SAFETY PERFORMANCE INDICATORS

1.0 PURPOSE

This Advisory Circular (AC) is issued to provide general information and guidance to service providers on how to identify, establish, and document organisational safety performance indicators and safety performance targets.

2.0 REFERENCES.

2.1 The Civil Aviation (Safety Management) Regulations, 2018 as amended
2.2 ICAO Doc 9859 Safety Management Manual

3.0 GUIDANCE PROCEDURES AND INFORMATION

3.1 Definitions:

- Aacceptable Performance: Is normal expected behaviour and includes unintended errors and some violations or deviations.
- Safety performance: Is a State or a service provider's safety achievement as defined by its targets and safety performance indicators.
- Safety performance indicator. A data-based safety parameter used for monitoring and assessing safety performance.

3.2 The Civil Aviation (Safety Management) Regulations 2018 requires the service providers to develop and maintain a Safety performance monitoring and measurement system. The system as a part of the SMS safety assurance activities is required to establish and maintain the safety performance of the organization in reference to the safety performance indicators and safety performance targets

3.3 Establishing safety performance indicators and safety performance targets requires the service provider to;

(i) Develop an organisation safety data collection and analysis system.
(ii) Establish performance-based monitoring and measurement procedures.

3.4 Safety performance monitoring is verified in reference to the safety performance indicators and safety performance targets of the SMS. It is therefore very important to ensure that realistic, data based and representative safety performance indicators and safety

performance targets are identified, established, documented and monitored. This enables evaluation and validation of the safety risk control system effectiveness.

3.5 Monitoring and measurement of a performance process requires identification of appropriate performance, quality or safety indicators that continuously track and define the desired performance of the operations. The parameters for such performance tracking and definition may be occurrence outcomes, deviations from the procedures, operational event that reflect or present a risk to safety and or quality process levels.

3.6 It is recommended that the data used to track safety system performance is presented as occurrence rates rather than absolute numbers. Alert as well as desired improvement, target levels should be set for each indicator, as applicable. These serve as markers to define what is the abnormal/unacceptable occurrence rate as well as the desired target (improvement) rate for the indicator.

3.7 The alert level setting will effectively serve as the demarcation line between the acceptable trending region and the unacceptable region for a safety performance indicator. So long as the occurrence rate for a process does not trend beyond or breach the set alert level criteria, the number of such occurrences is deemed to be acceptable (i.e. not abnormal) for that monitoring period. On the other hand, the aim of performance targeted improvement level is to achieve the desired improvement level within a defined future milestone or monitoring period. With such defined alert and target settings, it becomes apparent that a qualitative/quantitative performance outcome can be derived at the end of any given monitoring period.

3.8 The Service Provider Safety Performance Chart below illustrates the recommended presentation format of a service provider: SMS Safety Performance Indicators/Alert Level Criteria/ Safety Targets Criteria for the occurrence / outcome based on the left and the event / activity based on the right. It is clearly shown that the SMS safety performance effective functioning is dependent on data, therefore, the importance of continuous collection and analyzing of safety information and the update of safety data bank cannot be over emphasized.

Table 1: Service Provider Safety Performance Chart

Service Provider SMS safety performance indicators						
High-consequence indicators (occurrence/outcome-based)				**Lower-consequence indicators (event/activity-based)**		
	Safety performance indicator	***Alert level criteria***	***Target level criteria***	***Safety performance indicator***	***Alert level criteria***	***Target level criteria***
	Individual fleet monthly serious incident rate (e.g. per 1000 FH)	Average + 1/2/3 SD (annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate	Combined fleet monthly incident rate (e.g. per 1000 FH)	Average + 1/2/3 SD (annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate
	Air operator combined fleet monthly serious incident rate (e.g. per 1000 FH)	Average + 1/2/3 SD (annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate	Operator internal QMS/SMS Annual audit LEI % or findings rate (findings per audit)	Consideration	Consideration
	Air operator engine IFSD incident rate (e.g. per 1 000 FH	Average + 1/2/3 SD (Annual or 2 yearly reset	__% (e.g. 5%) improvement between each annual mean rate	Operator voluntary hazard report rate (e.g. per 1 000 FH))	Consideration	Consideration

TABLE 1A. EXAMPLES OF SAFETY PERFORMANCE INDICATORS FOR AIR OPERATORS

SMS safety performance indicators (individual service provider)					
High-consequence indicators (occurrence/outcome-based)			Lower-consequence indicators (event/activity-based)		
Air operators (air operators of the United Republic of Tanzania)					
Safety performance indicator	**Alert level criteria**	**Target level criteria**	**Safety performance indicator**	**Alert level criteria**	**Target level criteria**
Air operator individual fleet monthly serious incident rate (e.g. per 1 000 FH)	Average + 1/2/3 SD (Annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate	Operator combined fleet monthly incident rate (e.g. per 1 000 FH)	Average + 1/2/3 SD (Annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate
Air operator combined fleet monthly serious incident rate (e.g. per 1 000 FH)	Average + 1/2/3 SD (Annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate	Operator internal QMS/SMS annual audit LEI % or findings rate (findings per audit)	Consideration	Consideration
Air operator engine IFSD incident rate (e.g. per 1 000 FH)	Average + 1/2/3 SD (Annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate	Operator voluntary hazard report rate (e.g. per 1 000 FH)	Consideration	Consideration
			Operator DGR incident report rate (e.g. per 1 000 FH)	Average + 1/2/3 SD (Annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate

TABLE 1B. EXAMPLES OF SAFETY PERFORMANCE INDICATORS FOR AERODROME OPERATORS

Aerodrome operators					
Safety performance indicator	**Alert level criteria**	**Target level criteria**	**Safety performance indicator**	**Alert level criteria**	**Target level criteria**
Aerodrome operator quarterly ground accident/serious incident rate — involving any aircraft (e.g. per 10000 ground movements)	Average + 1/2/3 SD (Annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate	Aerodrome operator internal QMS/SMS annual audit LEI % or findings rate (findings per audit)	Consideration	Consideration
Aerodrome operator quarterly runway excursion incident rate — involving any aircraft (e.g. per 10 000 departures)	Average + 1/2/3 SD (Annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate	Aerodrome operator quarterly runway foreign object/debris hazard report rate (e.g. per 10 000 ground movements)	Consideration	Consideration
Aerodrome operator quarterly runway incursion incident rate — involving any aircraft (e.g. per 10 000 departures)	Average + 1/2/3 SD (Annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate	Operator voluntary hazard report rate (per operational personnel per quarter)	Consideration	Consideration
			Aerodrome operator quarterly aircraft ground foreign object damage incident report rate — involving damage to aircraft (e.g. per 10000 ground movements)	Average + 1/2/3 SD (Annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate

TABLE 1C. EXAMPLES OF SAFETY PERFORMANCE INDICATORS FOR ANS PROVIDERS

ANS Providers					
Safety performance indicator	**Alert level criteria**	**Target level criteria**	**Safety performance indicator**	**Alert level criteria**	**Target level criteria**
ATS provider quarterly FIR serious incident rate — involving any aircraft (e.g. per 100 000 flight movements)	Average + 1/2/3 SD (Annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate	ATS provider quarterly FIR TCAS RA incident rate — involving any aircraft (e.g. per 100 000 flight movements)	Average + 1/2/3 SD (Annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate
ATS provider quarterly/annual near-miss incident rate (e.g. per 100 000 flights movements)	Assuming the historical annual average rate is 3, the possible alert rate could be 5.	Assuming the historical annual average rate is 3, the possible target rate could be 2.	ATS provider quarterly FIR level bust (LOS) incident rate — involving any aircraft (e.g. per 100 000 flights movements)	Average + 1/2/3 SD (Annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate
			ATS provider internal QMS/SMS annual audit LEI % or findings rate (findings per audit)	Considera tion	Consideration

TABLE 1D. EXAMPLES OF SAFETY PERFORMANCE INDICATORS FOR MAINTENANCE, PRODUCTION AND DESIGN ORGANIZATIONS (DOA/POA/MRO)

DOA/POA/MRO					
Safety performance indicator	**Alert level criteria**	**Target level criteria**	**Safety performance indicator**	**Alert level criteria**	**Target level criteria**
MRO/POA quarterly rate of component technical warranty claims	Average + 1/2/3 SD (Annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate	MRO/POA/DOA internal QMS/SMS annual audit LEI % or findings rate (findings per audit)	Consideration	Consideration
POA/DOA quarterly rate of operational products which are the subject of ADs/ASBs (per product line)	Consideration	Consideration	MRO/POA/DOA quarterly final inspection/testing failure/rejection rate (due to internal quality issues)	Consideration	Consideration
MRO/POA quarterly rate of component mandatory/major defect reports raised (due to internal quality issues)	Consideration	Consideration	MRO/POA/DOA voluntary hazard report rate (per operational personnel per quarter)	Consideration	Consideration

The Service Provider Safety Performance Chart above, is an example of high consequence SMS safety performance indicators of an airline operator's reportable/mandatory incident rate. On the left is the preceding year's performance, while the chart on the right is the current year's ongoing data updates.

The alert level setting is based on basic safety metrics standard deviation criteria. The Excel spreadsheet formula is "= STDEVP".
For the purpose of manual standard deviation calculation, the formula is:

$$\sigma = \sqrt{\frac{\Sigma\,(x-\mu)^2}{N}}$$

Where: “x” is the value of each data point; “N” is the number of data points and “μ” is the average value of all the data points.

3.9 The initial safety system design is based on three fundamental assumptions:

i) The technology available to achieve the service provider production goals.
ii) The people and their level of training to properly operate the technology, and
iii) The regulations and procedures to control and dictate the system and human behaviour.

These assumptions underlie the baseline of system to perform as designed. In reality, however, operational performance is different from baseline performance as a consequence of real-life operations and changes in the operational and regulatory environment. Since the drift is a consequence of daily practice, it is referred to as a “practical drift” i.e. the gradual departure from an intended course due to external influences. The causes of the drift should be monitored and controlled hence the need to collect safety information, analysing it, setting safety performance indicators, targets and alerts as discussed above.

3.10 The analysis methods used to continuously monitor safety performance should be in the form of a periodic data extraction to generate a trend chart or graph, updated on a monthly or quarterly basis as shown in the **C**ontinuous Monitoring Safety Indicator Chart below. This data chart provides information on the monthly reportable incident rate, taking into consideration the number of accumulated flying hours (FH) for the operator’s fleet. A periodic (monthly) upload of the incident rate data will then allow the chart to serve as a continuous trend monitoring indicator. Once such a continuous trend monitoring indicator chart is in place, the next step is to transform it into a safety performance measurement indicator by setting target and alert levels which are the basis for setting or defining unacceptable alert trend levels as well as any desired targeted improvement level to be achieved within a specified period. This may be done by counting the number of alert breaches and/or the number of targets achieved for an individual indicator and/or a package of safety indicators.

3.11 When establishing SPIs service providers should consider:

3.11.1 **Measuring the appropriate parameters:** Determine the best SPIs that will show the organization is on track to achieving its safety objectives. Also consider what are the biggest safety issues and safety risks faced by the organization and identify SPIs which will show effective control of these. The SPIs can be generated from the organizational systemic factors, operational or related external factors

3.11.2 **Availability of safety data and safety information**: Is there data and information available which aligns with what the organization wants to measure? If there isn’t, there may be a need to establish additional data collection sources. For small organizations with limited amounts of data, the pooling of data sets may also help to identify trends. This may be supported by industry associations who can collate safety data from multiple organizations.

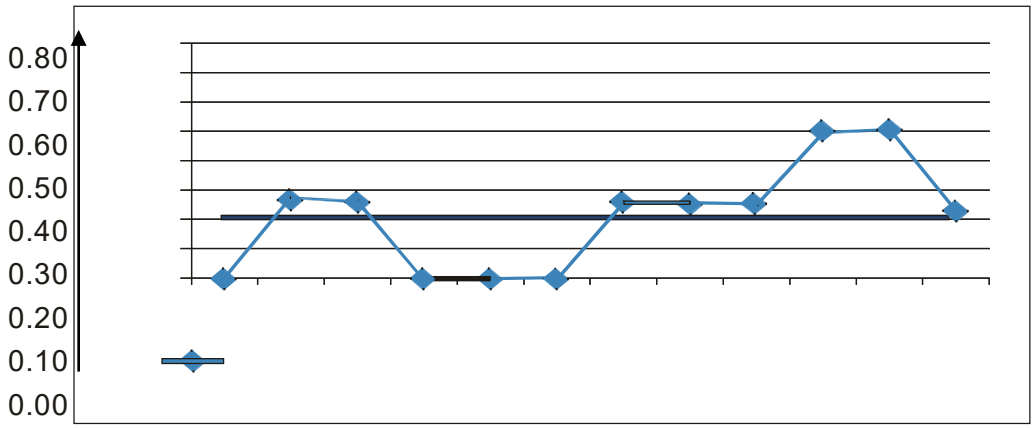
3.11.3 **Reliability and integrity of the data**: Data may be unreliable either because of its subjectivity or because it is incomplete.

3.11.4 **Common industry SPIs:** It may be useful to agree on common SPIs with similar organizations so that comparisons can be made between organizations. The regulator or industry associations may enable these.

3.12 The Safety performance targets (SPTs) define short-term and medium-term safety performance management desired achievements. They act as “milestones” that provide confidence that the organization is on track to achieving its safety objectives and provide a measurable way of verifying the effectiveness of safety performance management activities. SPT setting should take into consideration factors such as the prevailing level of safety risk, safety risk tolerability, as well as expectations regarding the safety of the particular aviation sector. The setting of SPTs should be determined after considering what is realistically achievable for the associated aviation sector and recent performance of the particular SPI, where historical trend data is available.

3.13 The combination of safety objectives, SPIs and SPTs working together should be SMART, to allows the organization to more effectively demonstrate its safety performance. There are multiple approaches to achieving the goals of safety performance management, especially, setting SPTs. One approach involves establishing general high-level safety objectives with aligned SPIs and then identifying reasonable levels of improvements after a baseline safety performance has been established. These levels of improvements may be based on specific targets (e.g. percentage decrease) or the achievement of a positive trend. Another approach which can be used when the safety objectives are SMART is to have the safety targets act as milestones to achieving the safety objectives. Either of these approaches are valid and there may be others that an organization finds effective at demonstrating their safety performance. Different approaches can be used in combination as appropriate to the specific circumstances.

TABLE 2: A CONTINUOUS MONITORING SAFETY INDICATOR CHART



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