk management policy and procedures
- Ongoing oversight of the program.

It is too early to determine the effectiveness of this program, which has yet to fully evolve. However, the Canadians are confident of its success.

Information about the Nav Canada safety program may be obtained through the internet: www.navcanada.ca

**AQD**

**Aviation Quality Database (AQD)** was developed in New Zealand for the aviation industry, utilising the research and quality management experience of the New Zealand Civil Aviation Authority (CAA). It is not strictly a self-sufficient safety program, but it is a useful tool for implementing and managing comprehensive quality and safety systems.

The database allows New Zealand aviation operators to be compatible with New Zealand CAA computer data, and assists in compliance with regulatory reporting requirements. It has been comprehensively tested and successfully adopted by aviation operators outside the New Zealand system.

AQD can be used in applications ranging from a single-user database to include operations with corporate databases over wide-area networks.

The system features:

- The recording and analysis of occurrences such as incidents, accidents and events
- The recording and tracking of quality deficiencies or improvements
- A codified interpretation of the James Reason human factors model for determining causal factors, as developed by the New Zealand CAA
- The basic elements of a quality system, including the tools to create an internal audit program
- The ability to track corrective and preventative actions, and to analyse trends in quality indicators.

In summary, AQD provides tools for data gathering, analysis and planning for effective risk management. It enables presentation of the results as raw data or graphics.

Information about the Aviation Quality Database (AQD) can be obtained from the New Zealand CAA. Phone 0011 64 4 5609400.
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