Civil Aviation Authority of Nepal

Advisory Circular 13/2020			
Subject:	**FLIGHT CREW PROFICIENCY** **Guidance for air operators in utilizing safety trend information to address LOC-I events through performance based training**		
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1.0 INTRODUCTION

1.1 Purpose

This document was written to provide background information and guidance material for Air Operators that intends to develop and establish performance based flight crew training program using their own aggregate and safety trend information, specifically with regard to mitigating LOC-I events.

1.2 Applicability

This document is intended to provide guiding principal to Air Operators of aeroplanes with maximum certified take-off mass in excess of 27,000 kg, in the development, implementation and management of an effective performance based training utilizing safety trend information to address LOC-I events. The scope covers hazard identification and risk management in relation to LOC-I events, determination of Safety Performance Indicator and Targets, evaluation and monitoring of the training performance outcome.

1.3 Description of Changes

Not Applicable

2.0 REFERENCES

2.1 Reference Documents

a) ICAO Annex 19, Safety Management, 1st Edition, June 2013
b) ICAO Doc 9859, Safety Management Manual, Third Edition, 2013
c) IOSA Standards Manual, Edition 10 Revision 1, September 2016
d) IATA Loss of Control In-Flight Accident Analysis Report, 2010-2014, 1st Edition
e) FOR (A) Chapter 9, para 9.3.1

2.2 Cancelled Documents

Not Applicable

2.3 Definitions and Abbreviations

Acceptable Level of Safety Performance (ALoSP). The minimum level of safety performance of civil aviation in a State, as defined in its State safety program, or of a service provider, as defined in its safety management system, expressed in terms of safety performance targets and safety performance indicators.

Flight Data Analysis Program (FDAP). A process of analyzing recorded flight data in order to improve safety of flight operations. (ICAO annex 6 – Operations of aircraft)

Loss of Control-Inflight (LOC-I). The definition of LOC-I as stated in the IATA Safety Report is "Loss of Aircraft Control While In-Flight". This includes events such as aerodynamic stalls and upset following failures of aircraft systems. Loss

of control in-flight is an extreme manifestation of a deviation from intended flight path. LOC-I accidents often result from failure to prevent or recover from stall and upset. (Refer Appendix A for causal factors to LOC-I)

Operator means a person, organization or enterprise engaged in or offering to engage in an aircraft operation.

Risk Mitigation. The process of incorporating defenses or preventive controls to lower the severity and/or likelihood or a hazard's projected consequence.

Safety Management System (SMS). A systematic approach to managing safety, including necessary organizational structures, accountabilities, policies, and procedures.

Safety Performance. A State's or service provider's safety achievement as defined by its safety performance target and safety performance indicators.

Safety Performance Indicator (SPI). A data-based safety parameter used for monitoring and assessing safety performance.

Safety Performance Target (SPT). Define the required level of safety performance of a system.

Safety Risk. The predicted probability and severity of the consequence or outcome of a hazard.

3.0 BACKGROUND

Operators and Regulators alike are placing increased emphasis on performance-based methods and performance-based compliance to regulation. Such mechanisms allow for greater operational flexibility without degrading the safety performance of an operational activity. This presumption is primarily dependent on the presence of specific organizational and operational capabilities, the results of safety risk management activities and the determination of acceptable standards of safety performance.

In order to establish an effective performance-based methodology and performance-based compliance program to address risks, Operators must possess the requisite knowledge, skills, experience, processes including: resources and technologies necessary to implement and oversee the many systems and processes required to support performance-based compliance.

a) The development of policy and procedure.
b) The staffing of positions with an appropriate number of qualified personnel.
c) Training to the operator's policy and procedure and to ensure personnel remain competent and qualified.
d) Implementation or the demonstration of performance in accordance with policy and procedure.
e) Data reporting, measurement and analysis for the purpose of monitoring the effectiveness and efficiency of systems, processes, policies and/or procedures.

f) An adjustment component or subsystem to respond to any underperformance or deviation and for the purpose of continuous improvement.

4.0 INFORMATION MANAGEMENT

Not applicable

5.0 DOCUMENT HISTORY

Not applicable. This is original issue.

6.0 OPERATOR'S RESPONSIBILITY

This Circular shall apply to all operators of aeroplanes of a maximum certified take-off mass in excess of 27,000kg.

(i) Operators should ensure that their training and qualification processes utilize trend information from Flight Data Analysis (FDA), Safety Reports, LOSA, internal audits, and other safety performance monitoring tools prescribed under SMS, to mitigate the risk of a LOC-I incident.

(ii) The Operator should have processes for setting performance measurement as a means to monitor the operational safety performance of the organization and to validate the effectiveness of safety risk controls.

(iii) The operator should establish a program to identify and monitor events leading to LOC-I with the aim of developing specific Safety Performance Indicator (SPI) and its corresponding Safety Performance Target (SPT). These elements should be used in the development of a performance based training program to address LOC-I.

(iv) The operator should establish a safety performance working group to provide an on-going monitoring and periodic review of the LOC-I Safety Performance Indicator (SPI) and Safety Performance Target (SPT).

(v) The selection and effectiveness of the LOC-I Safety Performance Indicator (SPI) and its corresponding Safety Performance Target (SPT) remain the responsibility of the operator, with concurrence from the CAAN.

(vi) The effectiveness of the flight crew proficiency training using data derived from FDAP and other safety performance monitoring tools related to SMS should be periodically reviewed by the operator, and subjected to periodic regulatory oversight.

7. IMPLEMENTATION

7.1 STEP 1: Develop policy and procedure in regard to effective implementation of performance based training.

Development of policy and procedures on the use of FDA and other non-punitive safety data for the purpose of enhancing flight crew proficiency should be carried out appropriately.

7.2 STEP 2: Ensure that the Safety practitioner responsible for the management of aggregate data for the purpose of providing performance based training information is adequately trained and qualified.

The operator shall set the criteria for selection of the personnel required to lead and manage the program.

The safety personnel should be trained with respect to analyzing data and providing recommendation for the training department, based on the information gathered from FDA and other aggregate safety reporting.

7.3 STEP 3: Gather data from all safety programs and audits with regard to LOC-I.

This can be achieved by having a systematic data acquisition and monitoring program established through Flight Data Monitoring (FDM), Air Safety Reports, Audit reports and other means of acquiring trend data, including the use of integrated safety database.

Integrated Safety Database

In addition to having a basic database to capture and archive safety information is essential for the conduct of safety performance analysis on LOC-I events, greater benefit can be realized by linking the existing safety database within the organization such as database for air safety reports, FDA, audit reports, investigation findings, etc., in order to provide integrated analysis of events or lead indicators to incidents or accidents.

This integration of all available sources of safety data provides the organization viable information on the overall safety health of the operation, including prevention of LOC-I events.
For example, failure to extend landing flaps during an approach may be captured by:

a. Air safety report submitted by the flight crew
b. FDA event captured
c. Engineering report

In this instance, the crew report provides the context, the FDA event provides the quantitative description, and the engineering report provides in depth technical information of the defect and the rectification performed.

Alternatively, safety information can be obtained from individual department and resources in the absence of an integrated safety database.

7.4 STEP 4: Develop flight safety analysis program focusing on identification of hazards related to LOC-I events.

A primary function of flight safety analysis program is hazard identification supported by data analysis capability, which is an element of Safety Risk Management component of SMS.

Hazard identification and risk management is a prerequisite to establishing a performance based training. Information gathered from safety database is evaluated to identify hazards and its associated risks related to LOC-I events, particularly those hazards that are deemed to be contributors factors to LOC-I incidents or accidents. Among the LOC-I indicators that are available from Flight Data Analysis Program (FDAP) include: high pitch rate, dual input, thrust asymmetry, excessive bank angle, early configuration change, flight control malfunction, windshear, and others.

Following identification of hazard, the next step is to perform a risk assessment for each of the hazards using a risk matrix in relation to the likelihood and severity of the consequence of the risk related. Typically, a 5 x 5 risk matrix is used (as shown below), although there are several variations that are available such as 4 x 4 and 3 x 3 matrix. The matrix selected will depend upon the size and complexity of the organization and the risks being assessed.

Likelihood \ Impact	Negligible	Minor	Moderate	Significant	Severe
Very Likely	Low Med	Medium	Med Hi	High	High
Likely	Low	Low Med	Medium	Med Hi	High
Possible	Low	Low Med	Medium	Med Hi	Med Hi
Unlikely	Low	Low Med	Low Med	Medium	Med Hi
Very Unlikely	Low	Low	Low Med	Medium	Medium

Diagram 1: Risk Matrix

Note: Information on the method of performing risk assessment is covered extensively in ICAO Document 9859.

Determination of the level of risk provides the air operator guidance with regard to the allocation of resources and the priority accorded to eliminate or mitigate the risks identified.

A mitigation is an action taken to reduce the risk of exposure to a hazard. Based on System Safety Science, once a hazard is identified the priority for addressing the hazard should be:

a. Hazard elimination (intrinsic safety)
b. Hazard reduction
c. Hazard control
d. Damage reduction

Hazard and risk management will require a pragmatic approach and will require conducting realistic or credible and plausible appraisals of the hazards and associated risks faced by the air operator's operational activities (See figure below). A common approach may be applied but the hazards, risks and mitigation may vary due to the operating equipment, type of operation, and operating environment including supporting infrastructure.

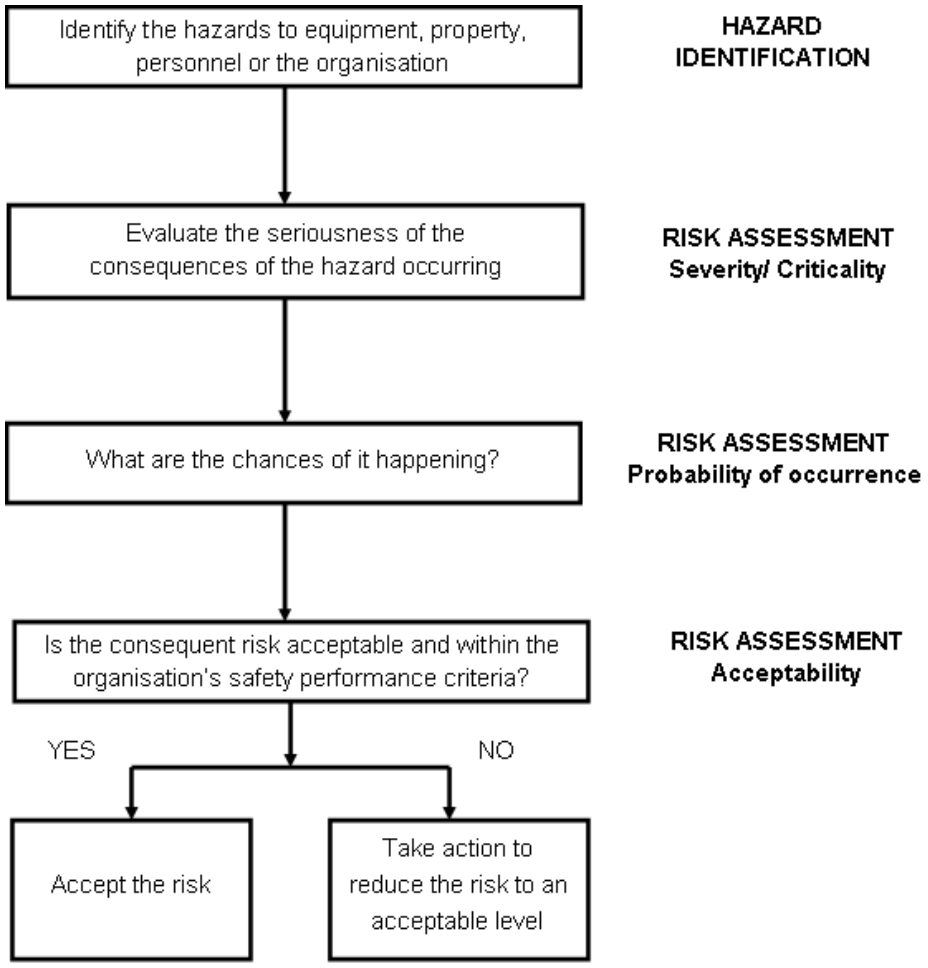


Diagram 2: Risk Assessment Process

For aircraft loss of control, hazard elimination is a desirable but difficult-to-reach goal, given the nature of performance demands in atmospheric flight. Thus, research should focus on hazard reduction, hazard control, and damage reduction.

Prevention of loss of control events are more important strategies when compared to recovery based mitigations, however, development of recovery-based mitigations are also required in order to ensure complete coverage when "breaking the chain" of events in a loss of control scenario.

Onboard systems that eliminate, or protect the aircraft from entering a loss of control scenario are most effective. Avoidance and detection of loss of control events should not be limited to real-time, onboard systems, but should include data mining of incident reports, accidents reports, and flight operations quality assurance data to identify trends and conditions that lead

to loss of control so that the precursors may be eliminated or minimized. Continued diligence by operational, research, and regulatory organizations is required in order to improve aviation safety record.

Another technique commonly employed by air operators in risk assessment is the Bowtie methodology. It is described as a risk evaluation method that can be used to analyze and demonstrate causal relationships in high risk scenarios. Taking its name after the shape of diagram which looks like a man's bowtie, the methodology serves to provide a visual summary of all plausible accident scenarios that could exist around a certain hazard, while it identifies the control measures that are put in place to mitigate the consequence of the hazard. (See diagram below)

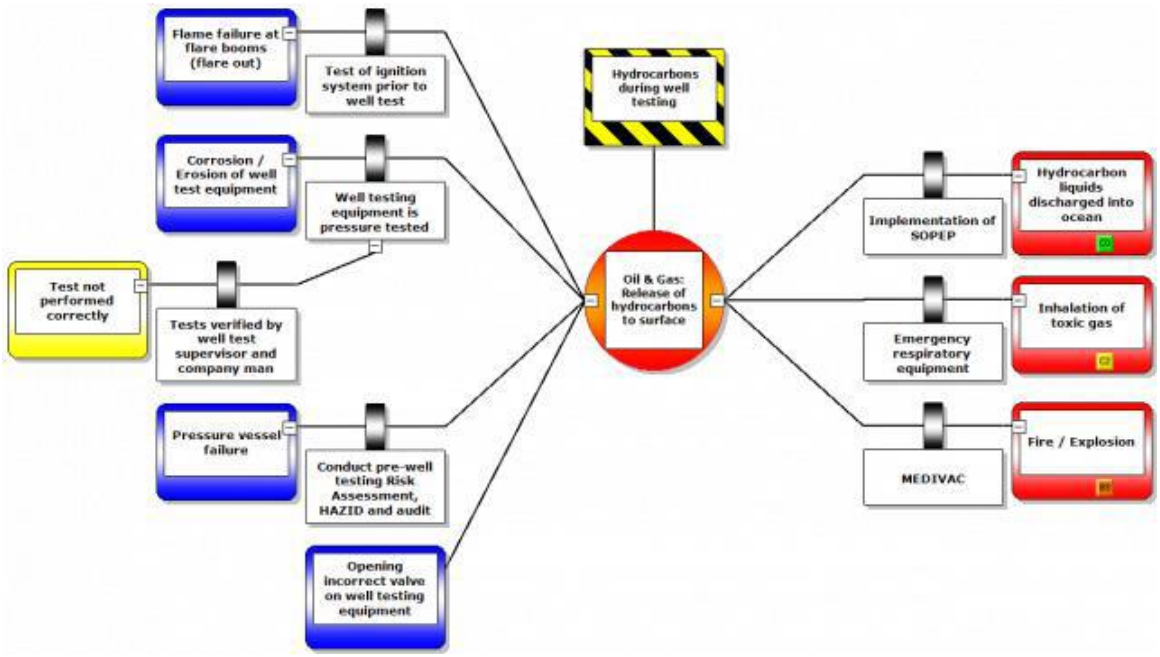


Diagram 3: Bow Tie Sample

The bowtie application may be integrated with organization's management system to provide an overview of the activities that keeps the control working and the persons responsible over the controls.

Ultimately, the risk management system established within the organization must be capable of identifying and addressing the current operational and systemic issues, as well as detecting any emerging risks that would affect safety of operations.

7.5 STEP 5: Development of Safety Performance Indicator (SPI) and setting of Safety Performance Target (SPT) by air operator.

Performance based safety management is dependent on having safety indicators that are monitored using basic quantitative data trending tools that can generate graphs and charts that incorporate alerts/targets. The safety indicators consist of high (accidents and serious

incidents) and low consequence events as hazard reports, audits findings, FDA, safety observations and others. Low consequence events are sometimes termed 'proactive/predictive' indicators.

SPTs which define long term safety performance objectives, are expressed in numerical terms (absolute or relative value) and must be concrete, measurable, acceptable, reliable, relevant and contain timeline (milestone) for completion. When setting the targets, consideration should be given into factors such as applicable level of safety risk, the cost and benefits attached to the expected safety improvement, and achievability of the set target, with reference to recent historical performance of that particular safety indicator, industry standards, regulatory requirement as well as expert opinion.

A corresponding alert level is identified for each SPI, quantifying the acceptable and unacceptable performance threshold during a specific monitoring period. The use of objective data-based criteria for setting alert levels is essential to facilitate consistent trending or benchmark analysis.

In general, the use of population standard deviation (STDEVP) provides a basic objective method for setting alert criteria, the method derives the standard deviation (SD) value based on the preceding historical data points of a given safety indicator. This SD value plus the average (mean) value of the historical data set forms the basic alert value for the next monitoring period. The SD principal (a basic MS Excel function) sets the alert level criteria based on the actual historical performance of the given indicator, including its volatility (data point fluctuations). Guidance on SPI, SPT and alert level setting using SD criteria is provided in ICAO Doc 9859 Safety Management Manual.

Risk Ref	Safety Performance Indicator	Source	Target	YTD 2016 Performance	Rating	B/Threshold (1)	Threshold (2)	On Target (3)	Exceeding (4)	Outstanding (5)
A-02	[redacted]									
	[redacted]	FDA	4-6	10	1	>9	7-9	4-6	2-3	1
	[redacted]	ASR	2-3	0	5	>5	4-5	2-3	1	0
	[redacted]	ASR	2-3	1	4	>5	4-5	2-3	1	0
	[redacted]	ASR	2-3	2	3	>5	4-5	2-3	1	0
	[redacted]	ASR	5-6	7	2	>8	7-8	5-6	3-4	<3

Diagram 4: Safety Performance Indicator and Target

7.6 STEP 6: Establish and maintain a flight data analysis program (FDAP) as part of its Safety Management System, in addition to maintaining an effective open reporting system.

A flight data analysis program shall be non-punitive and contain adequate safeguards to protect the source(s) of the data. In addition, having an open reporting initiatives supported by "Just Culture" principals, is aimed at identifying and managing potentials hazards and risks associated with on-going aviation activities. They serve as a useful tool to ensure

sufficient information is available to make appropriate decisions and operational controls with regard to managing emerging safety threats. This is achieved by offering the ability to track and evaluate flight operations trends, identify risk precursors, and taking appropriate remedial action.

The parameters analyzed on FDA framework should reflect elements that could contribute towards of LOC-I event.

The de-identified data is processed in accordance with the flow chart shown below:

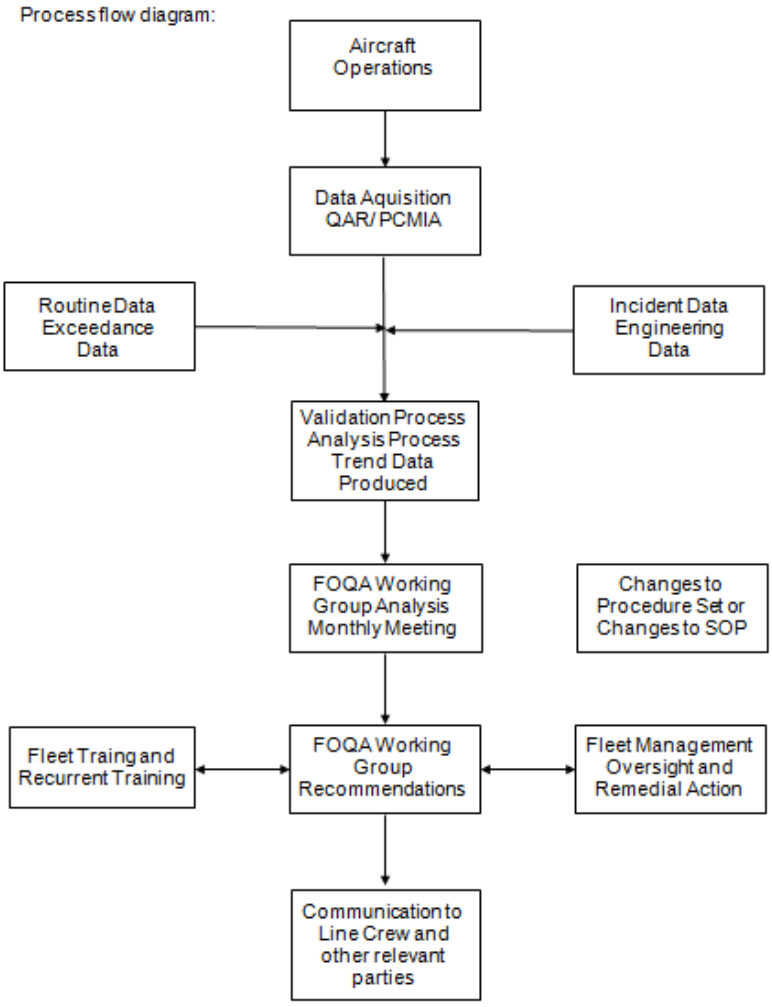


Diagram 5: FDM Process Flow

7.7 STEP 7: Analyze collected data to identify events leading to an LOC-I.

Based on the analysis of data collected, lead indicators to LOC-I event could be identified from the list of probable cause outlined (human, system and environmentally induced), FDA outputs, safety/audit reports, investigation findings, and others, which may be translated into Safety Performance Indicator (SPI). The corresponding Safety Performance Target (SPT) value can be developed based on quantification of its potential outcome, taking into consideration the risk factors identified for each of the elements. These include applying various combinations of high/low probability against severity of occurrence, as prescribed by

the Safety Risk Assessment Matrix, to formulate the appropriate target in relation to past performance, industry standards or regulatory requirement. This provides the basis for the Operator to develop/design specific LOC-I training enhancements.

An alert level can be set prior to reaching the target limit, in order to provide early notification to Training Department of the imminent risks and to initiate enhancement program to improve on related flight crew proficiency.

This analysis of LOC-I related safety data, identification of SPI and setting of SPT and the corresponding alerts should be undertaken by the SMS Integrated Working Group who will be the subject matter experts in the related field.

7.8 STEP 8: Develop and design LOC-I enhancement training specifically in preventing LOC-I events, identification of impending LOC-I and recovery.

From the trend analysis and safety reports, areas of greater safety concern can be identified and the training department will be notified to develop a safety action plan to address the impending unsafe concerns identified. The training department will then notify the working group of the action plans, and on agreement between both parties, implement the training program which shall be accomplished within a period of 6 months (proficiency check intervals).

Simultaneously, the training department shall incorporate such specific training curricula in the training syllabus and the relevant operations manual in concurrence with the manufacturer. Emphasis must also be given in developing training program in the prevention of LOC-I incidents through a more effective flight path monitoring function.

7.9 STEP 9: Deliver the enhanced LOC-I training through both simulator training and appropriate literature.

Once established, the training curricula will be incorporated in the Part D of the Operations Manual approved by the regulator, which will then be referenced for the proper conduct of the training and qualification. The delivery method shall include the use of simulator, computer based training (CBT) or literatures highlighting the safety event and the follow up action established. Appropriate revisions and syllabus enhancement may be referenced from lessons learned both internally and from other operators around the globe.

The simulator used in the conduct of LOC-I training must be suitably programmed and capable of simulating possible scenarios or conditions that can lead to this specific event. In this respect, consultation with the aircraft and simulator manufacturer is crucial in the development of appropriate simulator training program, whilst ensuring that the flight instructors are suitably trained and qualified to conduct the relevant training.

The operator may incorporate this into Evidence Based Training (EBT) Program.

7.10 STEP 10: Monitor the effectiveness of the training program through quality assurance program.

Internal audits and Safety Assurance Program should be established to monitor the effectiveness of the performance-based training in achieving the required safety objective. Operators should develop or propose specific LOC-I training enhancement performance indicator to facilitate effective assessment of the training program.

7.11 STEP 11: Review and modify the training program to meet overall safety performance.

In the event that a short fall in training and safety performance in the areas relating to LOC-I is evident, it is necessary to conduct an immediate review of the process involved to ascertain whether the prescribed safety action plan is indeed effective and appropriate to realize the desired outcome. If this cannot be accomplished, a new or updated follow up plan must be executed and subsequently monitored for any deviation from the required target.

Refer Appendix B for the Data Integration and Safety Performance Enhancement Process flow chart.

Refer Appendix C for the Checklist for Implementation of Performance Based Methodology for Flight Crew Training Enhancement.

Appendix A

The causal and contributory factors to loss of control events with reference to individual categories are illustrated in the following. The list is not in the order of risk priority.

1. Pilot or human-induced

a. Improper training
b. Poor energy management
c. Changing pilot skill base
d. Spatial disorientation
e. Poor pilot awareness
f. Distraction
g. Automation confusion or mode confusion
h. Automation and human factors
i. Improper procedure
j. System integration issues (complexity, interdependencies and lack of standard interfaces)
k. Pilot actions leading to destabilized approaches
l. Faulty loading or shifting of cargo
m. Incompetence

2. Environmentally-induced

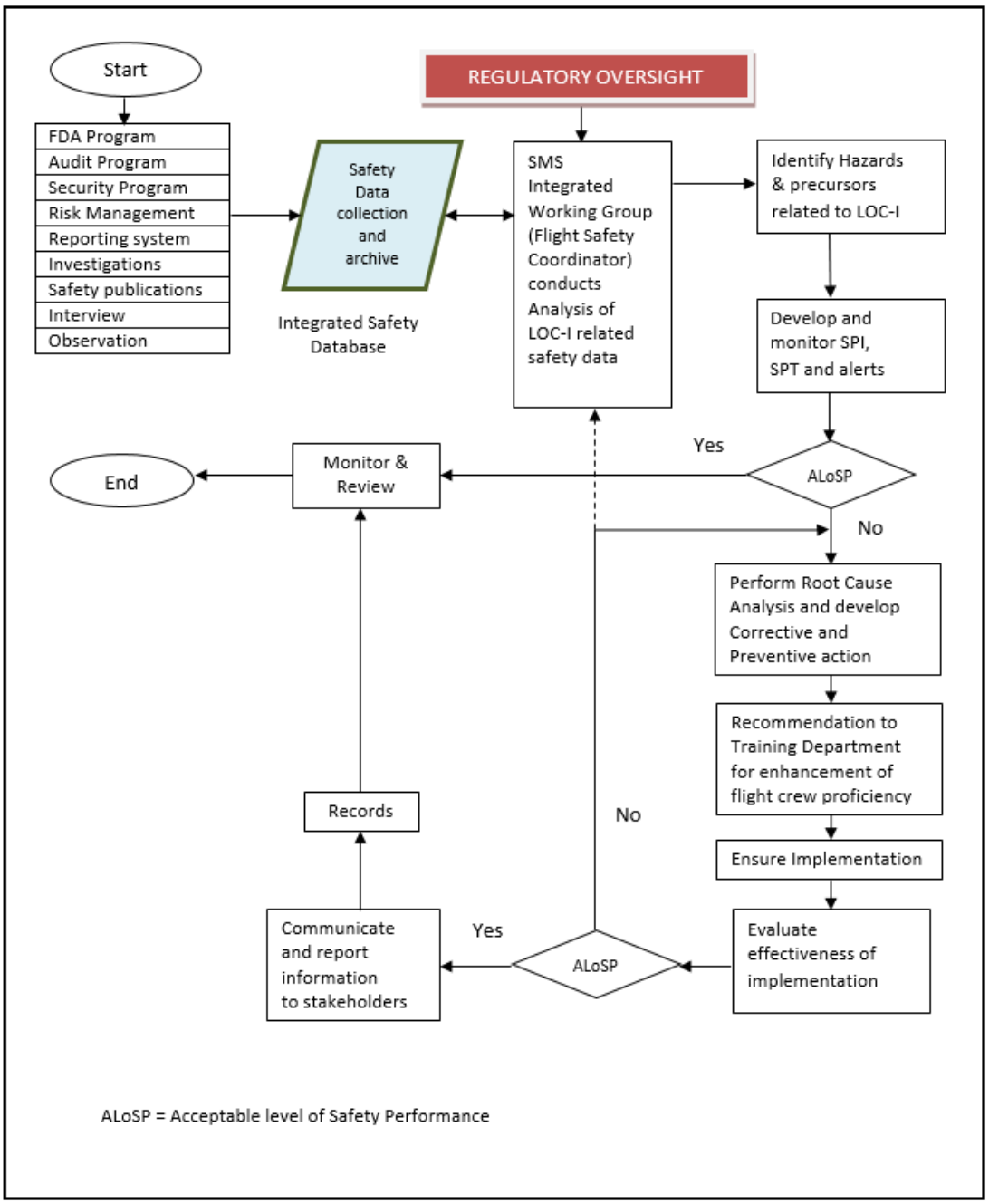
a. Weather (turbulence, icing, adverse winds, wind shear)
b. Wake vortices
c. Hail leading to loss of control (engine performance)
d. Visibility degradation
e. Foreign object damage (hail, bird strike, volcanic ash)

3. Systems-induced

a. Poor design
b. Poor energy management (systems-induced)
c. Propulsion related (asymmetric thrust, energy management)
d. Erroneous sensor data
e. Air traffic operations leading to destabilized approaches
f. Loss of control power, authority, or effectiveness
g. Aircraft system failures (non-propulsion and propulsion)
h. Faults or failures or damage of or to any or all of the aircraft control effectors
i. Pilot-induced oscillation (PIO)

Appendix B

Data Integration and Safety Performance Enhancement Process - SMS Working Group (headed by Flight Safety Coordinator)



Appendix C

Checklist for Implementation of Performance Based Methodology for Flight Crew Training Enhancement

Item	Question	Response	Reference	Remarks
1.1	Are there regulations in place with regard to establishment of performance based training relating to LOC-I events for the State?			
1.2	Are there specific regulations which provides a standardized operational procedures, equipment, and infrastructures (including safety management and training system), in conformance with the Standard and Recommended Practices (SAPRs) contained in the Annexes to the Convention on International Civil Aviation?			
1.3	Has the operator established the following safety programs:			
	a. Safety Management System			
	b. Flight Data Analysis			
	c. Open Reporting			
	d. Audit program			
	e. Flight Crew Training program			
	f. Flight Monitoring program			
	g. Engineering & Maintenance program			
	h. Communication and coordination program			
	i. Operating manual revision and updating processes and procedure			
	j. Cargo packing loading, weight and balance program/processes			
	k. Equipment reliability program			
	l. Weather monitoring and reporting system			
	m. Security program			
1.4	Does the organization have an integrated safety database? Alternate means of compliance include obtaining data from individual operational units.			
1.5	Are the participants in the safety working group:			
	a. Suitably qualified			
	b. Knowledgeable			
	c. Skilled			
	d. Experienced			
	e. Have attended the relevant training			

Item	Question	Response	Reference	Remarks
1.6	Does the organization have a process for data analysis?			
1.7	Is the safety working group independent of any management influence?			
1.8	Does the policy provide authority to the working group to ensure that all recommendations by the working group shall be implemented?			
1.9	Does the State have an oversight program with regard to performance based methodology?			
2.0	Does the operator have an internal audit or inspections program with regard to performance based methodology to ensure that the organization continues to meet the established requirement and functions at the level of competency and safety required by the State?			
2.1	Does the operator have an escalation process to Board of Safety and Security to address immediate high risk and long standing issues?			

8.0 CONTACT OFFICE

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Suggestions for amendment to this document are invited, and should be submitted to:

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