A review of Safety Management System elements and the identification of organisational factors

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Hans has been a Member of ISASI since 2007.

Disclosure

While I base this presentation on ICAO guidelines to safety management systems, I have included some aspects of the Australian regulations and my experiences obtained during safety management system audits of Australian aviation organisations. Views expressed in this presentation are not necessarily the views of my employer, the Civil Aviation Safety Authority. Regulated Safety Management Systems also vary between the States.

Summary

Accident and incident investigation reports are based on factual information discovered during the course of the investigation. They are logically presented in the investigation report as per the paragraphs provided by the ICAO Annex 13 format. With a typical investigator background in either flying operations or engineering, the focus is often on the technical details contributing to the event. While we have come a long way following the chain of events, I believe that we have plenty more opportunities to identify the organisation's contributing factors.

The organisation's safety management system (SMS) can hold the key for identifying these organisational factors if the right enquiries are made. This requires a good understanding of SMS principles by the investigator.

James Reason identified that *"The history of organisational accidents is rich with examples of management neglecting or postponing the elimination of previously identified defensive weaknesses."*

So what should an investigator look for when investigating organisational factors?

Presentation overview

Accident and incident investigation reports are based on factual information discovered during the course of the investigation and are normally logically presented following the ICAO Annex 13 format. A typical investigator's background is either in flying operations or engineering, which may mean that the focus is on the pilot's actions or mechanical failures resulting in the event. While it is acknowledged that we have come a long way in finding out the causal factors leading up to the event, we may still be in the early days to identify the organisational factors in the report. If we are not confident enough to include these factors, investigation of organisational factors may remain a by-product of the investigation rather than an equal aspect.

The organisation's safety management system (SMS) can hold the key for identifying these factors if the right enquiries are made. This requires a solid understanding of SMS principles by the investigator.

James Reason identified that *"The history of organisational accidents is rich with examples of management neglecting or postponing the elimination of previously identified defensive weaknesses."*

So what should an investigator look for when investigating organisational factors?

In this presentation I will identify the paragraphs in the investigation report which may provide some pieces for the big organisational picture. I will introduce ICAO's definition of a SMS and the various elements that build the SMS. We will then review each SMS element in regards to regulatory and safety expectations, which can provide the investigator with identifiable safety deficiencies in the organisation. As a result, the investigator should be able to identify if an organisational accident occurred to be able to propose meaningful recommendations within the organisational context.

ICAO Annex 13 Investigation report

An investigation report in the ICAO Annex 13 format contains the title and the synopsis, followed by the report body with factual information, finishing with the analysis, a conclusion, safety recommendations and appropriate appendices.

The factual information section of the report includes amongst others, the **History of the flight, Injuries to persons, Damage to aircraft, Other damage, Personnel information of the** flight crew members, A**ircraft information, Meteorological information, Aids to navigation, Communications, Aerodrome information, Flight recorders, Wreckage and impact information, Medical and pathological information, Fire, Survival aspects, Tests and research statements,**

Organizational and management information, Additional information and **Useful or effective investigation techniques.**

The section on **Organizational and management information,** includes: *"Pertinent information concerning the organizations and their management involved in influencing the operation of the aircraft."* and "*The information could include, but not be limited to, organizational structure and functions, resources, economic status, management policies and practices, and regulatory framework."*

Investigations of a larger scale may include information from other organisations like air traffic services, aerodrome operators, weather service agencies or the regulatory authority.

So, where can we find this "*Pertinent information concerning the organization and their management involved in influencing the operation of the aircraft."*?

While the information we are looking for should be evident by reviewing the organisation's SMS, we need to identify particular elements to gain an insight into the organisation's culture and to find out if we in-fact have an organisational accident?

What is an organisational accident?

According to James Reason we are looking for an indication or even evidence of work conditions for which the organisation has a "reasonable degree of control". These are conditions reflected by the safety policy, communication between stakeholders, allocation of resources, supervision of staff, the safety culture etc.

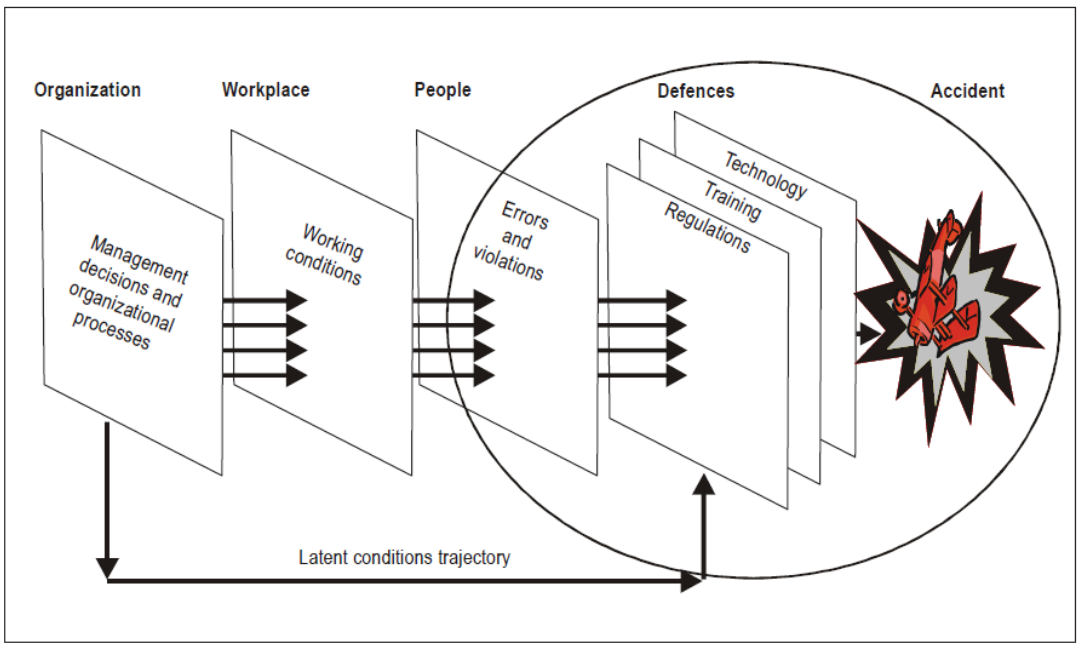
These are also the latent conditions, such as unidentified or identified but untreated deficiencies in equipment, incorrect or unworkable procedures and insufficient resources.

The normalisation of deviance is another important factor, where as a consequence of the lack of resources or impracticable procedures, the only way to achieve the production target is by adopting short-cuts and violations of the rules and procedures.

Workplace conditions such as workforce stability, qualifications and experience, morale, management credibility as well as the standard work environment like lighting, heating and cooling directly influence the efficiency of staff.

We know that deficient workplaces can directly contribute to active failures like errors and violations, when the focus of staff is to finish the task quickly rather than properly.

These are some examples which can lead to an organisational accident.



Source ICAO Document 9859

The Safety Management System (according to ICAO)

Now that we reminded us again what an organisational accident is, we can look for evidence in the organisation. For this, we need to understand what an SMS is and what information we can expect to find.

According to ICAO, an SMS is a system to assure the safe operation through effective management of safety risks. A system designed to continuously improve safety by identifying hazards, collecting and analysing data and by continuously assessing safety risks with the intent to proactively contain or mitigate risks before they result in accidents or incidents.

The requirements of an SMS framework include four components and twelve elements depending on the relevant State Safety Programme. These are:

Safety Policy and Objectives
1.1 Management commitment and responsibility
1.2 Safety accountabilities
1.3 Appointment of key safety personnel
1.4 Coordination of Emergency Response Planning (ERP)
1.5 SMS documentation

Safety Risk Management
2.1 Hazard identification
2.2 Safety risk assessment and mitigation

Safety Assurance
3.1 Safety performance monitoring and measurement
3.2 The management of change
3.3 Continuous improvement of the SMS

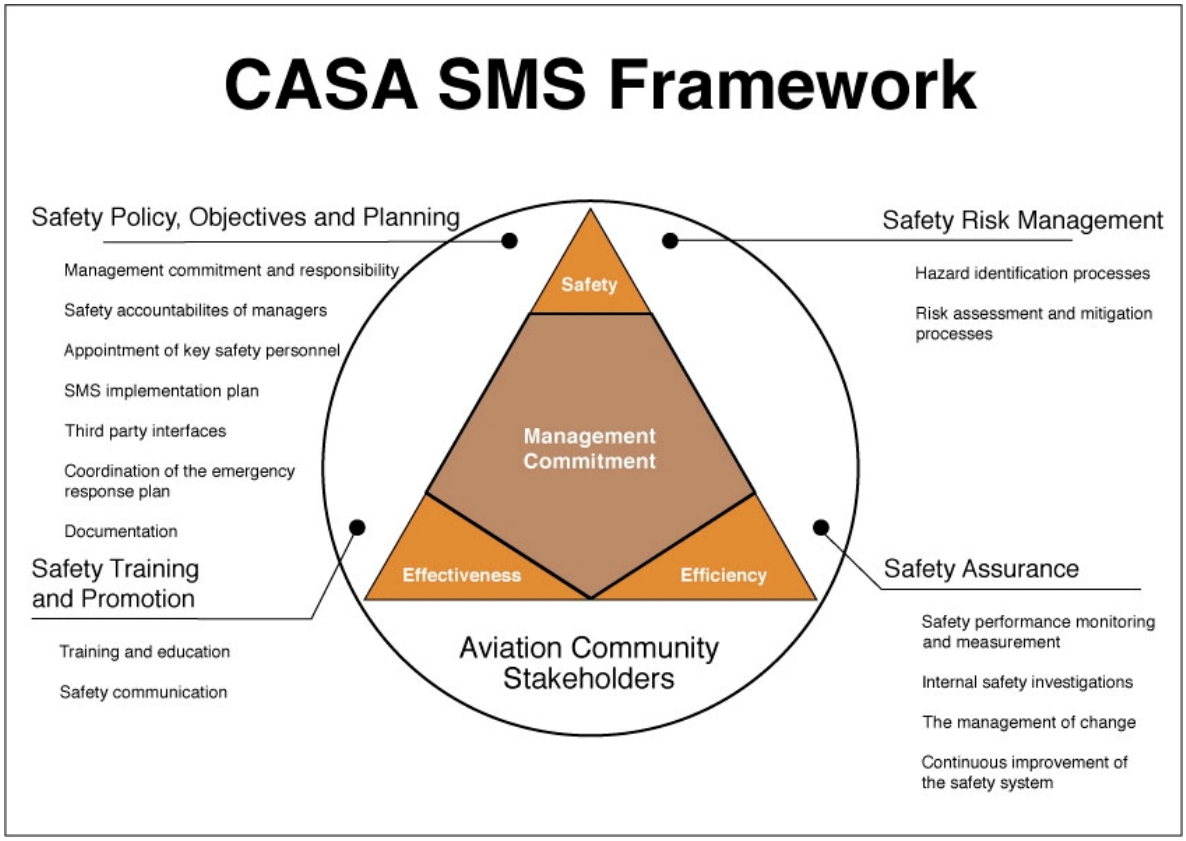
Safety Promotion
4.1 Training and education
4.2 Safety communication.

In brief, Safety Policies and Objectives create the context for the SMS and should reflect the size and complexity of the organisation.

The objective of the Safety Risk Management component is to identify hazards, assess the related risks and develop appropriate mitigations.

Safety Assurance is accomplished through on-going processes that monitor compliance with international standards and national regulations through internal and external audits as well as investigations.

Safety Promotion covers the training requirements and safety awareness initiatives throughout the workforce.



Source. CASA CAAP SMS-1

Safety Culture

So before we talk about the SMS elements, a brief word on an organisation's Safety Culture. We know that a culture is generally characterized by the beliefs, values, biases and the accepted behaviour among members of a society, group or organization.

The effectiveness of SMS elements present in an organisation is a good indication for the organisation's Safety Culture. We know that a mix of cultural elements can negatively influence open hazard reporting, effective root cause analysis and the resultant risk mitigation. While Safety Culture relies on trust and respect between staff and management, it must be created and supported at the senior management level. Continuous improvement in safety performance is only possible when safety becomes a priority for the organization and for each member of the culture.

"A safety culture cannot be effective unless it is embedded within an organization's own culture."
ICAO SMM 3rd edition

So we are looking for an Organisational Culture with a focus on Safety Culture values. Organizational cultures with a clearly defined "Just Culture" set the limits for accepted behaviour and as a result provide the basis for management and employee decision-making.

The Organizational Culture can positively or negatively affect the interactions between management and employees, between the organisation and the regulatory authority, how open information is shared internally and with the regulatory authorities, the quality of teamwork in the organization, how employees react to demanding operational conditions, how new technology is accepted and what punitive measures are taken as a reaction to operational errors.

On the other hand, an Organizational Culture is positively or negatively affected by its policies and procedures, how supervisors behave, what the published safety improvement goals are, the management attitude toward quality or safety issues, how employee are trained and motivated, the relationship to regulatory authorities and product and service providers and existing work life balance policies.

We see that the Organisational Culture affects the employee and that the employee affects the Organisational Culture. The Organisational Culture has an ingrained Safety Culture when personnel consider the impact on safety on every activity they do, report any identified hazard, error or threat and fully support all initiatives intended to manage the risks. Not only is management creating an environment in which personnel are aware of risks, it also provides sufficient resources to manage the risks and actively support the SMS.

FLEXIBLE CULTURE
An organisation can adapt in the face of high tempo operations or certain kinds of danger - often shifting from the conventional hierarchical mode to a flatter mode.

INFORMED CULTURE
Those who manage and operate the system have current knowledge about the human, technical, organisational and environmental factors that determine the safety of the system as a whole.

JUST CULTURE
There is an atmosphere of trust. People are encouraged (even rewarded) for providing essential safety-related information, but they are also clear about where the line must be drawn between acceptable and unacceptable behaviour.

LEARNING CULTURE
An organisation must possess the willingness and the competence to draw the right conclusions from its safety information system and be willing to implement major reforms.

REPORTING CULTURE
An organisational climate in which people are prepared to report their errors and near-misses.

Managing the risks of organisational accidents. Aldershot, UK, Reason, J. (1997), Ashgate.

So as an investigator of an accident or incident, what are you looking for to determine the causal factors in the organisational culture?

There are a number of tools available to formally assess the effectiveness of an SMS. Most of these are designed to assess against regulatory compliance rather than to highlight the deficiency and the possible consequence for the organisation. Some give scores between 1 and 5 for each element and while these are helpful to determine if an SMS is improving or decreasing over time, it does not provide details on the effect to the safety culture.

Here is an attempt to review the status of an organisation's SMS and how it may have contributed to an incident or accident.

Management Commitment and Responsibility

The first component is the “Management Commitment and Responsibility”.

It is expected from an organisation that the Chief Executive Officer (CEO) is committed to the SMS. It is in the CEO’s best interest because the CEO is the accountable executive or manager and like in every important initiative, if it not driven and supported from the top down, it will not succeed.

Being committed to the SMS firstly means that the CEO has developed an organisational structure that is supportive of the SMS. It defines safety responsibilities for managers and shows a clear line of communication from the CEO to the safety manager.

We are looking for a clear, concise and up-to-date statement from the CEO in form of a published Safety Policy which should include the safety objective of the organisation, the commitment to safety in all aspects of the operation and to provide the necessary resources necessary for an effective safety management, clear advise who is responsible for safety in the organisation and a statement to explicitly support the “Just Culture” principle as part of the safety culture.

This policy will provide staff with the confidence that safety concerns are taken seriously. Staff can always refer to the safety policy if conflicting information is provided.

Some organisations have a published Just Culture Policy, which publishes how personal responsibilities are managed in the organisation. It is important to understand that organisation’s interpretation of the term “Just Culture” may be very different to James Reason’s initial idea. The Safety Policy and Just Culture Policy may therefore provide a first impression of how far the organisation has caught up with contemporary safety awareness.

With the Safety Policy in mind, we are looking at how this commitment translates into an effective set up of the organisation. Have sensible Safety Objectives been published and are they achievable in the time frame. Are they SMART (Specific, Measurable, Achievable, Realistic and Timely)? Have they been achieved or is the organisation well on the way to achieving these? This will show how serious management is to the goal of a safety culture and if the goal is not in everybody’s mind, staff will not support it.

The CEO is ultimately accountable for the SMS. While the CEO may employ a Safety Manager who runs the SMS on a day-to-day basis or even establish a safety department, the CEO remains accountable for the SMS. This is not to say that the CEO is solely responsible to the safety of staff, customers and the operation, that is everybody’s job and we come to this later.

It is important that safety responsibilities are clear and come from the top down. Each department manager should be a nominated “Responsible Manager”, meaning that they are nominated to be responsible for the safety in their respective area and actively support and promote the SMS. They are expected to show safety leadership and ensure that their staff comply with all SMS processes and procedures. This responsibility needs to be described in their duty and responsibility statement. Responsible Managers should be nominated in the SMS manual and should at least include the key management positions.

That leaves a closer look at the selected Safety Manager. The appointment of the Safety Manager is a good indication for the organisation’s commitment towards the SMS. A high experienced Safety Manager demonstrates that the organisation is serious about safety. Attaching the Safety Manager duties and responsibilities to another manager shows that the commitment is limited to the resources available or considered necessary.

The lay-out of the safety department structure obviously depends on the size and complexity of the organisation. While the safety responsibilities are pretty much the same, it can be expected that with the size of the organisation, the expectations on the Safety Manager increase. A safety manager in smaller organisations may have other duties, however every safety manager should have the authority to ensure that SMS processes are established, implemented and maintained. The communication link to the CEO is provided to report on the performance of the SMS and to promote safety awareness throughout the organisation.

The safety manager should directly liaise with the Responsible Managers in matters concerning specific safety activities and safety performance outcomes, as these are their safety responsibility. The safety manager should ensure that departmental safety activities focus on a common integration.

Documents to review for this section are:

- Safety Policy
- Safety Management Manual
- Just Culture Policy
- Documented Safety Objectives
- Organisation chart and identified Responsible Managers
- Position description for Safety Manager and Responsible Managers

Questions:
Is the Safety Policy up to date and when was it last revised?
Is the Safety Policy displayed throughout the organisation for staff and customers to see?
Is the Safety Management manual appropriate for the size and complexity of the organisation?
When was the Safety Management manual last reviewed and revised?
Has the Safety Manager appropriate responsibilities and authorities given by the CEO or does everything need prior approval from the CEO?
How much trust and oversight is there from top management?
Has a Deputy Safety Manager been appointed?
Are safety responsibilities described in the position descriptions of Responsible Managers? Does the organisational chart clearly describe the communication link between the CEO and the Safety Manager?

Third Party Interface

The next element for Safety Policy and Objective is the interface between the organisation and third party service providers. These services may be for ground handling, maintenance, training, contracted flight crew, catering, suppliers etc.

The SMS documentation should cover how these services are established and monitored. A contractor assessment process should be in place resulting in a contract or service level agreement which details the relationship, the requirements and the necessary training prior to starting the activities.

Contracted staff should be trained in the organisation's SMS procedures and in Human Factors/Non-technical Skills (HF/NTS) to a level, acceptable by the organisation. The concern is that third party service providers may erode the safety standard of the organisation. For this, the organisation should consider the safety record of the service provider with equal weight to other considerations like the price for the service.

A review of this SMS element will provide an overview of the level of responsibility the organisation takes for third party service providers. It will also indicate a possible erosion of the level of safety standard by contractors.

Documents to review are:

- The service provider section in the SMS manual
- The service provider assessment form (sample)
- A Service Level Agreement with a contractor
- Service provider's HF/NTS training assessment
- Induction documents

Questions:
Are service providers accepted through the proper process?
Who is involved in the acceptance and who has the final word?
How is cost vs. safety records assessed?

What is the periodic review interval for service providers?
How are SMS and HF/NTS training provided to contractors?

Emergency Response Plan

The Emergency Response Plan (ERP) is an integral part of the SMS and is generally designed to ensure an orderly and efficient transition from normal to an emergency situation and back. The plan assigns responsibilities, authorisations and delegations through procedures and checklists.

A review of the ERP will quickly show if the procedures are appropriate for the size and complexity of the organisation.

Safety Investigators are most likely reviewing the ERP after an incident or accident and can observe how effective the process is.

Documents to review:

- ERP Manual or section in the SMS manual
- Checklists and contact details

Questions:
Does the ERP ensure that no additional risk to the remaining operation is introduced?
Are checklists available and clearly describe the required actions?
Are the contact details and numbers up-to-date?
Does the organisation have a chance to be on top of the next accident, when it occurs?
Which ERP procedures did not work at the investigated accident and what is the organisation doing about it?
When was the last ERP exercise? (Desktop and practical)

Safety Risk Management

CASA's CAAP reads: *"The process of risk management involves establishing an appropriate infrastructure and culture and applying a logical and systematic method of establishing the context, identifying, analysing, evaluating, treating, monitoring and communicating risks associated with any activity, function or process in a way that will enable organisations to minimise losses and maximise gains."*

Safety Risk Management is an integral part of an effective SMS and may be based on national standards and norms (eg AS/NZS 31000). The objective of this SMS component is to reduce the identified risk by reducing the probability or the consequence to acceptable levels, and to manage the remaining risk so as to avoid or mitigate any possible undesirable outcome.
To do this, it is important to have a system to identify the level of Likelihood/Probability and Consequence/Severity.

These can be described in a diagram like this:

Risk probability		Risk severity				
		Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
Frequent	5	5A	5B	5C	5D	5E
Occasional	4	4A	4B	4C	4D	4E
Remote	3	3A	3B	3C	3D	3E
Improbable	2	2A	2B	2C	2D	2E
Extremely improbable	1	1A	1B	1C	1D	1E

Source ICAO Document 9859

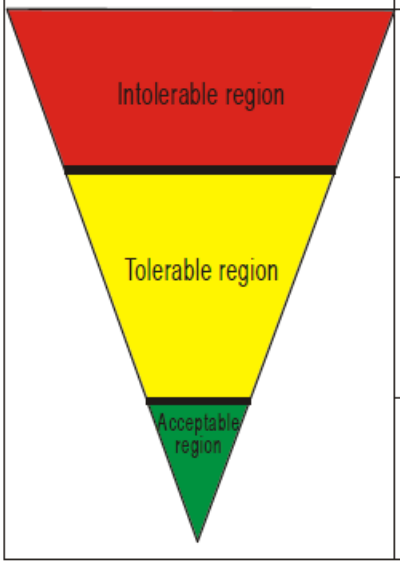
However, the different levels of likelihood and severity must be defined and must be appropriate for the size and complexity of the organisation to ensure consistency and relevance in the approach and outcome.

Likelihood	Meaning	Value
Frequent	Likely to occur many times (has occurred frequently)	5
Occasional	Likely to occur sometimes (has occurred infrequently)	4
Remote	Unlikely to occur, but possible (has occurred rarely)	3
Improbable	Very unlikely to occur (not known to have occurred)	2
Extremely improbable	Almost inconceivable that the event will occur	1

Severity	Meaning	Value
Catastrophic	— Equipment destroyed — Multiple deaths	A
Hazardous	— A large reduction in safety margins, physical distress or a workload such that the operators cannot be relied upon to perform their tasks accurately or completely — Serious injury — Major equipment damage	B
Major	— A significant reduction in safety margins, a reduction in the ability of the operators to cope with adverse operating conditions as a result of increase in workload, or as a result of conditions impairing their efficiency — Serious incident — Injury to persons	C
Minor	— Nuisance — Operating limitations — Use of emergency procedures — Minor incident	D
Negligible	— Little consequences	E

Source ICAO Document 9859

In some organisations the Likelihood and Severity levels are separately defined by categories such as Injury, Asset Management, Safety, Operational, Reputation, Damages, Financial, Environment and Compliance. The highest score of each of these categories is usually addressed first.

Suggested criteria	Assessment risk index	Suggested criteria
	5A, 5B, 5C, 4A, 4B, 3A	Unacceptable under the existing circumstances
	5D, 5E, 4C, 4D 4E, 3B, 3C, 3D 2A, 2B, 2C, 1A	Acceptable based on risk mitigation. It may require management decision.
	3E, 2D, 2E 1B, 1C, 1D, 1E	Acceptable

Source ICAO Document 9859

Risk Index Range	Description	Recommended Action
5A, 5B, 5C, 4A, 4B, 3A	HIGH Risk	Cease or cut back operation promptly if necessary. Perform priority risk mitigation to ensure that additional or enhanced preventive controls are put in place to bring down the risk index to the MODERATE or LOW range.
5D, 5E, 4C, 4D, 4E, 3B, 3C, 3D, 2A, 2B, 2C, 1A	MODERATE Risk	Schedule for performance of safety assessment to bring down the risk index to the LOW range if viable.
3E, 2D, 2E, 1B, 1C, 1D, 1E	LOW Risk	Acceptable as is. No further risk mitigation required.

Source ICAO Document 9859

These diagrams identify the combination of consequence and severity which is either unacceptable, acceptable under circumstances or at an acceptable level. What is the process that explains what has to happen at these different levels of assessment? When is a risk mitigated to a reasonable level and who decides that no further mitigation is required?

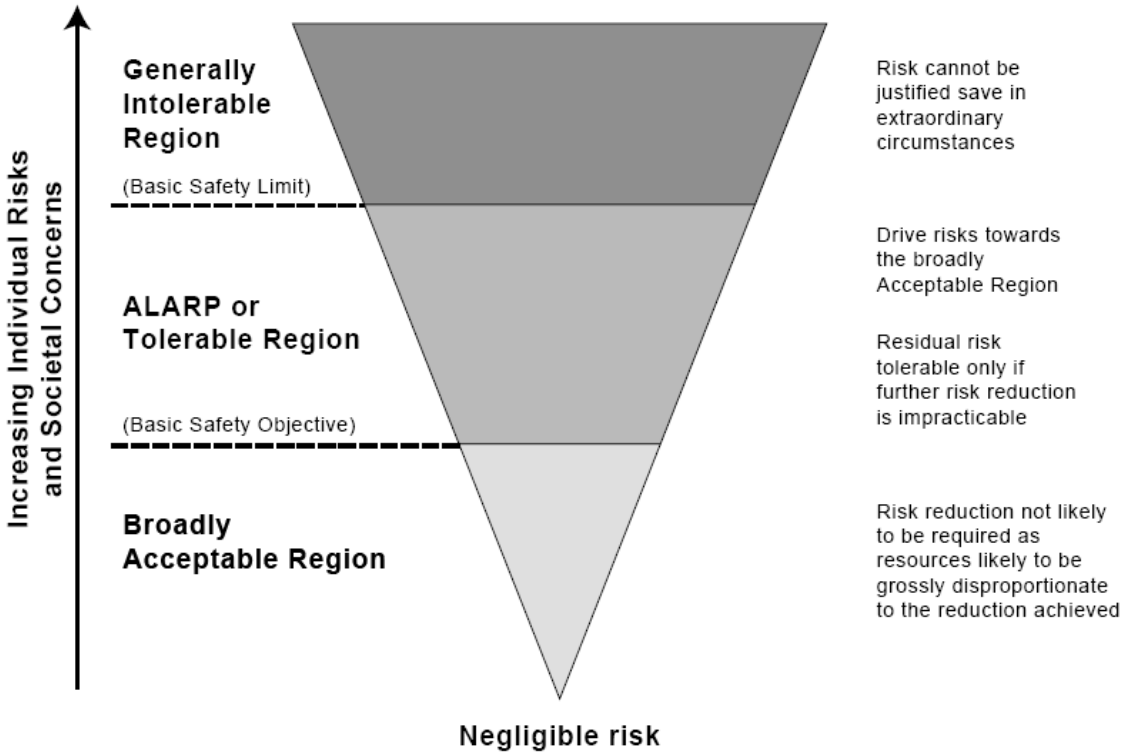
We are looking for a term like “ALARP” (As Low As Reasonable Practicable) or similar in the organsiation’s safety manual, and a procedure to identify what is acceptable and what is not.

The concept of 'ALARP'
The concept of ALARP describes the acceptance that not all risk can or should be eliminated and that there are practicable limits to which organisations can go.

There is an upper level of risk that is intolerable. If a risk is found to be intolerable, risk reduction measures are essential, regardless of cost. Executive management levels should be made aware of this risk and be involved in the risk mitigation process.

The lower level of risk is broadly acceptable. Further risk reduction may be made, but only if the cost is insignificant.

The ALARP or tolerable region lies between the upper and lower levels of risk. Any risk falling within the ALARP range should be assessed and reduced unless the cost of reducing the risk further is grossly disproportionate to the benefit gained. The Accountable Manager must be involved in the process and formally accept the remaining risk.



Source: CASA CAAP SMS-1(0)

Hazard Identification Processes

Because unidentified hazards lay dormant in the system and are excluded from any risk management process, a systematic and comprehensive hazard identification system is important.

There are a number ways operational or organisational hazards can be identified, including:

- Internal reporting system
- Safety investigations (internal or external)
- Safety audits
- Safety data trend analysis
- Feedback from training and exercises
- Flight data analysis programs
- Safety surveys

- Monitoring of normal operations (LOSA, GOSA)
- External information exchange (similar operators, regulators, etc.)

Documents to review:
- Safety data analysis
- Internal audit/investigation reports
- LOSA/GOSA reports
- Assessment of external information
- Training feed-back forms
- Safety survey analysis

Questions:
Which of these methods are used by the organisation to identify new hazards?
What is the reporting method and where does the information go?
Are human factors considered on the reporting form?
Who is responsible for the information and the follow-up?
How are these findings published within the organisation?

Hazard and Occurrence Reporting

All incidents and identified hazards must be seen as opportunities to learn and improve. The organisation can only learn from the incident if the event or the identified hazard are analysed. An effective analysis looks beyond the event and investigates contributing factors, the organisational factors and human factors.

While the SMS includes procedures for an internal reporting system, the aviation legislation requires organisations to report Immediately Reportable Matters (IRM) and Routine Reportable Matters (RRM) to the authority investigating accident and incidents.

This is probably an area that every investigator is familiar with and we all know how important a quality report is to assess the criticality of the event.

The SMS manual must describe a system that is accessible to everyone, user-friendly and encompass the following elements:
- Procedures for reporting occurrences, hazards or safety concerns (including IRM and RRM)
- Methods for the collection, storage and distribution of safety data (hazard register or log)
- Procedures for analysing data, safety reports and any other safety related information
- Documentation of corrective action and risk reduction strategies
- Determination of the effectiveness of corrective action
- Ongoing monitoring and review of mitigated risks

According to ICAO, a "***Reporting Culture*** *emerges from personnels' beliefs and attitudes toward the benefits and potential detriments associated with reporting systems and the ultimate effect on the acceptance or utilization of such systems. It is greatly influenced by the organizational, professional, and national cultures,* ***and is one criterion for judging the effectiveness of a safety system****.* "

Documents to review:
- Hazard reporting procedures in the SMS manual
- Safety data examples
- The quality of data stored in system

Questions:
Is the organisation doing everything it can to promote the reporting system?
Are investigation results discussed and published for all staff?
What gets reported and what gets investigated?
Are human factors considered?
Is confidential reporting possible?
What is done to keep the reporter in the loop?

Are staff part of the solution?
What is staff thinking about the reporting process?

Safety Surveys

The intent of safety surveys is to provide managers and staff with the opportunity to respond to safety related matters and can also be a useful source to identify hazards and other safety concerns. It establishes a benchmark for the level of perceived safety in the organisation and can provide a measurement of perceived safety improvements over time. There are many ways in which safety surveys may be conducted but the important aspect is the relevance of questions and the analysis and subsequent publishing of the findings.

Documents to review:

- Safety survey format
- Recent survey results
- Review of general responses from participants
- Identified issues
- Response to identified issues

Questions:
What is the quality of the survey questions?
What is the organisation's response to safety concerns?
Have previous surveys identified concerns which contributed to an accident later on?
Have concerns been documented and forwarded to the appropriate person?
Are staff satisfied with the HF/NTS training?

Risk Management and Mitigation Process

Safety Risk Management is the formal process of hazard identification, risk assessment and the implementation and review of controls or mitigation strategies for effectiveness.

There are national standards outlining a formal risk management process, like AS/NZS ISO 31000 (2009), which can describe the process further.

In the review of SMS documentation and processes, we are looking for a process similar to that described in the following graph:

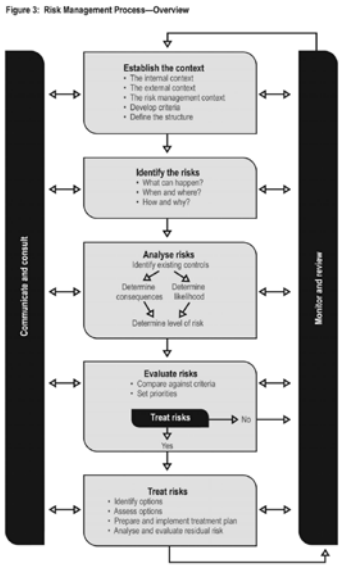


Figure 3: Risk Management Process – Overview
Source: AS/NZS 4360(2004)

A process that follows a logical sequence and include all or most of the following steps:

- Communication and consultation with internal and external stakeholders at each stage of the risk management process
- Establishing the risk management context in which the process will take place
- Identification of the hazard and resultant risk
- Analysis of the risk by consequences and likelihood
- Assessment of the risk level and its acceptability
- The introduction of mitigation strategies
- The monitoring and review of these
- A formal record of each of these stages in the process

Documents to review:

- Risk management process
- Risk management forms
- Risk assessment records (samples)
- Risk register with acceptance of the Accountable Manager
- Evidence of mitigation strategy reviews

Questions:
Are the procedures clearly described in the Safety Management manual?
What are the highest identified risks and how are they managed?
What is in the risk register?
Are human factors issued included in the risk assessment?
Are mitigated risks regularly revisited and re-assessed?
Is management involved in this process?

Safety Assurance and the Practical Drift

At this point I would like to draw the attention to Scott A. Snook's theory of the Practical Drift.
It explains how a deviation from the baseline performance to practical operational performance is foreseeable in any system, no matter how careful and well thought out its design may have been.

The initial system design is based on the assumptions that the technology needed to achieve the production goals is available, that the people are trained appropriately to operate the technology and that the regulations and procedures will always be adhered to by the individuals.

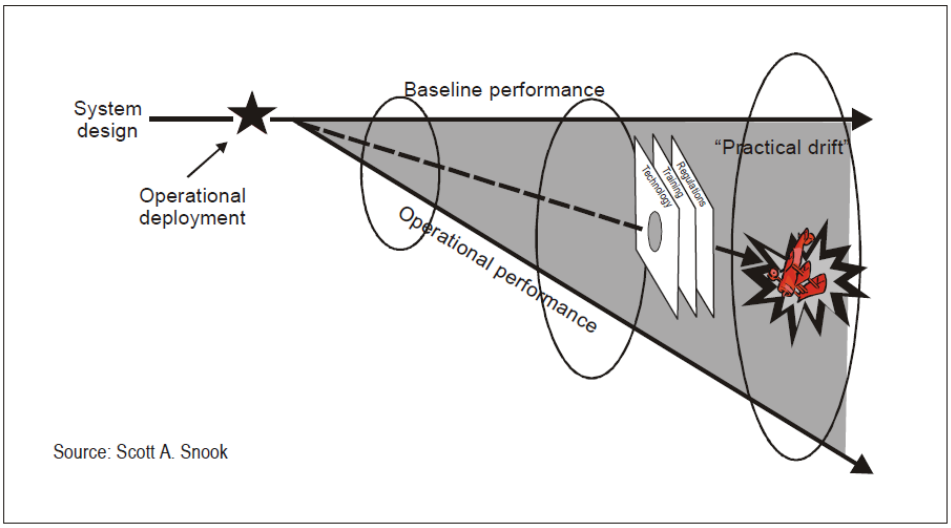
Reasons for the practical drift from the initial system design may be that technology does not operate as predicted in certain situations, the procedures were written without the necessary system knowledge, regulations may not cover certain situations or have changed, unforeseeable changes to the system, the interaction with other systems and so on.

With all these influencing factors, the system still works. Why? Despite all the system‘s problems, individuals operating inside the practical drift make the system work on a daily basis, applying local adaptations and personal strategies to get the job done. They may not be aware that they are now working outside the designed parameters of the system.

Scott A. Snook says that “*Capturing and analysing the information on what takes place within the practical drift holds considerable learning potential about successful safety adaptations and, therefore, for the control and mitigation of safety risks.”* and that *“The closer to the beginning of the practical drift that the information can be systematically captured, the greater the number of hazards and safety risks that can be predicted and addressed, leading to formal interventions for re-design or improvements to the system.”*

It is in the best interest for the organisation to accept that a practical drift exists and to ensure that there are systems in place to capture these practices early before a deviation too far from the designed baseline performance create a situation where an incident or an accident becomes a greater possibility.

Figure "The practical drift"



Source ICAO Document 9859

With the theory of the practical drift in mind, the term Safety Assurance is used to oversee and monitor the safety performance of the organisation and the functioning of the SMS.

Safety Performance Monitoring and Measurement

To monitor and measure the performance of the SMS, feedback and data are required. The size and complexity of the organisation will determine the best methods for establishing and maintaining an effective safety performance monitoring program.

A Safety Performance Monitoring system may include some or all of the following methods:

- a hazard/incident reporting system
- line managers monitor day-to-day activities
- regular inspections of day-to-day activities in all safety-critical areas
- safety surveys
- follow up on all reports of identified safety issues
- using programs such as Flight Data Analysis (FDA) or LOSA
- conduct of safety studies
- a regular audit program including both internally and externally conducted safety audits
- communication of safety results to all affected staff

Documents to review:

- The FDAP system with records
- The audit schedule
- An audit report and its findings
- Management of audit findings
- Any safety studies

<u>Questions:</u>
Are FDAP triggers set correctly?
What is the process for reported FDAP data?
Does the organisation have an audit schedule?
Is the organisation following the audit schedule and are they up-to-date?
How many external audits are conducted and is there a mix of auditors?
What are the human factors components audited?
Is it ensured that an independent auditor audits a section?

Internal Safety Investigation

This is probably an area that most investigators are very familiar with. We know that for every accident or serious incident, there will likely be hundreds of minor events or near-misses which have the potential to result in an accident. We also agree that it is important that all reported hazards and incidents are reviewed and a decision made which ones should be investigated, and to which extend.

Obviously, the investigation process should be comprehensive and should attempt to address the root cause and other contributing factors. A detailed analysis of organisational factors is required to ensure latent organisational conditions are identified and mitigated.

Documents to review:

- Investigator training records
- Investigation report for quality
- Identification of contributing factors
- Grouping and analysis of contributing factors
- Actions as a result of the investigation
- Follow up of mitigation strategies

Questions:
Do we find a statement what the purpose of the investigation is?
Do we have a reference to the Just Culture policy?
Who is responsible to communicate with an external agency?
What training has been provided to the investigators?
Are human factors thoroughly investigated?
What is the authority of the investigator in charge (IIC)?
Can the IIC interview any manager and staff?
Does the IIC have access to all documents?

Change Management

Change management is a formal process to manage all identified risks associated with the implementation of changes to an organisation. Changes can result in the creation of hazards which may have the potential for adverse safety outcomes.

Typical changes to an organisation that would require a formal change management process include new schedules, new ports, new type of operation, addition of a new aircraft type, addition of extra aircraft of the same or similar type, introduction of new equipment and/or operational procedures, changes in key personnel and a restructure of operational departments.

Documents to review:

- List of changes which require a change management processes
- Change management process records
- An assessment of the identified risks
- A review of identified created hazards

Questions:
Is the list of changes appropriate and according to ICAO and legislation?
Is the process followed for all changes as described in the SMS?
Which changes are not included? Why?
Are human factors considered?
Is the process transparent and are all stakeholders involved?
Are change management processes re-used and further developed, why not?
Is there evidence that change management processes are “reversed-engineered” to achieve the desirable outcome?

Continuous improvement of the Safety Management System

Continuous improvement of the SMS requires some form of measurement and a regular review. This measurement of the safety performance can be achieved through annual safety surveys. Periodic changes to the Safety Management procedures are required to keep up with processes and regulation changes.

Documents to review:

- The safety objectives described in the SMS Manual
- Recent changes to the SMS manual
- A review of the manual change requests
- Follow findings identified in the Safety Survey into the reporting database (any actions?)

Questions:
Have the safety objectives changed over time?
Has the initially approved SMS been revised?
Had changes been made which undermine the initial intent of the SMS?
Were these changes intended to save money or to increase safety?
What are the changes to the HF/NTS training over time?
What is the result of the Safety Survey?

Management Review

In larger organisations there may be several levels of safety meetings, from Safety Review Committees (SRC) to Safety Review Board (SRB) meetings and Safety Action Groups (SAG). The higher level (strategic) meetings are monitoring the effectiveness of the SMS and the performance against the published safety objectives, the members are making recommendations and decisions based on the information provided by the SAGs. These decisions should ensure that the SMS continues to meet its safety objectives and that identified hazards are addressed in a timely and appropriate manner. High risk findings should be discussed during this meeting and a decision for their management made.

The SAG meetings are tactical and coordinate and review the implementation of safety actions. SAG meetings should include a review on safety management activities, measuring and reporting on safety management performance, reporting on change management issues, reporting on resource issues and reporting on safety training performance.

The intent of regular reviews and evaluations is to pursue improvements in operational safety and to ensure that the SMS remains effective and relevant to the organisation's operation.

Results from these meetings could include proposed changes to SMS objectives, changed safety goals/targets and improved SMS procedures resulting in manual changes.

The minutes of these meetings should provide a good insight into the organisation's safety activities and show a certain level of approach to safety.

CASA's CAAP notes that: *"Should the Accountable Manager choose to assign this task [to chair the meetings] to an appropriate senior person, it should be clearly stated and substantiated in the SMS manual that they are performing the task on behalf of the Accountable Manager whose accountability for safety is not compromised and that the CEO remains accountable for all decisions of the Safety Committee/SRB."*

Documents to review:

- Minutes from SRB meetings
- Minutes from SAG meetings
- Review of high risk findings and their time management
- Meeting attendance lists
- Follow up of recommendations

Questions:
How often do these meetings take place?
Is the CEO chairing high level safety meetings?
How much time is allocated for the Safety Review meetings?
Are all participants trained in HF/NTS?
Who is present at these meetings?
Who sends delegates often and why?
Which safety objectives have been reached and revised?

Safety Training and Promotion

Safety Training and Promotion includes the safety training and education of all staff and the ongoing promotion of safety to raise the awareness of the objectives of the SMS. The success of Safety Training and Promotion depends on the experience and knowledge of the Safety Manager and the responsibilities extended by the accountable manager.

Safety training should be provided to all safety critical personnel at induction and should also include the training on non-technical skills / human factors. The expansion of non-technical skills training to staff in non-safety critical roles will ensure that staff are communicating in the same “safety” language. The management team should also have a good understanding of SMS principles and receive additional training in risk management and safety responsibilities and accountabilities.

Staff performing specialised SMS tasks like audits, risk assessments and investigations without the required training, will not be able to provide satisfactory outcomes. This may result in undiscovered hazards or root causes and a lost opportunity for improvement.

Safety promotion is an ongoing program for safety communication and should include the dissemination of lessons learned from safety events. Through safety promotion, the organisation can effectively shape and maintain the safety culture. Safety promotion can be provided in various ways, safety training, thought a regular newsletter, safety days, nominations of staff or teams, publication of safety investigation reports etc.

Documents to review:

- Induction training program
- SMS training program
- NTS/HF training program and content
- Training records for safety critical personnel
- Training records for staff in specialized roles (auditors, investigators)
- Management training records
- Safety content in newsletters

Questions:
What is the qualification and experience of the Safety Manager for the role?
How much training has the Safety Manager received for the role or is anticipated?
What is the organisation’s commitment to training of staff performing specialised tasks?
What is the quality of investigations reports, audit reports and risk assessments?
Are these reports accessible to staff?
What safety promotion methods are used in the organisation and how frequently are they updated?

Result

Now that we have investigated the SMS aspects of the organisation by collecting evidence in form of documentation and interviews, what have we learned?

We should be at a point where we can identify the elements which are not properly supported and have influenced the organisational safety culture to a point where they may have contributed to the accident or incident.

For the sake of quantifying the missing elements, we can give a score of 1 to 5 for 'Flexible Culture', 'Informed Culture', 'Just Culture', 'Learning Culture' and 'Reporting Culture'.
More importantly however is to identify in the investigation report the areas of the SMS which require improvement with directed and meaningful safety recommendations.

FLEXIBLE CULTURE
An organisation can adapt in the face of high tempo operations or certain kinds of danger - often shifting from the conventional hierarchical mode to a flatter mode.

INFORMED CULTURE
Those who manage and operate the system have current knowledge about the human, technical, organisational and environmental factors that determine the safety of the system as a whole.

JUST CULTURE
There is an atmosphere of trust. People are encouraged (even rewarded) for providing essential safety-related information, but they are also clear about where the line must be drawn between acceptable and unacceptable behaviour.

LEARNING CULTURE
An organisation must possess the willingness and the competence to draw the right conclusions from its safety information system and be willing to implement major reforms.

REPORTING CULTURE
An organisational climate in which people are prepared to report their errors and near-misses.

Score 1 (Not implemented/effective) to score 5 (Fully implemented)

Managing the risks of organisational accidents. Aldershot, UK, Reason, J. (1997), Ashgate.

Conclusion

Any accident or incident must be investigated in the context of the organisation's safety culture because an individual can only work as safely as the work environment allows. It is therefore important to consider the organisational safety culture to understand what the conditions are and if these had contributed to the event.

Identifying an insufficient crew roster system can't be the end of the investigation. What is the safety culture in the flight operations department? Why has nobody reported fatigue issues before? If there were reports, how good was the investigation and what happened with the findings? If these findings were assigned and actioned, what mitigations were put in place? What was the review process for these mitigations?

Generally the question is, has the organisation provided the necessary support for staff to perform their duties safely. To extend the focus of the investigation to the organisation's safety culture can provide valuable insight in causal factors, other latent conditions and may be the only way to identify areas that have the potential to lead to another event in the future.

An investigation of SMS elements can provide the investigator with the evidence needed to support the finding that organisational factors have contributed to the accident or incident.

Sources

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