Civil Aviation Safety Authority
of Papua New Guinea

Advisory Circular

AC100-1C

Safety Management Systems (SMS) Component 3 - Safety Assurance:

A Practical Guide

Initial Issue

01 July 2026

GENERAL

Civil Aviation Authority Advisory Circulars (AC) contain information about standards, practices and procedures that the Director has found to be an Acceptable Means of Compliance (AMC) with the associated rule.

An AMC is not intended to be the only means of compliance with a rule, and consideration will be given to other methods of compliance that may be presented to the Director. When new standards, practices or procedures are found to be acceptable, they will be added to the appropriate Advisory Circular.

This Advisory Circular also includes Explanatory Material (EM) where it has been shown that further explanation is required. Explanatory Material must not be regarded as an acceptable means of compliance.

PURPOSE

This Advisory Circular provides methods, acceptable to the Director, for showing compliance with the Safety Management System requirements of Part 100 and explanatory material to assist in showing compliance.

RELATED CAR

This AC relates specifically to Civil Aviation Rule 100 Subpart B – Safety Management Systems.

CHANGE NOTICE

There was no previous issue of this AC, consequently no change is in effect.

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1.1 EM 100.77 What is Safety Performance?

1.1.1 ***What is Safety Performance?***

PNG CAR Part 100 and ICAO Annex 19 defines **safety** as *'the state in which risks associated with aviation activities, related to, or in direct support of the operation of aircraft, are reduced and controlled to an acceptable level'* and **safety performance** as *'an organisational certificate holder's safety achievement as defined by its safety performance targets and safety performance indicators'*. These definitions provide a good indication of the complexity related to measuring safety performance. In many areas safety metrics tend to focus on serious incidents and accidents, as these are easy to measure and often receive more attention. In terms of safety management, the focus on such negative events should be considered with some caution, because:

- in systems such as aviation with a low number of high consequence negative outcomes, the low frequency of such outcomes may give the wrong impression that your system is safe;
- the information is available too late to act on it;
- counting final outcomes will not reveal any of the systemic factors, hazards or latent conditions that have a potential to result in high consequence negative outcomes, under the same conditions; and
- where the resilience of a system has been undermined, such outcomes are more likely to occur by chance and therefore these outcomes may draw unwarranted attention and use scarce resources when they are not predictive of later events.

1.1.2 The issue is further complicated because the aviation system is a highly dynamic, complex system with many different players, interactions, dependencies and parameters that may have a bearing on final safety outcomes. Therefore, in most cases it is impossible to establish a linear relationship between specific parameters or safety actions and the final, aggregate safety outcome. Hence, the absolute measurement of safety is itself unachievable. Whilst there are many models of what makes up the level of safety (and conversely the level of exposure to risk), indicators will always constitute imperfect markers of these levels.

1.1.3 Safety is more than the absence of risk; it requires specific systemic enablers of safety to be maintained at all times to cope with the known risks, to be well prepared to cope with those risks that are not yet known, and to address the natural 'erosion' of risk controls over time. Thus, from the perspective of your company there cannot be any direct measures of safety.

1.1.4 Measures should in particular focus on those features of your system that are intended to ensure safe outcomes —those elements that will constitute organizational enablers of safe outcomes and specific safety controls and barriers for any risks identified. Measures also need to address how external factors may influence these enabling elements, risk controls and barriers or how these controls and barriers influence each other. This approach is aligned with current industry practice in the area of quality management as promoted for example by International Organization for Standardization (ISO) 9000 series standards; when the resulting output cannot be directly measured, the underlying systems and processes need to be validated instead.

1.1.5 The principles above are valid both from a regulator's perspective and from the perspective of an individual service provider; in all cases the dynamic nature of the systemic, operational and external components of safety performance should be considered.

1.1.6 The Figure 1 below illustrates the various components of Safety Performance.

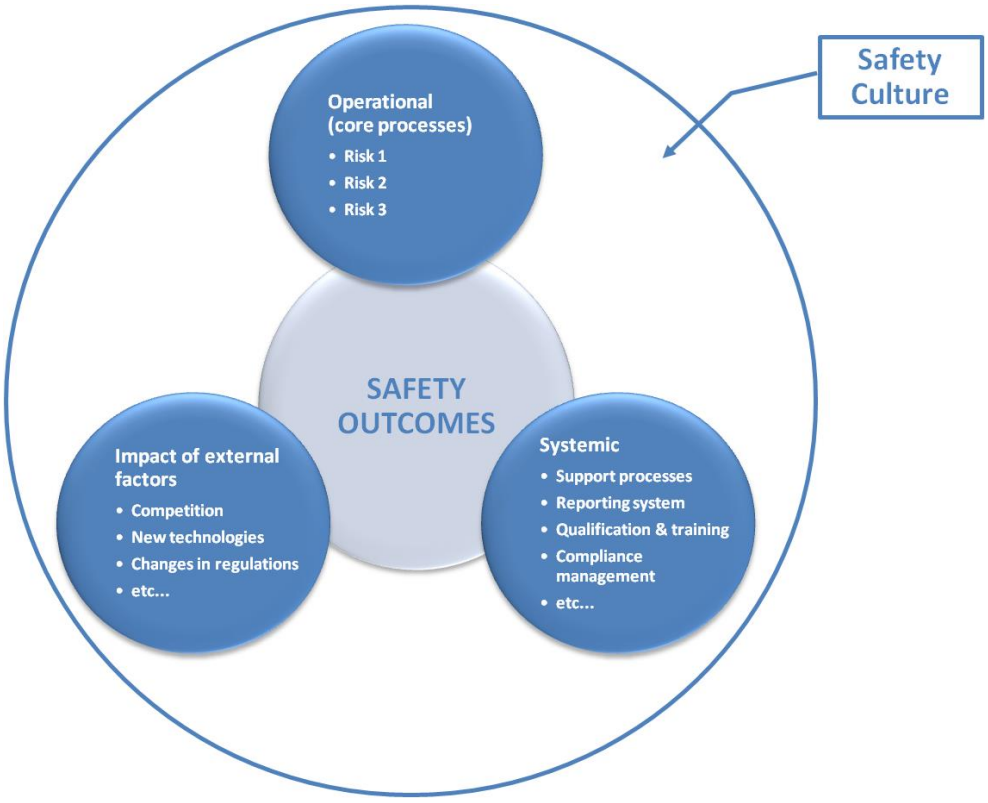


Figure 1: Components of safety performance

1.2 EM 100.77 What is Safety Assurance?

1.2.1 Safety assurance activities are at the core of your safety management system (SMS), with assurance functions monitoring compliance and performance as well as managing changes. Assurance consists of processes and activities undertaken to determine if your SMS is operating according to expectations and requirements.

1.2.2 Safety Assurance is the way you demonstrate your SMS actually works.

1.2.3 Safety assurance includes systematic and ongoing monitoring and recording of your safety performance, as well as evaluating your safety management processes and practices. It also involves continuously monitoring your operating environment to detect changes which may introduce emerging risks or degrade any existing safety risk controls.

1.2.4 Safety Assurance is a key component of an SMS and involves three fundamental safety-related activities:

SMS Component	SMS Element
Safety Assurance	1.Safety Performance Measurement and Monitoring (Rule 100.77)
	2.Change Management (Rule 100.65)
	3.Continual Improvement of the SMS (Rule 100.107)

1.3 EM 100.77 Why measure Safety Performance?

1.3.1 Rule Part 100 and ICAO Safety Management System (SMS) standards and recommended practices promote the development and maintenance of means to verify the safety performance of your organization and to validate the effectiveness of safety risk controls.

The analysis and assessment of how your company 'functions' to deliver its activities should form the basis for defining your safety policy, the related safety objectives and the corresponding safety performance indicators and targets.

SMS requires a systemic approach as with any other element of business management (e.g., quality, finance), and in this respect safety performance measurement provides an element that is essential for management and effective control: 'feedback.'

- Feedback will allow management to validate the analysis and assessment of how well your organization functions in terms of safety and to make adjustments as required (Plan-Do-Check-Act).
- Feedback to your management will guide decision-making and resource allocation.
- Feedback to all staff will ensure that everyone is informed on your company's safety achievements. This will help to create commitment and contribute to fostering your company's safety culture.

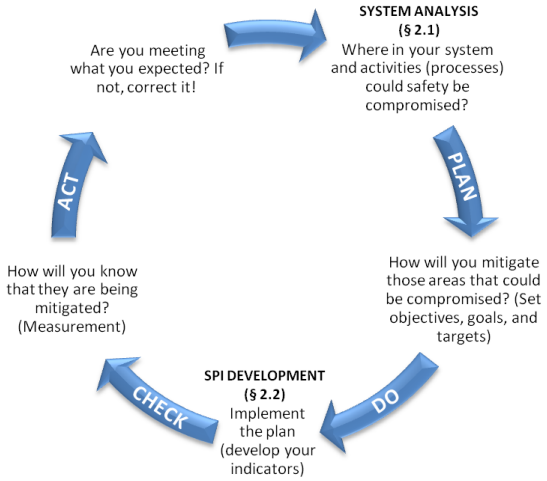


Figure 2 – The Measurement Cycle

1.3.2 Effective safety performance measurement will support the identification of opportunities for improvement not only related to safety, but also to efficiency and capacity.

1.3.3 The management of safety relies on the capabilities of your organization to systematically anticipate, monitor, and further develop your organizational performance to ensure safe outcomes of your activities. Effective safety management requires a thorough understanding and sound management of your system and processes. This cannot be achieved without some form of measurement.

1.3.4 Rather than randomly selecting outcomes that are easy to measure, you should select safety performance indicators that consider the type of feedback needed to ensure your company's capabilities for safety management can be properly evaluated and improved. This implies that you will need to measure performance at all levels of your organization by adopting a broad set of indicators involving key aspects of your system, and operations and allowing to measure those key aspects in different ways.

1.4 EM 100.77 Ways of Measuring and Monitoring Safety Performance

1.4.1 You have decided on your safety objectives; you have implemented them; and now you are monitoring and measuring how you are progressing to meeting these targets. You need feedback on your safety performance so that you can evaluate it and make changes where necessary.

1.4.2 Your stakeholders may also need assurance of the level of safety within your organisation.

For example:

- staff need to be confident that your organisation can provide a safe working environment;
- line management needs feedback on safety performance to help allocate resources, given the often-conflicting goals of production, profit and safety;

- passengers have concerns about their personal safety;
- senior management seeks to protect corporate image shareholders wish to protect their investment (for larger organisations).

1.4.3 Safety performance monitoring occurs through collecting safety data and information across various sources. The types of monitoring you do depends on the size and complexity of your organisation. However, having safety data to support informed decision-making is an essential aspect of your SMS.

1.4.4 The most important outcome of establishing a safety performance management structure is the presentation of information to the organisation's decision makers so they can make decisions based on current, reliable safety data and information. The aim should always be to make decisions in accordance with the safety policy and towards your safety objectives.

1.4.5 You can monitor your safety performance using a variety of data sources including:

(a) **hazard and safety reports:** using your safety reporting data to identify common issues or trends that may warrant further analysis or investigation. This includes those hazard or safety reports that when assessed individually may appear to be a low-level safety risk but when trended could identify a latent or emerging safety risk for your organisation. This is supported by having established an effective hazard and safety reporting process as part of safety risk management (see book 3 for further information).

(b) **safety surveys**: provide an inexpensive and valuable source of safety information and are used to canvass your employees' views on safety, examining their thoughts on procedures and processes related to specific areas of the operation or safety policies. Surveys can involve the use of checklists, questionnaires, monitoring and observing day-to-day activities, regular inspections of safety-critical areas, or confidential interviews or focus groups of staff. Safety surveys generally provide qualitative information, which may require validation via other safety data to determine if corrective action is required.

(c) **safety audits:** these focus on assessing the integrity of your SMS and can evaluate the effectiveness of implemented safety risk controls, while also monitoring compliance with safety regulations.

(d) **safety investigations:** findings and recommendations from investigations can provide useful information which can be analysed against your other safety data. Information from investigations can also help evaluate the effectiveness of safety risk controls, by identifying controls that have worked but also any that failed.

(e) **operational performance data:** systematically capturing daily performance data can provide useful data of events and operational performance. This data can be obtained from programs such as flight data analysis, line operations safety audits, maintenance operations safety audits, normal operations safety survey and maintenance error decision aid.

Performance monitoring and measurement requires you to have:

(f) **safety objectives:** these have been established within your safety policy and objective element of the SMS. They outline your desired safety outcomes related to safety concerns specific to your operational context. Refer to PNG AC 100-1A: Safety policy and objectives for further information on setting safety objectives.

safety performance indicators (SPIs): these are tactical parameters relating to your safety objectives and are a reference point for your safety data collection

safety performance targets (SPTs): another tactical parameter used to assist with achieving your safety objectives.

SPIs and associated SPTs must be routinely reviewed to determine if they are providing the information needed to track progress being made toward the safety objectives.

Safety performance management is an ongoing activity. Safety risks and availability of data change over time. Initial SPIs may be developed using limited sources of safety information. Later more safety data will be available and the organisation's safety analysis capabilities will likely mature. As this happens you should consider refining the scope of your SPIs and SPTs to better align with your desired safety objectives.

1.5 EM 100.77 Safety Performance Measurement Process

1.5.1 *Pre-requisites for effective safety performance measurement*

In essence, your safety performance is determined by your capability to implement and maintain those organizational elements required to ensure safe outcomes. The purpose of your SMS is to build up, maintain, and continually improve this capability. As a prerequisite for effective safety management, your organization needs to perform a system analysis to generate an accurate and reliable description of your organizational structures, policies, procedures, processes, staff, equipment, and facilities. This analysis should have a particular focus on the interactions between system components and external factors. This will provide you with a model of how your system elements and activities interact to produce the expected safety outcomes, allowing you to identify the strengths and weaknesses of your system. The system description and related model of how your activities lead to the expected outcomes will inform you on what to measure to drive safety performance and what to monitor to keep an eye on all of those elements that may affect your organization's safety performance[1].

Guidance on system description and hazard identification for design and manufacturing organizations may be found for example in the Federal Aviation Administration (FAA) Aircraft Certification Service (AIR) SMS Pilot Project Guide. Most of the elements developed in this guidance document can be adapted for other sectors.[2] Although designed for regulators, the SM ICG SMS Evaluation Tool[3] may be useful in assessing the completeness and adequacy of your SMS. Your internal audit system and regulator audits and inspections may also identify areas of concern or safety critical tasks.

If your organization has a quality management system, such as those defined in ISO 9001/AS9100, CAR Part 100 Subpart C or equivalent standards, the existing system and process description is a starting point for your system analysis, but you should ensure that your system and process description properly addresses aviation safety risks as well as business risks.

Following completion of the system description, including analysis and assessment, your company should have gained or confirmed its understanding of where it stands with regard to safety. Through this exercise you should have identified:

At the systemic level:

- whether the elements that constitute enablers of effective safety management are present, suitable, and effective;
- the elements that are still missing for effective safety management;
- whether the elements are sufficiently integrated with each other and with the core management and operational processes of your organization; and
- the weaknesses and vulnerabilities in your organization.

At the operational level:

- the main risks in operations that need to be addressed (the things that may cause 'your next accident').

This will form the basis for reviewing the adequacy of your safety policy, defining or adapting your safety objectives, and deriving your safety performance indicators.

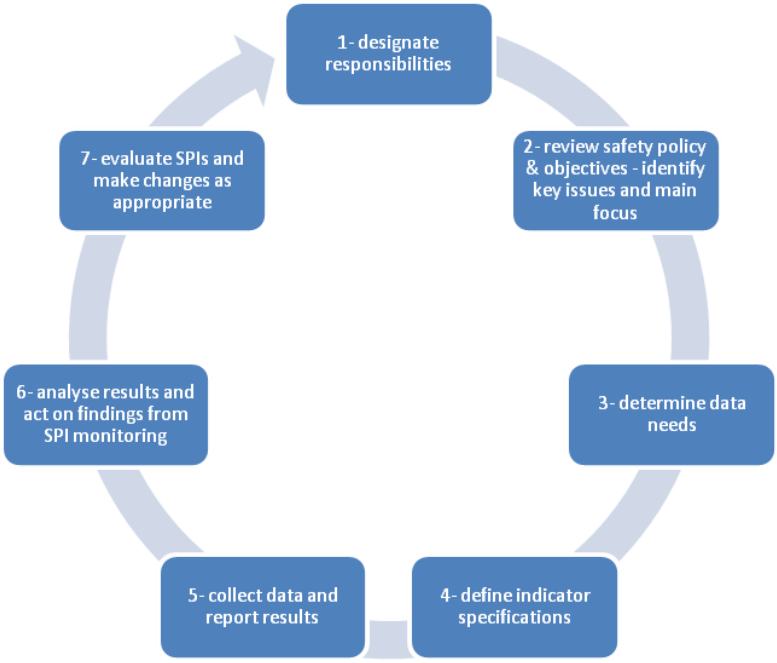
1.5.2 *Process for defining and reviewing safety performance indicators*

1.5.2.1 As with anything that relates to effective safety management, defining and using safety performance indicators must be a dynamic process. A step-by-step process for developing your own set of safety performance indicators is proposed, which follows the 'Plan-Do-Check-Act' logic for continual improvement. This should help you to involve and get buy-in from all staff concerned.

[1] See also ICAO Doc 9859 Edition 3 "7.4 SYSTEM DESCRIPTION"

[2] http://www.faa.gov/about/initiatives/sms/pilot_projects/guidance/media/DM_SMS_PilotProjectGuide.pdf

[3] http://www.skybrary.aero/index.php/SM_ICG_SMS_Evaluation_Tool



1.5.2.2 Step 1: Designate Responsibilities:

It is critical to the success of the SPI project, as to the SMS journey in general, that your management are fully committed to implementing SPIs as a fundamental part of your company's safety management approach. Rather than just supporting a system of SPIs, management must define aspects of your organization that require measurement and management and then must commit to a systematic approach to managing those elements, in accordance with your safety policy and defined safety objectives.

The first step for establishing SPIs will be for management to designate personnel with responsibilities for initiating the effective promotion and coordination of the introduction of the SPIs. This will require responsibility for ensuring effective communication and generally overseeing the implementation, with due consideration of your existing organizational setup in relation to safety management. These personnel (hereafter referred to as 'SPI team') should ideally include, and certainly have access to, personnel with appropriate experience and knowledge of safety and/or quality management principles and data analysis. They should also have experience applying this knowledge and these skills in the context of your policies, programs, operational procedures and practices.

Process owners must be *directly* involved even if 'specialists' are used to supply measurement expertise or to support/facilitate the SPI development process. Also, it is essential that process owners take ownership of safety performance measurement for their processes. The SPI team (or individual with designated responsibilities, depending on the size and complexity of your organization) must clearly be shown to be in either a support or advisory role to management and process owners.

Management should be kept informed of progress on a regular basis and should take an active role in steering the process of implementing SPIs. For larger organizations it may be useful to develop an analysis of the costs and benefits of the SPI development project, with particular focus on the positive effects on your company's 'management information system' that will lead to improved resource allocation.

Finally, the SPI team should set a reasonable timetable, including milestones, to ensure adequate progress in developing the SPIs.

1.5.2.3 Step 2: Review Safety Policy and Objectives – Identify key Issues and main focus

At this step, the SPI team should identify the scope and focus of measurement considering the results of the system analysis (cf. § 1.5.1), paying particular attention to the completeness and adequacy of your SMS.

To define indicators for specific operational safety issues, the bow-tie methodology4 or similar tools can be used to determine the safety actions and risk barriers that would be most suitable for the definition of operational SPIs. A thorough hazard identification will be required as part of your system analysis to provide a good understanding of threats to safety in your operations.

The SPI team may also review typical indicators used within your industry segment and assess them to determine whether they are pertinent to your organization. For example, measuring the number of internal

[4] http://www.skybrary.aero/index.php/Bow_Tie_Risk_Management_Methodology

reports may not be meaningful if your system analysis reveals that there are no easily accessible means to report or there are concerns about confidentiality.

1.5.2.4 Step 3: Determine Data needs

To be meaningful, measures of performance must be based on reliable and valid data, both qualitative and quantitative. Therefore, the SPI team should identify all pertinent data and information that is available within your company and determine what additional information is needed. It should also consider information available through the internal audit/compliance monitoring system.

Regardless of the type of data, ***quality*** is one of the most important elements in ensuring that the data can be integrated and used properly for analysis purposes. Data quality principles and practices should be applied throughout the processes from data capture and integration to analysis. Guidance about required data attributes and data management can be found in the SM ICG 'Risk Based Decision Making Principles' document[5].

You may be tempted to identify things that lend themselves to being measured instead of identifying what you should measure. This is likely to result in identifying SPIs that are most obvious and easy to measure rather than SPIs that are most valuable for effective safety management. Therefore, at this step of the process, it is important to focus on what changes your organization wants to 'drive' and what aspects it needs to 'monitor.' You should also consider that, to be effective at assessing system safety, a broad set of indicators involving key aspects of your system and operations should be developed; this will reduce the possibility of having a narrow and therefore potentially flawed view of your company's safety performance.

Also, it may be necessary to measure the same system in several ways in order to gain a more precise idea of the actual level of safety performance. For example, only assessing your company's safety culture without measuring operational parameters will merely provide a very partial indication of safety performance.

In the area of hazard identification and risk management in operations (core processes), availability of data will depend in part on the maturity of your internal safety reporting schemes. Aggregate data for your industry segment may also be considered, particularly when your SMS has not yet generated sufficient data. Other information, such as number of flights, fleet size, and financial turnover, may contribute to a better understanding of the context of operations. Continuous availability of data should be ensured to generate relevant and timely indicators. Delays in compiling data for the generation of indicators are likely to delay any safety actions that may be required.

1.5.2.5 Step 4: Define Indicator Specifications

Once the scope and focus of your SPIs have been determined and available data/information reviewed, the specifics need to be defined. Each SPI should be accompanied by sufficient information (or metadata) which enables any user to determine both the source and quality of the information, and place this indicator in the context necessary to interpret and manage it effectively.[6]

Whenever possible, indicators should be **quantitative**, as this facilitates comparison and detecting trends. Quantitative metrics should be precise enough to allow highlighting trends in safety performance over time or deviations from expected safety outcomes or targets.

For qualitative SPIs, it is important to minimize subjectivity. This may be achieved through an evaluation by members of staff not directly involved in the definition of SPIs.

Depending on the size of your company and the complexity of your activities, a hierarchical framework for your SPIs could be defined to reflect the different processes and sub-systems within your organizational structure. While some indicators for assessing systemic issues may be common to different processes and subsystems, indicators for assessing operational issues will need to be specific. This underlines the importance of having performed an accurate system analysis identifying all system components and sub-systems as a prerequisite for implementing SMS (cf. § 1.5.1).

Aspects of good SPIs include:

The indicator is:

- valid and reliable,
- sensitive to changes in what it is measuring, and not susceptible to bias in calculating or interpretation; and

[5] http://www.skybrary.aero/index.php/Risk_Based_Decision_Making_Principles

[6] For an example, see http://aviationsafetywiki.org/index.php/Reporting_metadata_specification. Metadata should include information on data sources, currency, accuracy, and any other pertinent details.

- Capturing the data is cost effective.

The indicator is:

- broadly applicable across company operations, and ideally throughout the larger aviation sector, and
- easily and accurately communicated.

1.5.2.6 Step 5: Collect data and report results

Once you have defined your SPIs, you must decide how you will collect the data and report the results. Data collection approaches (i.e., data sources, how data will be compiled, and what the reports will look like), as well as roles and responsibilities for collection and reporting, should be specified and documented. Data collection procedures should also consider the frequency with which data should be collected and the results reported for each SPI. Some of these issues will have been addressed when deciding on the SPIs in steps 3 and 4.

The presentation format of the indicator results should take into account the target audience. For example, if you track several indicators addressing the same key issue, it may be useful to identify a subset of the most critical indicators to be given greater emphasis for reporting to top management. The presentation of indicator results should facilitate understanding of any deviations and identification of any important trends (e.g., scoreboards with traffic lights, histograms, linear graphs).

1.5.2.6 Step 6: Analyse Results and Act on Findings from SPI monitoring

This is the most relevant step in terms of safety management, as the ultimate goal of implementing SPIs is to maintain and improve your company's safety performance over time. There is no point in collecting information if the results are not used. Remember that SPIs are indicators of safety performance, not direct measures of safety. The information collected through different SPIs needs to be carefully analyzed, and SPIs collected for different issues need to be put in perspective and the results interpreted, so as to gain an overall picture of the organization's safety performance. The results obtained through an individual indicator may be insignificant if taken in isolation, but may be important when considered in combination with other indicators.

Inconsistencies between SPIs may be an indication of an inaccurate system description or problems with the SPIs themselves. For example, you may encounter situations where leading and lagging indicators associated with the same safety issue provide contradictory results or where a positive trend in systemic indicators goes with a negative trend in operational indicators.

If you find that the metrics are not defined well enough to capture safety critical information the SPIs should be reviewed. Any inconsistencies in the overall picture represent a potential opportunity for learning and for adjusting not only the SPIs (see Step 7) but your SMS itself.

Indicators should not be simply seen as a metric, with actions being taken to get a good score rather than to improve safety performance. It is important that results obtained through the collection, analysis and interpretation of SPIs are conveyed to your management for decision and action. Ideally, these results should be presented at regular meetings (e.g., management reviews, safety review board meetings) to determine what actions are required to address deficiencies or to further improve the system. It is important that such actions do not focus on certain indicators in isolation, but on optimizing your organization's overall safety performance.

As part of your safety communication and promotion, all staff should be informed of the results obtained through the collection, analysis, and interpretation of SPIs.

1.5.2.7 Step 7: Evaluation SPIs and make changes as appropriate

The systems analysis of your organization, along with the set of SPIs and their specifications, including the metrics and any defined targets, should be periodically reviewed and evaluated to consider:

- the value of experience gained,
- new safety issues identified,
- changes in the nature of risk,
- changes in the safety policy, objectives; and priorities identified,
- changes in applicable regulations, and
- organizational changes, etc.

The frequency of the review cycle should be defined. Periodic reviews will help to ensure that the indicators are well defined and that they provide the information needed to drive and monitor safety performance. Periodic reviews will also help identify when specific 'drive' indicators are no longer needed (e.g., if the intended positive changes have been achieved) and allow adjustment of SPIs so that they always focus on the most important issues in terms of safety. Nevertheless, too frequent reviews should be avoided, as they may not

allow establishing a stable system.

After the first two to three cycles, you should have collected enough data and gained sufficient experience to be able to determine which are your 'key' SPIs - those that are most valuable and most effective to monitor and to drive safety performance. At this stage you may be able to derive targets for these key SPIs by extrapolating the data collected during previous cycles. Any such extrapolation needs to consider the 'dynamics' of your organization. You might also compare your SPIs with those implemented by other organizations within your industry segment, but you should never simply copy another organization's SPIs without checking that they are meaningful for your organization.

1.6 EM 100.77 Safety Performance Indicator (SPI) Examples

1.6.1 SPI List

Below is a non-exhaustive list with examples of indicators intended to assist your organization with selecting your own set of safety performance indicators, following the process described in Section 1.5.1. Before adopting any of these as your own SPIs, you should determine if the particular indicator is relevant to your specific organization, considering the maturity of your SMS and the specific features you would like to improve or that need attention.

1.6.2 SPIs for Systemic Issues

A total of about sixty (60) SPIs on Systemic issues are suggested as follows:

Area	Focus of measurement	Metrics
Compliance	- internal audits/compliance monitoring: all non- compliances	- total No.of findings per audit planning cycle / trend - % of findings analyzed for their safety significance,
	- internal audits/ compliance monitoring: significant non-compliances	- No. of significant findings versus total number of findings - number of repeat findings within audit planning cycle
	- internal audits/ compliance monitoring: responsiveness to corrective action requests	- average lead time for completing corrective actions per oversight planning cycle - trend
	- external audits/ compliance monitoring: all non- compliances	- total No. of findings per oversight planning cycle / trend - % of findings analyzed for their safety significance,
	- external audits: significant non-compliances (level 1)	- No. of significant (level 1) findings versus total number of findings
	- external audits: responsiveness to corrective action requests	- average lead time for completing corrective actions per oversight planning cycle - trend
	- consistency of results between internal and external audits/compliance monitoring	- No. of significant findings only revealed through external audits
SMS effectiveness	- Strategic management	- the degree to which safety is considered in the organization's official plans and strategy documents - the frequency with which the organization's official plans and strategy documents are reviewed with regards to safety

Area	Focus of measurement	Metrics
	- Management commitment	- No. of management walk-arounds per month/quarter/year - No. of management review meetings dedicated to safety per month/quarter/year
	- Turnover rate of key safety personnel	- length of term - No. of cases where the reasons for departure of key personnel have been analyzed
	- Supervision	- No. of cases where supervisors provided positive feedback on safety-conscious behavior of your staff per month/quarter/year
	- Reporting	- No. of reports received per month/quarter/year & trend - % of reports for which feedback to reporter was provided within 10 working days - % of reports followed by an independent safety review
	- Hazard identification	- No. of accident/serious incident scenarios analyzed to support Safety Risk Management (SRM) per month/quarter/year - No. of new hazards identified through the internal reporting system per month/quarter/year & trend - findings from external audits concerning hazards that have not been perceived by personnel/ management previously - No. of safety reports received from staff per month/quarter/year & trend
	- Risk controls	- No. of new risk controls validated per month/quarter/year - % of overall budget allocated to new risk controls
	- HR management & competence development	- % of staff for which a competence profile has been established - % of staff who have had safety management training - frequency for reviewing competence profiles - frequency of reviewing the scope, content, and quality of training programs

Area	Focus of measurement	Metrics
		- No. of changes made to training programs following feedback from staff per month/quarter/year - No. of changes made to training programs following analysis of internal safety reports per month/quarter/year
	- management of change	- No. of organizational changes for which a formal safety risk assessment has been performed per month/quarter/year & trend - No. of changes to Standard Operating Procedures (SOPs) for which a formal safety risk assessment has been performed per month/quarter/year & trend - No. of technical changes (e.g., new equipment, new facilities, new hardware) for which a formal safety risk assessment has been performed per month/quarter/year & trend - No. of risk controls implemented for changes per month/quarter/year & trend - % of changes (organizational/SOP/technical etc.) that have been subject to risk assessment
	- management of contractors	- % of contractors whose safety performance has been assessed - frequency for assessing safety performance of contractors - % of contractors integrated with your company's safety reporting scheme - % of contractors for which safety training has been provided - % of contractors that have implemented training control procedures - % of contractors that have a feedback system on safety issues in place with their customer - No. of safety reports received from contractors per month/quarter/year & trend - No. of safety actions initiated following assessment of safety performance or safety reports received per month/quarter/year & trend

Area	Focus of measurement	Metrics
	- Emergency response planning (ERP)	- No. of emergency drills per year - frequency of reviewing the ERP - No. of trainings on ERP per month/quarter/year - % of staff trained on the ERP within a quarter/year - No. of meetings with main partners and contractors to coordinate ERP per month/quarter/year
	- Safety promotion	- No. of safety communications published - No. of trainings performed - No. of safety briefings performed. - (per month/quarter/year)
	- Safety Culture	- the extent to which personnel consider safety as a value that guides their everyday work (e.g., on a scale from 1= low to 5=high) - the extent to which personnel consider that safety is highly valued by their management - the extent to which human performance principles are applied - the extent to which the personnel take initiatives in improving organizational practices or report problems to management - the extent to which safety-conscious behavior is supported - the extent to which staff and management are aware of the risks your operations imply for themselves and for others.

1.6.3 SPIs for Operational Issues

A total of about seventy-six (76) SPIs on Operational issues are suggested as follows:

Area	High Severity outcome to be prevented	Metrics
Air operators See also Air Traffic management/	- Traffic collision	- No. of Traffic Collision Avoidance System (TCAS) resolution advisories (RA) per 1000 flight hours (FH)
	- Runway excursion (RE)	- No. of unstabilized approaches per 1000 landings
	- Runway incursion/ground collision (RI)	- No. of runway incursions per 1000 take-offs
	- Controlled flight into terrain (CFIT)	- No. of Ground Proximity Warning System (GPWS) and Enhanced

Area	High Severity outcome to be prevented	Metrics
Air Navigation Services for additional indicators		Ground Proximity Warning System (EGPWS) warnings per 100 take-offs
	- Accident/incident related to poor flight preparation	- No. of cases where flight preparation had to be done in less than the normally allocated time - No. of short fuel events per 100 flights - No. of fuel calculation errors per 100 flights
	- Accident/incident related to fatigue	- No. of extensions to flight duty periods per month/quarter/year & trends
	- Accident/incident related to ground-handling	- No. of accidents/incidents with ground handlers per month/quarter/year & trends - No. of mass and balance errors per ground handler per month/quarter/year & trends - No. of dysfunctions per ground handler per month/quarter/year & trends
	- Maintenance related accident/incidents	- No. of Pilots Reports (PIREPS) per 100 take offs - No. of MEL deferred items per month and aircraft - No. of Engine In Flight Shut Down (IFSD) per 1000 FH - No. of In Flight Turn Backs (IFTB) and deviations per 100 take offs - No. of Ground/Taxi return to gate events per 100 take-offs. - No. of service difficulty reports (CA 005) filed with CASA Dispatch reliability: - No. of delays of more than 15 minutes due to technical issues per 100 take offs - No. of cancellations per 100 scheduled flights due to technical issues - rejected take offs per 100 take offs due to technical issues
Aircraft Maintenance organizations (Part 145)	- maintenance planning/rostering related accident/incidents	- % of work orders for which a detailed planning has been made
	- maintenance planning/rostering related accident/incidents	maintenance engineer fatigue / maintenance error: - % of work orders with a difference > 10% between the expected lead time and the actual processing time - % of work orders with a difference > 10% between the estimated work force and the actual needs

Area	High Severity outcome to be prevented	Metrics
	- maintenance related accident/incidents	maintenance error: - % of work orders that required re-work - No. of duplicate inspections that identified a maintenance error
	- maintenance data related accident/incidents	- No. of safety reports related to ambiguous maintenance data
	- maintenance related accident/incidents	- No. of investigations performed following components removed from service significantly before expected life limit was reached
Air Traffic management/ Air Navigation Services	- Traffic collision	- No. of level busts/exposure - No. of TCAS required action (RA) (with and without loss of separation) /exposure - No. of minimum separation infringement/exposure - No. of inappropriate separation (airspace in which separation minima is not applicable) /exposure - No. of aircraft deviation from air traffic control (ATC) clearance/exposure - No. of airspace infringements/exposures
	- Traffic collision / controlled flight into terrain	- No. of aircraft deviations from air traffic management (ATM) procedures/exposure - No. of inappropriate or absences of ATC assistance to aircraft in distress
	- Controlled flight into terrain (CFIT)	- No. of near Controlled Flight Into Terrain (CFIT) IFSD /exposure
	- Runway excursion (RE))	- No. of inappropriate ATC instruction (no instruction, wrong information, action communicated too late, etc.)
	- Runway incursion (RI)	- % of runway incursions where no avoiding action was necessary - % of runway incursion where avoiding action was necessary
Part 139 Airports	- post-accident/incident fire	- Fire Extinguishing Services (ICAO Airport Fire Fighting Categories) decrease in value (# decrease- hours/ # airport annual operating hours) - number of radio/phone failures per 100 operations number of fire rescue vehicles failures per 100 operations
	- runway incursion	- runway incursions per 1000 operations Signage: - No. of failures or defects found during routine inspection - No. of defects reported - average lead-time for repair/replacement

Area	High Severity outcome to be prevented	Metrics
		- (per month/quarter/year & trends)
	- collision with vehicle on ground / ground-equipment	- notified platform safety rules violations per 1000 operations.
	- ground collision with wildlife	- No. of ground collisions with wildlife - No. of inspections of fences and other protective devices per month/quarter/year
	- FOD (Foreign Object Damage)	- No. of FOD found during routine inspections - No. of FOD found out of inspections and after report
	- runway incursion	Runway lights: - No. of failures or defects found during routine inspection - No. of defects reported - average lead-time for repair/replacement (per month/quarter/year & trends)
	- bird-strike In Flight Shut Down (IFSD)	- No. of IFSD per 10000 FH following a bird-strike
Flight training organizations (Part 141 ATOs)	- accident/incident related to poor training	- No. of trainees per instructor - No. of changes in instructor per training - No. of major changes to training program (per month/quarter/year & trends)
	- accident/incident related to poor training/complacency during examinations	- No. of significant deviations from average exam pass rates
Design Organizations (Applies to Part 139 Aerodrome Design changes - MOWP & Part 146 ADOC)	- design related accident/incidents	During the design phase: - No. of design changes requested due to design errors per program and per period - No. of rejected compliance demonstrations per program and per period
	- design planning related accident/incident	- % of technical reports with a difference > 10% between the expected lead time and the actual processing time - % of technical reports with a difference > 10% between the estimated work force and the actual needs
	- design related accident/incidents	Post certification: - No. of service difficulty/safety reports due to design errors per program and per period - No of safety reports related to ambiguous design data - No. of design changes classified incorrectly (minor/major) per period
Manufacturing Organizations	- manufacturing related accident/incidents	- No. of service difficulty/safety reports due to manufacturing errors per program and per period

Area	High Severity outcome to be prevented	Metrics
(Applies to all OEMs)	- manufacturing process related accident/incidents	- % of work orders that required re-work - No. of investigations performed following work orders that required re-work
	- manufacturing process related accident/incidents	- % of duplicate inspections that identified a manufacturing error - No. of warranty claims due to manufacturing defects
	- manufacturing process related accident/incidents	- No. of cases where final delivery was delayed due to significant non-compliances - No. of investigations performed following delayed delivery
	- manufacturing data related accident/incidents	- No of safety reports related to ambiguous manufacturing data
	- manufacturing planning related accident/incidents	Production personnel fatigue / production error: - % of work orders with a difference > 10% between the estimated work force and the actual needs - % work orders with a difference > 10% between the expected lead time and the actual processing time

1.6.4 SPIs to Monitor External Factors

A total of about fourteen (14) SPIs on External factors are presented as follows:

Area	Monitoring focus	Metrics
Regulations	- new regulations	- No. of new CARs that will affect your organization within the next 12 months
	- amendments to regulations -CASA NPRMs	- No. of amended regulatory requirements that will affect your organization within the next 6 months
	- evolution towards performance-based regulations	- No. of objective based rules for which you have defined your own means of compliance
Technology	- new technologies relevant to your core business – hardware	- % of total investment that is spent on new technologies
	- new technologies relevant to your core business – software	- % of total investment that is spent on new technologies
	- new technologies relevant to your core business	- rate of obsolescence of existing qualifications
	- new technologies installed in aircraft	- No. of aircraft modifications / Supplemental Type Certificates (STCs) that require a change to your company's approval rating
	- new technologies installed in aircraft	- No. of new modifications / STC that require new qualifications
Competition	- financial turn -over	- evolution in your turnover
	- staff turnover	- average time to fill a vacant post

Area	Monitoring focus	Metrics
		- No. of staff leaving to work for a competitor or overseas
	- market opportunities	- evolution in the number of requests for quotation from new customers - ratio of requests for quotation from new customers that are followed by a firm order
	- competitors	- evolution in the number of your direct competitors

1.6.5 Reference documents for further research and reading on Safety Performance Indicators

1. Leading indicators of system safety – Monitoring and driving the organizational safety potential, Teemu Reiman, Elina Pietikäinen, Safety Science Journal 50 (2012)

2. Leading Performance Indicators – Guidance for effective use 'Step Change in Safety'

   http://www.stepchangeinsafety.net/knowledgecentre/publications/publication.cfm/publicationid/26

3. ICAO Document 9859 'Safety Management Manual', Third edition - unedited advance version

   http://www2.icao.int/en/ism/Guidance%20Materials/SMM_3rd_Ed_Advance_R4_19Oct12_clean.pdf

4. Organization for Economic Cooperation and Development (OECD) Guidance on Developing Safety Performance Indicators – Series on chemical accidents No. 18, Second edition 2008

   http://www.oecd.org/chemicalsafety/risk-management/41269639.pdf

5. Identifying and Using Precursors. A gateway to gate-to-gate safety enhancement

   http://www.skybrary.aero/bookshelf/books/1442.pdf

   http://www.skybrary.aero/bookshelf/books/1443.pdf

1.7 EM 100.77 Safety Performance Indicators (SPIs)

1.7.1 SPI Development

The development of SPIs should be linked to your safety objectives and be based on the analysis of data that is available or obtainable. The monitoring and measurement process involves the use of selected SPIs and corresponding SPTs.

You should monitor the performance of established SPIs and SPTs to identify any abnormal changes in safety performance. Safety performance monitoring and measurement provides a means to verify the effectiveness of safety risk controls. Assessing the effectiveness of safety risk controls is important as their application does not always achieve the intended results. This will help identify whether the right safety risk controls have been selected and if necessary, may result in the application of a different safety risk control strategy.

In addition, they provide a measure of the integrity and effectiveness of SMS processes and activities.

SPIs should encompass a wide spectrum of indicators to provide a fuller and more realistic picture of your safety performance.

This should include:

- low probability / high severity consequence events, such as accidents and serious incidents
- high probability / low severity consequence events, such as non-consequential operational events, non-conformance reports or operational deviations
- process or system performances, such as training completion status, safety meeting frequencies and attendance, and safety report processing.

When establishing your SPIs you should consider:

measuring the right stuff: determine the best SPIs which will identify if your organisation is tracking

to achieve your safety objectives. Consider what are your biggest safety issues and risks, identify SPIs that show how effective your controls are in these areas.

availability of data: is there data already available that you want to measure? If not, you may need to establish additional data collection sources. For small organisations with limited amounts of data, pooling data sets may help identify trends, this could be supported through industry associations who can collate safety data from multiple organisations. Or even using your own safety data and comparing this to broader industry data, such as from external investigation reports (ATSB) and other industry publications relating to safety.

reliability of the data: data may be unreliable either because of its subjectivity or because its incomplete. In these instances, using various data sources can assist as it allows you to develop a clearer picture to identify if subjective data is also appearing across multiple sources, improving its reliability.

common industry SPIs: it can be useful to identify if there are any common SPIs used within your area of the industry. This can assist when first developing your SPIs but can also allow for comparisons to be made between organisations, helping to identify, and set best safety practices. Industry associations may be able to assist with these, or even reaching out to talk to other operators in your area for assistance.

1.7.2 Leading and Lagging Safety Performance Indicators (SPIs)

There are two common categories used to classify SPIs: ***leading*** and ***lagging*** indicators.

Lagging SPIs measure events that have already occurred. They are also referred to as outcome-based and are normally, but not always, the negative outcomes you're aiming to avoid. Because lagging SPIs measure actual safety outcomes, they can measure the effectiveness of existing safety mitigations.

For example, a lagging SPI monitoring effectiveness of a safety mitigation would be the number of ramp collisions per number of movements between vehicles, following a redesign of ramp markings. This provides a measure of the effectiveness of the new markings, assuming nothing else has changed. A reduction in collisions validates an improvement in the overall safety performance of the ramp system, which may be attributable to the change in question.

Using the same example, an increasing trend in ramp collisions per number of movements may have been what led to the identification of sub-standard ramp markings. This would have been identified through using safety data trending analysis, which showed an increased number of safety reports regarding ramp collisions.

Leading SPIs measure processes and inputs being implemented to improve or maintain safety. These are also known as activity or process SPIs, as they monitor and measure conditions that have the potential to lead to or contribute to a specific outcome.

Examples of leading SPIs driving the development of capabilities for proactive safety performance include such things as percentage of staff who have successfully completed safety training on time or frequency of bird scaring activities.

1.7.3 Safety Performance Targets (SPTs)

Once your SPIs have been established you should consider if it's appropriate to identify and develop SPTs and subsequent alert levels. SPTs should be realistic, context specific and achievable when considering your resources available and your operational context.

It is not always necessary or appropriate to set SPTs as there may be some SPIs that are better for monitoring trends rather than being used to determine a target. Safety reporting is an example of when having a target could either discourage people from reporting, if your target is to not exceed a specific number of reports, or to report trivial matters to meet a target, if the target is to reach a certain number.

There may also be SPIs better suited to be defined as a trend (i.e. a reduction or increase, depending on the nature of the SPI) to target continuous safety performance improvement, such as to reduce the number of events, rather than used to define an absolute target.

When first implementing your SMS, it is more appropriate to develop safety objectives and SPIs, and for SPTs to come later. This allows you to start gathering, analysing, and presenting on your SPIs. Trends will start to emerge, which provide an overview of your safety performance and if it is steering towards or away from your safety objectives. At this point you can then identify reasonable and achievable SPTs for relevant SPI.

Once you have an idea what your current level of performance is, by establishing your baseline safety performance, you start setting SPTs to give a clear sense of what you should be aiming to achieve.

The organisation may also use benchmarking to support setting performance targets.

Understanding what achieving SPTs means is also important. Achieving SPTs may not always be indicative of safety performance improvements. You need to be able to distinguish between just meeting a SPT and actual, demonstratable safety performance improvement. You need to consider the context within which the target was achieved, and not look at the SPT in isolation.

SPTs are useful in driving safety improvements but, implemented poorly, they have been known to lead to undesirable behaviours. That is individuals and departments becoming too focused on achieving the target and perhaps losing sight of what the target was intended to achieve, rather than an improvement in organisational safety performance. In such cases it may be more appropriate to monitor SPI for trends.

1.8 EM 100.103 Safety Audits

1.8.1 Internal Safety Audits

Safety audits are used to ensure that your organisation, including your SMS, is sound in terms of:

- adequate staff levels
- compliance with approved procedures and instructions
- levels of competency and training to carry out specific roles
- maintaining required levels of performance
- achievement of the safety policy and objectives
- effectiveness of interventions and risk mitigation

Internal safety audits are used to assess the effectiveness of the SMS and identify areas for potential improvement. They can also assess if safety risk controls have been effectively implemented and are being monitored. The focus of your internal audit is on the policy, processes and procedures that provide your safety risk controls.

Internal audits are most effective when those conducting them are independent from the functions being audited. Ensuring independence and objectivity is a challenge for safety audits and can be difficult to achieve in smaller organisations. However, independence and objectivity can be achieved by having protections in place, such as dedicated policies, procedures, roles, and communication protocols.

The results from audit processes become one of the various inputs to your safety risk management and safety assurance functions. Internal audits inform management of the level of compliance within the organisation, the degree to which safety risk controls are effective and where corrective or preventive action is required.

1.9 EM 100.69 Safety Investigations

1.9.1 Safety Investigations

Safety investigations are conducted as part of your SMS to support hazard identification and risk assessment processes (see PNG AC 100-1B: Safety risk management), however they also provide a mechanism for monitoring safety performance. Investigations provide valuable sources of hazard identification and to identify weaknesses in risk controls for corrective actions to be taken.

For every accident or serious incident in your organisation, there are likely to be hundreds of minor events or near-misses, many of which have the potential to become accidents. You should review all reported events and hazards to decide if there is a need to investigate, and how thoroughly.

A reactive approach would be to investigate only serious incidents or accidents. However, there are other proactive reasons for conducting investigations, these include for hazard-based trending, risk identification and for instances where more in-depth complex analysis of systems failures may be warranted.

The benefits of conducting safety investigations include:

- gaining a better understanding of the events leading up to the occurrence
- identifying contributing human, technical and organisational factors
- making recommendations to reduce or eliminate unacceptable risks
- identifying lessons learned that should be shared within the organisation, and where appropriate the broader aviation community.

You must have a clearly Policy stating that the purpose of internal investigations is to find systemic

causes and implement corrective actions, not to blame individuals. Your internal investigation procedures should state this which underlies the principles of a positive safety culture.

Resources for carrying out safety investigations are normally limited, so the effort you make should be in proportion to the perceived benefit. In other words, how will the investigation assist in identifying systemic hazards and risks to your organisation?

Accountability for the management of internal safety investigations and the investigation process should be documented in your SMS. Your documentation should include guidance for:

- determining when and under what conditions an investigation will be considered
- the scope of the investigation
- identifying who will investigate, including specialist assistance (if required)
- recording the investigation findings for follow-up trend analysis, and who is responsible for this
- timeframes for completion.

The extent of the investigation will depend on the actual and potential consequences of the event or hazard. You can determine this through an initial risk assessment. Reports that demonstrate a high-risk potential should be investigated in greater depth than those with low potential.

The investigative process should be comprehensive and must identify the contributing factors that lead to an accident or incident as well as the contributing factors that may increase risk. Incorrectly performed investigations may potentially fail to provide the necessary information to address the real cause(s) of the event/problem.

Internal safety investigation process flow: Suggested checklist.

1. Established systems are in place to ensure feedback on safety performance is received and the data is analysed.	Yes/No
2. Feedback data us used to evaluate safety performance and identity necessary changes	Yes/No
3. An indication of the level of safety within the organisation is available to all stakeholders.	Yes/No
4. A safety performance monitoring program appropriate to the organisation is established and maintained	Yes/No

Investigations are more beneficial when they include a focus on contributing factors: the ‘why’, rather than a description of the accident or incident only (the ‘what’). Accident investigation requires trained investigators who use evidence as the basis for identifying contributing factors including, but not limited to, organisational issues and human performance limitations.

Organisations need to ensure investigators are properly trained and have appropriate support. Investigative output, including reporting, should be disseminated/actioned throughout the organisation, along with details of lessons learned. Is your internal safety investigation process doing its job? Is it validating the hazards you have identified and reviewing your underlying risks? Both the information identified through the investigation process as well as the effectiveness of the investigation process form an element of your safety assurance.

The way an investigation is conducted, and most importantly, how the report is written, will influence the likely safety impact, the organisation’s safety culture, and the effectiveness of future safety initiatives. Again, the purpose of investigations is not to apportion blame to any individual or group, but rather to improve safety.

Suggested Safety Investigation checklist:

1. The investigative process is comprehensive and attempts to address the factors that contributed to the event, rather than simply focusing on the event itself. (The 'why', not just the 'what'.) The process includes a detailed analysis undertaken to establish organisational factors contributing to events.	Yes/No
2. All reported events and hazards are reviewed, and a classification system guides the decision-making process on which ones should be investigated, and how thoroughly.	Yes/No
3. The organisational safety policy states that the purpose of internal investigations is to find systemic causes and implement corrective actions, not to apportion blame to individuals.	Yes/No
4. Where a positive safety culture/safety reporting culture policy is in place, the policy and protocols for internal investigations clearly reference it.	Yes/No
5. The safety manager, or delegate, acts as the organisation's point of contact/coordinator for PNG AIC investigations (where applicable) as a way of keeping informed as they progress.	Yes/No
6. The extent of the investigation depends on the actual and potential consequences of the event or hazard (as determined by an initial risk assessment).	Yes/No
7. The effort expended on investigations is proportional to the perceived benefit in terms of potential for identifying systemic hazards and risks to the organisation.	Yes/No
8. Accountability for the management of internal safety investigations is documented in the organisation's SMS manual.	Yes/No

1.10 EM 100.69 SMS Self-Evaluation Tool: Safety Performance Measuring and Monitoring

1.10.1 To help service providers, self-check the maturity and effectiveness of their *Safety Performance Measuring and Monitoring systems*, CASA has provided you with the below Guidance and Checklist using the PSOE acronym from guidance material developed by the Safety Management International Collaboration Group (SM-ICG) and summarized below:

Present (P)	There is evidence that the indicator is clearly visible at all levels of the organisation and is documented within the organisation's SMS manual.
Suitable (S)	There is evidence that the indicator is suitable based on the nature, size and complexity of the organisation and/or the inherent risk in the activity.
Operating (O)	There is evidence that the indicator is in use and an output is being produced
Effective (E)	There is evidence that the indicator is effective and is achieving the desired outcome
Best Practice	Organisations striving to continuously improve their SMS, *may* use the Best Practice indicators to achieve a higher level of safety performance.

1.10.2 Self-Evaluation Checklist for ***Safety Performance Measuring and Monitoring systems***, (Required for CASA SMS Acceptance)

Evaluation	Indicators of compliance and performance		P	S	O	E	How it is achieved	Verification Evidence
	2.1.1	Safety performance indicators (SPIs) linked to the organisation's safety objectives have been defined, promulgated, and are being monitored and analysed for trends.						

Guidance

What to look for

- Evidence that SPIs are based on reliable sources of data.
- Evidence of when SPIs were last reviewed.
- The defined SPIs and targets are appropriate to the organisation's activities, risks, and safety objectives.
- SPIs are focused on what is important rather than what is easy to measure.
- Consideration of any State SPIs.
- Review whether any action has been taken when an SPI is indicating a negative trend (reflecting a risk control or an inappropriate SPI).
- Evidence that results of safety performance monitoring are discussed at the senior management level.
- Evidence of feedback provided to the Chief Executive.

Present	Suitable	Operating	Effective
There is a process in place to measure the safety performance of the organisation including SPIs and targets linked to the organisation's safety objectives and to measure the effectiveness of safety risk controls.	SPIs are focused on what is important rather than what is easy to measure. Reliability of data sources is considered in the design of SPIs. SPIs are linked to the identified risks and safety objectives. Frequency and responsibility for the trend monitoring of SPIs are appropriate. Realistic targets have been set. State SPIs are considered, as applicable.	The safety performance of the organisation is being measured and meaningful SPIs are being continuously monitored and analysed for trends.	SPIs are demonstrating the safety performance of the organisation and the effectiveness of risk controls based on reliable data. SPIs are reviewed and regularly updated to ensure they remain relevant. Where the SPIs indicate that a risk control is ineffective, appropriate action is taken.

Evaluation	Indicators of compliance and performance		P	S	O	E	How it is achieved	Verification Evidence
	2.1.2	Risk mitigations and controls are being verified/audited to confirm they are working and effective.						
	2.1.3	Safety assurance takes into account activities carried out by all directly contracted organisations.						

Guidance

What to look for

- Evidence of risk controls being assessed for effectiveness (e.g., audits, surveys, reviews, SPIs and safety performance targets [SPTs], reporting systems).
- Evidence of risk controls applied by contracted organisations being assessed and overseen (e.g., quality check, reviews, and regular meetings).
- Information from safety assurance and compliance monitoring activities feeds back into the safety risk management process.
- Review where risk controls have been changed as a result of the assessment.

Present	Suitable	Operating	Effective
There is a process in place to assess whether the risk controls are applied and effective.	Responsibilities, methods, and timelines for assessing risk controls are defined. Contracted organisations are included in the safety assurance process.	Risk controls are being verified to assess whether they are applied and effective.	Risk controls are assessed and actions taken to ensure they are effective and delivering a safe service.

Evaluation	Indicators of compliance and performance		P	S	O	E	How it is achieved	Verification Evidence
	2.1.4	Responsibilities and accountability for ensuring compliance with safety regulations are defined and applicable requirements are clearly identified in organisation manuals and procedures.						
	2.1.5	There is an internal audit programme including details of the schedule of audits and procedures for audits, reporting, follow up, and records.						
	2.1.6	Responsibilities and accountabilities for the internal audit process are defined and there is a person or group of persons with responsibilities for internal audits with direct access to the Accountable Manager.						

Guidance

What to look for

- Review how senior management ensure the organisation remains in compliance.
- Review job descriptions for compliance responsibilities.
- Evidence that senior management take action on internal and external audit results.
- Review how independence of the internal audit function is achieved.
- Review how the internal audit function interacts with:
  - Senior management,
  - Line managers, and
  - The safety management staff.
- Assess the contents of the programme against any regulatory requirements.

Present	Suitable	Operating	Effective
Responsibilities and accountabilities for compliance are defined. The organisation has an internal audit programme and procedures for audits, reporting, and records. A person or group of persons with responsibilities for internal audits has been identified and they have direct access to the Chief Executive.	The internal audit programme covers all applicable regulations and includes details of the schedule of audits. Independence of the internal audit function is achieved.	The compliance monitoring programme is being followed and regularly reviewed. All staff are aware of their responsibilities and accountabilities for compliance and to follow processes and procedures. Internal and external audit results are reported to the Chief Executive and senior management.	Individuals are proactively identifying and reporting potential non-compliances. The Chief Executive and senior management actively seek feedback on the status of internal and external audit activities.

Evalu	Indicators of compliance and performance		P	S	O	E	How it is achieved	Verification Evidence
	2.1.7	After an audit, there is appropriate analysis of causal factors and corrective/preventive actions are taken.						

Guidance				
What to look for				
- Review the methods used for causal analysis - Check that the method is used consistently. - Review any repeat findings and check for actions have not been implemented or are overdue. - Check for timely implementation of actions. - Review senior management awareness of the status of significant findings and related corrective/preventive actions. - Check that appropriate personnel participate in the determination of causes and contributing factors. - Look for consistency between internal audit results and external audit results. - Review whether causal factors are considered as potential hazards.				
Present	**Suitable**	**Operating**	**Effective**
The process for the identification and follow-up of corrective/preventive actions are defined. The interface between internal audits and the safety risk management processes is described.	Responsibilities and timelines for determining, accepting, and following-up the corrective/preventive action are defined. Compliance monitoring includes contracted activities.	The identification and follow-up of corrective/preventive actions is carried out in accordance with the procedures including causal analysis to address root causes. The status of corrective/preventive actions is regularly communicated to relevant senior management and staff.	The organisation investigates the systemic causes and contributing factors of findings. The organisation proactively reviews the status of corrective/preventive actions. Effectiveness of the corrective/preventive actions is verified.

2. EM100.65 THE MANAGEMENT OF CHANGE

2.1 EM100.65 Introduction to Change Management

2.1.1 Aviation document holders experience on-going change due to a number of factors including, but not limited to:

(a) organizational expansion or contraction;

(b) business improvements that impact safety; these may result in changes to internal systems, processes or procedures that support the safe delivery of the products and services;

(c) changes to the organization's operating environment;

(d) changes to the SMS interfaces with external organizations; and

(e) external regulatory changes, economic changes and emerging risks.

2.1.2 Change may affect the effectiveness of existing safety risk controls. In addition, new hazards and related safety risks may be inadvertently introduced into an operation when change occurs. Hazards should be identified and related safety risks assessed and controlled as defined in the organization's existing hazard identification or SRM procedures.

2.1.3 The organization's management of change process should take into account the following considerations:

(a) ***Criticality.*** How critical is the change? The service provider should consider the impact on their organization's activities, and the impact on other organizations and the aviation system.

(b) ***Availability of subject matter experts***. It is important that key members of the aviation community are involved in the change management activities; this may include individuals from external organizations.

(c) ***Availability of safety performance data and information***. What data and information is available that can be used to give information on the situation and enable analysis of the change?

2.1.4 Small incremental changes often go unnoticed, but the cumulative effect can be considerable. Changes, large and small, might affect the organization's system description, and may lead to the need for its revision. Therefore, the system description should be regularly reviewed to determine its continued validity, given that most service providers experience regular, or even continuous, change.

2.1.5 The service provider should define the trigger for the formal change process. Changes that are likely to trigger formal change management include:

(a) introduction of new technology or equipment;

(b) changes in the operating environment;

(c) changes in key personnel;

(d) significant changes in staffing levels;

(e) changes in safety regulatory requirements;

(f) significant restructuring of the organization; and

(g) physical changes (new facility or base, aerodrome layout changes etc.).

2.1.6 The service provider should also consider the impact of the change on personnel. This could affect the way the change is accepted by those affected. Early communication and engagement will normally improve the way the change is perceived and implemented.

2.1.7 ***Change Management Process:*** the change management process should include the following activities:

(a) ***Step 1 Understand and define the change;*** this should include a description of the change and why it is being implemented. At this step you should be identifying if the change is occurring due to internal or external factors and what the overall objective for the change is.

For example, a change in regulations would be an external change and the objective would be for the organisation to ensure compliance with the new regulations. The introduction of a new ground power unit (GPU) however, would be an internal change that has come about due to identifying the current GPU is nearing the end of its service life. The objective would be to replace the old GPU with a more cost-effective model.

Provide a compelling argument for making the change and a clear statement of the benefits that will result. If undertaken properly, this step will enable you to respond to people's questions, concerns, and perceptions, thereby ensuring their willing participation, their sense of ownership and thus the project's eventual success.

(b) ***Step 2 Understand and define who and what it will affect; this*** may be individuals within the organization, other departments or external people or organizations. Equipment, systems and processes may also be impacted. A review of the system description and organizations' interfaces may be needed. This is an opportunity to determine who should be involved in the change. Changes might affect risk controls already in place to mitigate other risks, and therefore change could increase risks in areas that are not immediately obvious;

When considering who will be affected, this may be individuals within the organisation across various departments, including contractors and even external parties to the organisation. Equipment, systems, and processes may also be impacted. A review of the system description and organisational interfaces may be needed to fully identify all areas and individuals that may be affected.

This is also an opportunity to determine who should be involved in the change process. Changes may affect risk controls already in place to manage other risks, and therefore change could increase risks in areas that are not immediately obvious.

(c) ***Step 3 Identify hazards*** *related to the change and carry out a safety risk assessment;* this should identify any hazards directly related to the change. The impact on existing hazards and safety risk controls that may be affected by the change should also be reviewed. This step should use the existing organization's SRM processes; (see PNG AC 100-1B: Safety risk management).

Whenever there is change, there are likely to be both opportunities and risks. You should adopt a risk-based approach to planning change. Identify and quantify both opportunities and risks, analysing, evaluating, and reducing risk will minimise the negative impact of change on aviation operations, while maximising potential benefits.

Don't make this process overly complicated. The most important part of the process is having all the people who are likely to be affected by the change, or who can add value to identifying potential risk, in the room to openly discuss the issues.

(d) ***Step 4 Develop an action plan;*** this should define what is to be done, by whom and by when. There should be a clear plan describing how the change will be implemented and who will be responsible for which actions, and the *sequencing* and scheduling of each task;

Developing an action plan will define what is to be done, by whom and when, to ensure the change is implemented in such a way as to maintain or improve safety. There should be a clear plan describing how the change will be implemented and who is responsible for which actions, and the sequence and scheduling of each task. This includes not only the tasks required to implement the change itself but also any safety risk controls you identified in step 3 that would be needed to manage safety risks associated with the change.

The action plan should address the need to manage the change and be developed specifically for your organisation, considering its unique culture and circumstances. The level of detail in the plan will vary with the organisation, how complex the change is, and the number of variables involved.

The critical feature of step 4 is the link back to the hazard identification and risk assessment in step 3. This is achieved by extracting the risk treatment strategies, or risk controls, identified in

the risk assessments, and listing these items as tasks in the action plan. Each task will have a nominated timeline, responsibilities, and resources.

The pace of change and the required momentum also need to be considered in this step. For larger and more complex projects, the change implementation program might need to be maintained over several years.

An action plan must also outline internal implementation, communication strategies and needs to engage all staff. This will give stakeholders confidence that the risks of the change have been considered, and that the risk treatments are being appropriately resourced and managed.

An action plan also provides a documented record of activities, tasks, resources, and performance that can be used as a reference for future change management. Cultural and organisational factors need to be considered to ensure that the change is implemented smoothly and effectively. The key to effective implementation is engagement and communication. Many people in the organisation will want the benefits of the change but will need to be given a high level of confidence or reassurance that the benefits will outweigh the costs.

(e) ***Step 5 Sign off on the change****;* this is to confirm that the change is safe to implement. The individual with overall responsibility and ***authority*** for implementing the change should sign the change plan; and

This step is done to confirm the change is safe to implement. The individual with overall responsibility and authority for implementing the change should sign off on the change plan. However, your accountable manager and safety manager should also sign off on the appropriateness of the risk assessment and action plan steps of the change as well.

During this step you need to be:

- undertaking the tasks and activities in the action plan
- reporting progress to the change owner
- continually communicating with staff and other stakeholders
- reviewing action progress and performance, ensuring risk treatments listed in the risk assessment and action plan have been implemented and are complete.

During this step you should be checking regularly to ensure ongoing deliverables of the action plan are clear, understood, and are being implemented within the timeframes identified.

(f) ***Step 6 Assurance planning and on-going monitoring****;* this is to determine what follow-up action is needed. Consider how the change will be communicated and whether additional activities (such as audits) are needed during or after the change. Any assumptions made need to be tested.

At this step you need to identify what follow-up actions are needed. Consider how the change will be communicated both during implementation and at completion. Identify whether additional activities, such as a systems audit or post implementation review, are needed during and after change implementation.

This step should drive your planning assumptions to be tested to determine if they have held true. Also ensuring that the change is implemented as intended and any other changing circumstances do not alter priorities. Your action plan must be constantly monitored, reviewed, and adjusted where necessary.

A key factor in this step is maintaining communication and consultation with all stakeholders. You need to have a means for receiving feedback from all stakeholders and be monitoring their feedback to determine actions to continuously improve the change implemented and measure the success of actions taken.

The following should be monitored for changes or deviations, with revised actions taken accordingly:

- ***knowledge:*** new factors or information are included
- ***stakeholders***: new stakeholders are included over time and are consulted
- ***communication***: high quality and appropriate methods are used
- ***risks:*** risk treatments are implemented, and new risks are identified, addressed, and managed appropriately
- ***common understanding***: understanding is maintained by all participants

- ***quality of decisions***: decisions are reviewed at all stages
- ***external factors:*** changes in legislation, regulation, and market factors are monitored and taken into account
- ***effectiveness:*** implementation plan is monitored for effectiveness.

Management of Change Checklist

Management of change processes take safety issues into account.	Yes/No
Changes likely to occur in the business which would have a noticeable impact on the following are identified: -Resources - material and human -Management direction - processes, procedures, training -Management control.	Yes/No
The SMS documentation identifies the changes (including human factors issues) that require formal risk management processes.	Yes/No
Management of change utilises existing SMS safety risk management processes to identify hazards and risks that could impact safety.	Yes/No

2.2 EM100.65 SMS Self-Evaluation Tool: Change Management

2.2.1 To help service providers, self-check the maturity and effectiveness of their *Change Management systems*, CASA has provided you with the below Guidance and Checklist using the PSOE acronym from guidance material developed by the Safety Management International Collaboration Group (SM-ICG) and summarized below:

Present (P)	There is evidence that the indicator is clearly visible at all levels of the organisation and is documented within the organisation's SMS manual.
Suitable (S)	There is evidence that the indicator is suitable based on the nature, size and complexity of the organisation and/or the inherent risk in the activity.
Operating (O)	There is evidence that the indicator is in use and an output is being produced
Effective (E)	There is evidence that the indicator is effective and is achieving the desired outcome
Best Practice	Organisations striving to continuously improve their SMS, *may* use the Best Practice indicators to achieve a higher level of safety performance.

2.2.2 Self-Evaluation Checklist for **Change Management** (Required for CASA SMS Acceptance)

	Indicators of compliance and performance		P	S	O	E	How it is achieved	Verification Evidence
Evaluation	2.2.1	The organisation has a process to identify whether changes have an impact on safety and to manage any identified risks in accordance with existing safety risk management processes.						
	2.2.2	Human Factor (HF) issues have been considered as part of the change management process and, where appropriate, the organisation has applied the appropriate HF/human-centred design standards to the equipment and physical environment design.						

Guidance

What to look for

- Key stakeholders are involved in the process.
- Review what triggers the process.
- Review recent changes that have been through the risk assessment process.
- Check that change is signed off by an appropriately authorised person.
- Transitional risks are being identified and managed.
- Review follow up actions such as whether any assumptions made have been validated.
- Review whether there is an impact on previous risk assessments and existing hazards.
- Review whether consideration is given to the accumulative effect of multiple changes.
- Review that business-related changes have considered safety risks (organisational restructuring, upsizing or downsizing, IT projects, etc.).
- Evidence of HF issues being addressed during changes.
- Review impact of change on training and competencies.
- Review previous changes to confirm they remain under control.
- Consider how the changes are communicated to those people impacted by the change.

Present	Suitable	Operating	Effective
The organisation has established a change management process to identify whether changes have an impact on safety and to manage any identified risks in accordance with existing safety risk management processes.	Triggers for the change management process are defined. The process also considers business related changes and interfaces with other organisations/departments. The process is integrated with the risk management and safety assurance processes. Responsibilities and timelines are defined.	The change management process is being used and includes hazard identification and risk assessments with appropriate risk controls being put in place before a decision to make the change is taken. HF issues have been considered and been addressed as part of the change management process.	The change management process is used for all changes that may impact safety, including HF issues, and considers the accumulation of multiple changes. It is initiated in a planned, timely, and consistent manner and includes follow up action that ensures the change was implemented safely. The change is communicated to those affected. Risk control and mitigation strategies associated with changes are achieving the planned effect.

3. EM100.107 CONTINUAL IMPROVEMENT OF THE SMS

3.1 EM100.107 Continuous Improvement of the SMS

3.1.1 Annex 19, Appendix 2, 3.3 requires that "the service provider monitor and assess its SMS processes to maintain or continuously improve the overall effectiveness of the SMS." Maintenance and continuous improvement of the service provider's SMS effectiveness is supported by safety assurance activities that include the verification and follow up of actions and the internal audit processes. It should be recognized that maintaining and continuously improving the SMS is an ongoing journey as the organization itself and the operational environment will be constantly changing.

3.1.2 Internal audits involve assessment of the service provider's aviation activities that can provide information useful to the organization's decision-making processes. The internal audit function includes evaluation of all of the safety management functions throughout the organization.

3.1.3 SMS effectiveness should not be based solely on SPIs; service providers should aim to implement variety of methods to determine its effectiveness, measure outputs as well as outcomes of the processes, and assess the information gathered through these activities.

Such methods may include:

(a) ***Audits*****;** this includes internal audits and audits carried out by other organizations.

(b) ***Assessments*****;** includes assessments of safety culture and SMS effectiveness.

(c) ***Monitoring of occurrences*****:** monitor the recurrence of safety events including accidents and incidents as well as errors and rule-breaking situations.

(d) ***Safety surveys*****;** including cultural surveys providing useful feedback on staff engagement with the SMS. It may also provide an indicator of the safety culture of the organization.

(e) ***Management reviews*****;** examine whether the safety objectives are being achieved by the organization and are an opportunity to look at all the available safety performance information to identify overall trends. It is important that senior management review the effectiveness of the SMS. This may be carried out as one of the functions of the highest-level safety committee.

(f) ***Evaluation of SPIs and SPTs*****;** possibly as part of the management review. It considers trends and, when appropriate data is available, can be compared to other service providers or State or global data.

(g) ***Addressing lessons learnt;*** from safety reporting systems and service provider's safety investigations. These should lead to safety improvements being implemented.

Safety performance management is not intended to be a set and forget process. It is dynamic and should be reviewed and updated routinely based on inputs from safety analyses and in response to major changes in the operation, top risks, or environment.

Monitoring of the safety performance and internal audit processes contributes to your ability to continuously improve safety performance. Ongoing monitoring of the SMS, its related safety risk controls and support systems, assures the organisation that the safety management processes are achieving their desired safety performance objectives.

3.1.4 In summary, the monitoring of the safety performance and internal audit processes contributes to the service provider's ability to continuously improve its safety performance. Ongoing monitoring of the SMS, its related safety risk controls and support systems assures the service provider and the State that the safety management processes are achieving their desired safety performance objectives.

3.2 EM100.105 Management Review

3.2.1 It is important senior management review the effectiveness of the SMS. Your management review should look at all parts of your SMS to make sure they are still relevant and applicable. You need to outline how you are going to review each element of your SMS – safety policy and objectives, safety risk management, safety assurance, and safety promotion – in your SMS manual.

Small organisations should review their SMS at least once a year to ensure that:

- the SMS continues to meet its core safety objectives
- safety performance is monitored against objectives
- identified hazards and safety risks are addressed in a timely and appropriate manner.

3.3 EM100.107 SMS Self-Evaluation Tool: Continual Improvement of the SMS

3.3.1 To help service providers, self-check the maturity and effectiveness of their *Continual Improvement of the SMS systems*, CASA has provided you with the below Guidance and Checklist using the PSOE acronym from guidance material developed by the Safety Management International Collaboration Group (SM-ICG) and summarized below:

Present (P)	There is evidence that the indicator is clearly visible at all levels of the organisation and is documented within the organisation's SMS manual.
Suitable (S)	There is evidence that the indicator is suitable based on the nature, size and complexity of the organisation and/or the inherent risk in the activity.
Operating (O)	There is evidence that the indicator is in use and an output is being produced
Effective (E)	There is evidence that the indicator is effective and is achieving the desired outcome
Best Practice	Organisations striving to continuously improve their SMS, *may* use the Best Practice indicators to achieve a higher level of safety performance.

3.2.2 Self-Evaluation Checklist for **Continual Improvement of SMS** (Required for CASA SMS Acceptance)

Evaluation	**Indicators of compliance and performance**		**P**	**S**	**O**	**E**	**How it is achieved**	**Verification Evidence**
	2.3.1	The organisation is continuously monitoring and assessing its SMS processes to maintain or continuously improve the overall effectiveness of the SMS.						
Guidance	**What to look for** - Review the information and safety data used for management decision making and continuous improvement. - Evidence of: o Lessons learnt being incorporated into SMS and operational processes; o Best practices being sought and embraced; o Surveys and assessments of organisational culture being carried out and acted upon; o Data being analysed and results shared with Safety Committees; and o Follow-up actions. - Information from external occurrences, investigation reports, safety meetings, hazard reports, audits, and safety data analysis all contribute towards continuous improvement of the SMS.							
	Present		**Suitable**				**Operating**	**Effective**
	There is a process in place to monitor and review the effectiveness of the SMS using the available data and information.		The SMS is periodically reviewed, and the review is supported by safety information and safety assurance activities. Senior management and different departments are involved. The decision making is data informed. External information is considered in addition to internal information.				There is evidence of the SMS being periodically reviewed to support the assessment of its effectiveness and appropriate action being taken.	The assessment of SMS effectiveness uses multiple sources of information including the safety data analysis that supports decisions for continuous improvements.