In October last year, and again in April this year, Air New Zealand has hosted an "Aviation Safety Management Systems" training course. Conducted by the University of Southern California as part of their Aviation Safety and Security Certificate Program, the course was developed to provide the essential skills required to manage a modern organisational safety system. Both the Air Nelson Flight Operations Quality Manager and Head of Safety Programmes were invited to attend.

The Safety Management System is currently being promoted and adopted around the world. This article should help to explain the concepts behind the Safety Management System. From the 'reactive' safety philosophy of old, to the current 'proactive,' and ultimately 'predictive' methods of the future.

Managing Safety – what does it mean?
On the surface this might seem like a flippant question. We all know what safety is – it's when we don't have bad safety outcomes. Bad safety outcomes are accidents and incidents, so if we are to achieve a safe operation we stop all accidents and incidents! RIGHT?

Wrong.
The sad fact is that absolute safety – that is, no accidents or incidents – will most likely never be achieved. But we can strive to reduce them. Despite the incredible improvements in technology and systems reliability, the hardware in our industry still occasionally breaks down. In some cases this is the cause of an accident or incident.

But by far the biggest problem (present in well over 70 per cent of accidents) is the human factor – where despite our best efforts, individuals make errors or engage in deliberate unsafe acts. In managing safety, we must accept that what we are actually doing is carefully identifying risks and putting in place appropriate mitigators to prevent those risks developing into accidents.

Assessments of risks must cover the full spectrum associated with staff, hardware, software and the environment.

So managing safety is really about risk management, which means trying to prevent bad events from happening, or if something does go wrong, or slip through the cracks, trying to minimise the consequences of the event.

Safety Management should not be seen as achieving absolute safety. It's about accepting that things will go wrong and about controlling risks to a level that is acceptable, or to a level that is As Low As Reasonably Practical (ALARP).

Safety management involves judgement, assessing priorities and making decisions which are all elements of management in its more general sense.

Safety Management Systems (SMS) have now been incorporated by ICAO into its recommended guidelines. Most recently SMS has been mandated in the United States by congress and the FAA.

In the 1990's the term "organisational accident" emerged in formal recognition that most of the factors that lead to accidents are under the control of the organization rather than "individuals". Since the greatest threats to aviation safety are embedded within organisations, preventing accidents requires organisational action. Safety Management Systems (SMS) represents a systems approach to safety management in organisations. The need for a systems approach to aviation safety has been recognized for some time.

SMS is a systematic, explicit, and comprehensive approach to reducing threats to aviation safety embedded in organisations. It provides for goal setting, planning, and measuring performance in an organisational context. It integrates operations and technical systems with financial and
human resources. SMS is woven into the fabric of an organisation. It concerns itself with organisational safety. Properly understood and implemented it becomes a part of the organisational culture, the way people do their jobs.

SMS provides an organisation with the ability to anticipate and address safety issues before they lead to an incident or accident. The SMS can reduce losses and improve productivity. A key feature of an SMS is that it holds line managers accountable for safety related action or inaction compared to a traditional approach to safety which relegated responsibility for safety to a staff position.

Surveillance of Safety Management

Despite the significant improvements in modern technology and the high levels of reliability in our industry, aviation safety is a regulated activity because the nature of an aircraft accident normally results in a highly concentrated and visible loss of life. It is the nature of the consequences of an accident, rather than the likelihood of an accident happening in the first place, that drives public demand for governments to put in place regulatory controls.

Part of that surveillance now also looks at how industry management, including the CEO and other key personnel perform the safety management function.

So What is a Safety Management System?

One could argue that the requirement for an operator of an AOC to have in place a 'system' for managing safety is implicit in the requirement to exercise due care and diligence. Whilst it is true that many organisations have indeed implemented such systems for years, it is clear that others need some help.

Internationally, it is now recognised that a structured SMS is an essential feature of an aviation business. In 2005, ICAO published guidance material for implementation of SMS, including the requirement for regulatory oversight.

The SMS is basically a structured process for managing safety, and as already discussed, safety is actually about managing risk. A more detailed definition is:

The SMS is a systematic approach to managing safety risks, including the necessary organisational structures, accountabilities, policies and procedures.

One of the biggest challenges in establishing the SMS is to ensure the key elements of the SMS (and other requirements you want to include) that are listed below are integrated into the routine of the business, rather than being an appendage to the main business.

Key Elements of the SMS

At the highest level, the SMS must include the key elements shown in figure 1.

Most importantly, you should ensure your SMS processes are clearly documented. In most small organisations, this may be included in the operations manual or a specific SMS manual that is part of the operations manual suite.

An adequately structured SMS should provide assurance to you that regulatory compliance issues are adequately addressed.

It is one thing to write procedures into a manual, but entirely another to make sure they happen. Even in the smallest organisation with documented safety management procedures, a CEO should ensure that there is a check that documented procedures are actually followed.

This might include checks that responses to pilot or engineer safety reports are followed up, or that the documented frequency of safety meetings actually occurs. Ideally, these checks can be done by an employed auditor or a contracted auditor; however, they could be done by a specified person in the organisation as long as their duties are clearly defined and documented, and appropriate time away from their primary job is allocated.

Safety Meetings

Any organisation, regardless of size, should have documented into SMS processes the requirement for regular safety meetings. These types of meetings provide the structure and discipline needed to deliver the benefits of the SMS.

Key elements of the SMS include the need to review information and to provide an assurance process that tests safety performance, reviews the effectiveness of all elements of the SMS, and identifies existing and emerging risks. Most importantly, this structured meeting process should provide an opportunity to review all safety-related information available.

1. Safety policy, objectives and planning, to include:
   - Management commitment and responsibility
   - Safety accountabilities of managers
   - Appointment of key personnel
   - SMS implementation plan
   - Documentation
   - Measuring for capturing human error at all levels
   - Emergency response planning

2. Safety risk management, to include:
   - Hazard (risk) identification processes
   - Risk assessment and mitigation processes
   - Incident safety investigations
   - Safety occurrence and risk reporting system

3. Safety assurance and change management, to include:
   - Safety performance monitoring and measurement
   - Audits and surveys
   - Change management processes
   - Continuous improvement processes

4. Safety promotion and training, to include:
   - Training and education
   - Safety communication
   - Operational human error

FIGURE 1: Key elements of an SMS
in the organisation.

Even in very small organisations, a meeting where safety issues can be discussed, decisions made and actions documented is very useful. Large organisations will normally have safety meetings at varying levels and in varying parts of the organisation that feed information to the 'top' safety meeting that normally involves management and safety specialists. However, in small organisations it may be possible to involve all participants at all levels.

Regardless of the size of the organisation, the CEO should chair the 'top' safety meeting.

In large and medium sized organisations, a meeting chaired by the CEO who then holds line managers responsible for safety performance in their areas, is the ideal model. In this situation it would be normal for the CEO to be supported by safety and audit specialists who provide detailed information for assessment.

A less effective model is one where a safety manager chairs a meeting made up of line managers. The least effective model is a process chaired by a safety manager reviewing performance of line areas represented by line safety managers.

**Information is the key**

As the saying goes, 'If you can’t measure it, you can’t manage it'. As with financial systems, production systems and so on, sound safety management requires information – and the more the better.

Traditional safety information has focused on data related to incidents and accidents – in other words, after-the-event. This sort of information is useful, but any safety system that relies totally on after-the-event information is inefficient and purely reactive.

What you must have is some form of proactive – and in an ideal organisation, a predictive – information system that assesses potential risks. Remember, safety management is primarily about risk management and that requires 'before the event information'.

This could be as complex as monitoring technical staff in what we now call 'threat and error management' processes, or as simple as getting the views of management, supervisors and staff in a structured manner to determine what they think are potential risks. The latter method can be very useful in medium or small organisations that may not have access to complex data capture systems, but can tap into the views of operational staff.

**After-the-event or reactive information relates mainly to review of accident and incident data. Many safety systems have relied exclusively on analysis of this type of data assuming what has gone wrong in the past will tell you what's going to go wrong in future. There are clearly limitations in relying solely on this information.**

**Proactive information tells you more about the 'close calls', or concerns of individuals about issues that could lead to an accident or incident. This type of data is best collected through reporting systems that encourage reporting and provide, where necessary, confidentiality to the reporter.**

When establishing these types of reporting systems, you need to remember that staff will expect to see something done about reported concerns, or to receive feedback. Without action or feedback, staff will lose confidence in reporting systems.

**Predictive information tells you more about what is happening on the front line in real time. Flight operations quality assurance (FOQA) programs, or other electronic data collection systems, are a good example of collecting information and comparing data to selected parameters.**

For example, these systems can tell you how often aircraft are deviating from set parameters required for a stable approach to land. Line oriented safety audits (LOSA) are another example of data collection during normal operations, and can often show you why things go right on occasions rather than only looking at the issues from the other end. These programs can also be applied to maintenance procedures, aircraft loading and even air traffic control. The types of safety information, the levels of effectiveness and the ability to influence safety outcomes is shown in figure 2.

![FIGURE 2: Safety Management Levels](image)

**Getting More Information – The Safety Culture**

Safety culture is about attitudes and behaviours. From a CEO's perspective, the safety culture of your organisation will flow from your approach to the subject. If you are involved, and are seen to place safety as a high profile issue, you're more likely to influence the attitudes and behaviours of your management and staff.

**Attitudes that constantly emphasise the importance of safety must be demonstrated, developed and encouraged. Behaviour that support this approach should be rewarded. Behaviours that undermine this approach should not be tolerated.**
Errors and Violations

In aviation safety terms, human error, at all levels in an organisation, is the main problem facing managers trying to deliver a safe operation. Despite the use of modern hardware, and with shelves full of procedure manuals, in the end you rely on a lot of individuals delivering the right outcome.

To a large extent, your business is about people – and people, in varying degrees, will fail. The only thing we all have in common, is that on the one hand we are all different but we all make mistakes.

Expect people to make mistakes. Expect managers to develop deficient procedures, and expect your technical people to misapply good procedures. If, as CEO, the chief pilot, chief engineer or safety manager walks into your office and declares there are no safety issues, start worrying. Remember that bit of the safety culture earlier that encourages ‘constant unease’.

But what do you do about it? Seek assurance that there are defences for all possibilities. When it comes down to it, the best defence against a possible error made by one human is another human. That’s where all of us being different can help. Someone else to check, monitor, question or test, whether it relates to the development of a procedure, analysis of data at a safety meeting, or during the conduct of maintenance or flight operations.

The more likely a risk developing, or the greater the consequences of a particular risk, the more important is the involvement of another person. Even CEOs and chief pilots can make errors.

Violations are another matter. In many situations, violations can be the proverbial straw that breaks your camel’s back. Whilst it is to be expected for people to make occasional errors, you cannot tolerate violations. Professor James Reason put forward the following ‘formula’:

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\text{VIOLATION} + \text{ERROR} = \text{DISASTER}
\]

James Reason also assessed that there were three types of violation: Routine violations where the individual is corner cutting; optimising violations for ‘kicks’; and necessary violations, to get the job done. However, any violation may result in a bad outcome so cannot be tolerated.

Violations are driven by behaviours, and behaviours can be influenced as long as you know about them. Safety communication and education is important, particularly where the benefits of compliance are emphasised, but reporting systems, particularly a trusted confidential reporting system, can be a powerful defence against bad behaviour.

What’s in it for the Operator?

Although there are clearly legal duty-of-care issues that should compel an operator or CEO to own and drive his or her own SMS, there are practical reasons for this level of involvement.

Not surprisingly, the resources required to initiate rectification procedures after an incident are often greater than that required by proactive safety management practices. Therefore, the focus of the safety management system should not be the perceived additional cost of safety, but improving profitability by limiting the loss of resources.

Safety management should actually be part of the business and should not be seen as a specialist technical ‘add on’. Properly managed, the SMS can improve safety performance, which is good news for staff and customers alike. And good safety performance is good for business.