GUIDANCE ON HAZARD IDENTIFICATION

1.0 PURPOSE

This Advisory Circular (AC) provides guidance to Approved Training Organizations (ATO) on hazard identification.

2.0 REFERENCES.

2.1 The Civil Aviation (Safety Management) Regulations, 2018 as amended
2.2 ICAO Doc 9859 Safety Management Manual
2.3 ICAO Doc 4444 PANS ATM
2.4 ICAO Doc 9981 PANS Aerodromes

3.0 BACKGROUND

In the implementation of SMS, ATO is required to develop and maintain a formal process that ensures that Hazards in operations are identified. The Hazard Identification process shall be developed in accordance with requirements prescribed by the Authority. This AC provides guidance to enable ATO to develop and implement a Hazard Identification Process that complies with the regulatory requirements.

4.0 GENERAL

4.1 A Hazard is defined as a condition or an object with the potential to cause or contribute to an aircraft accident or incident. Hazard Identification is a core process in the management of safety. Hazards should be identified through reactive, proactive and predictive processes. Reactive processes involve identification of Hazard through accidents and incidents that have occurred. Proactive and predictive processes involve identification of Hazards before they result in aviation accidents and incidents.

4.2 Hazard Identification is the first step in a formal process of collecting, recording, acting on and generating feedback about Hazards and Safety Risks in operations. The Hazard Identification Process will involve reporting of Hazards, events or safety concerns; collection and storage of Safety Data; analysis of the Safety Data; and sharing of the Safety Information derived from the Safety Data.

5.0 SCOPE OF FACTORS AND PROCESSES IN HAZARD IDENTIFICATION

The factors and processes to be considered by ATO when engaging in Hazard Identification should include:

a) Equipment design;
b) Procedures and operating practices;
c) Communication;
d) Personnel factors;
e) Organizational factors;
f) Work environment;
g) Regulatory oversight factors;
h) System defences; and
i) Human performance.

6.0 SOURCES OF INFORMATION FOR HAZARD IDENTIFICATION

6.1 There are a variety of sources of information used in the Hazard Identification Process. Some sources are internal to the Organization while other sources are external to the Organization.

6.2 Examples of internal sources available to an Organization include:

a) Flight Data analysis;
b) Joint Industry working group or task forces;
c) Incident investigations;
d) Reported occurences;
e) Safety surveys;
f) Operational data monitoring systems;
g) Surveillance findings; and
h) Feedback from training.

6.3 Examples of external sources available to an Organization include:

a) Accident/Incident reports;
b) State mandatory occurrence reporting system;
c) State voluntary reporting system;
d) State oversight audits; and
e) Information sharing and exchange systems.

6.4 The fundamental point to note is that no source or programme entirely replaces others or makes other sources or programmes redundant or unnecessary. Hazard Identification conducted under mature Safety Management practices requires a well-thought-out combination of internal and external sources, reactive, proactive and predictive processes, and their underlying programmes.

7.0 CONDITIONS FOR HAZARD IDENTIFICATION

7.1 All personnel in Aviation Organizations should receive the appropriate Safety Management training, at a level commensurate with their responsibilities, so that everybody in the Organization is prepared and able to identify and report Hazards. From this perspective, Hazard Identification and reporting are everybody's responsibility. However, Organizations must have designated personnel with the exclusive charge of Hazard Identification and Analysis. This would normally be the personnel assigned to the Safety office.

7.2 How Hazards are identified will depend on the resources and constraints of each particular organization. Some organizations will deploy comprehensive, technology-intensive Hazard Identification programmes. Other Organizations will deploy modest Hazard Identification programmes better suited to their size and the complexity of their operations. Nevertheless, Hazard Identification, regardless of implementation, complexity and size, must be a formal process, clearly described in the Organization's Safety documentation. *Ad hoc* Hazard Identification is an unacceptable Safety Management practice.

7.3 Under mature Safety Management practices, Hazard Identification is a continuous, ongoing, daily activity. There are three specific conditions under which special attention to Hazard Identification is warranted. These are:

a) Any time the Organization experiences an unexplained increase in Safety-related events or regulatory infractions;

b) Any time major operational changes are foreseen, including changes to key personnel or other major equipment or systems;

c) Before and during periods of significant Organizational change, including rapid growth or contraction, corporate mergers, acquisitions or downsizing.

8.0 HAZARD IDENTIFICATION PROCESS

8.1 The hazard identification process shall include the following steps:

a) reporting of hazards, events or safety concerns;

b) collection and storage of safety data;

c) analysis of the safety data; and

d) sharing of the safety information derived from the safety data

8.2 **Reporting of Hazards, Events or Safety Concerns**

8.2.1 ***Hazard reporting*** and ***Hazard reporting systems*** are essential elements in Hazard Identification. An Approved Training Organizations (ATO) shall develop and maintain formal means for effectively collecting, recording, acting on and generating feedback about Hazards in operations, which combine reactive, proactive and predictive methods of Safety Data Collection. Formal means of Safety Data Collection shall include mandatory, voluntary and confidential reporting systems.

8.2.2 In ***Mandatory reporting systems***, people are required to report certain types of events or Hazards. This necessitates detailed procedures outlining who shall report and what shall be reported. Since mandatory systems deal mainly with "hardware" matters, they tend to collect more information on technical failures than on other aspects of operational activities. To help overcome this bias, voluntary reporting systems aim at acquiring more information on those other aspects.

8.2.3 In ***Voluntary reporting systems*** the reporter, without any legal or administrative requirement to do so, submits voluntary event or hazard information. The Approved Training Organizations (ATO) may offer incentives for voluntary reporting. The reported information should not be used against the reporters, i.e. such systems must be non-punitive and afford protection to the sources of the information to encourage the reporting of such information.

8.2.4 ***Confidential reporting systems*** aim to protect the identity of the reporter. This is one way of ensuring that voluntary reporting systems are non-punitive. Confidentiality is usually achieved by de-identification, and any identifying information about the reporter is known only to "gatekeepers" in order to allow for follow-up or "fill in voids" in the reported event(s). Confidential incident reporting systems facilitate the disclosure of Hazards leading to human error, without fear of retribution or embarrassment, and enable broader acquisition of information on Hazards.

8.3 **Collection, Storage and Analysis of Safety Data**

8.3.1 Effective Safety reporting is a cornerstone of the management of Safety. Once reported, data on Hazards is turned into Safety information. Effective Safety reporting is therefore the gate for Safety Data acquisition. Once acquired, Safety Data must be managed. Safety Data Management builds upon three clearly defined steps. The first two steps in Safety Data Management are; the collection of Safety Data on Hazards and the analysis of Safety Data, to turn Data into information. The third, and often overlooked, step is the mitigation or response

activities to Hazards by the Organization as a consequence of the Safety information developed.

8.3.2 Computer software may be used to facilitate the collection, storage and analysis of Safety Data. A wide range of relatively inexpensive electronic databases, capable of supporting the Organization's Data Management requirements, are commercially available for desktop computers. These stand-alone systems have the advantage of not using the Organization's main computer system, thus improving the Security of the data.

8.3.3 Depending on the size of their Organizations, Approved Training Organizations (ATO)s requires a system with a range of capabilities and outputs to manage their Safety Data. In general, Approved Training Organizations (ATO)s require:

a) A system with the capability of transforming large amounts of Safety Data into useful information that supports decision making;

b) A system that will reduce workload for managers and safety personnel;

c) An automated system that can be customized to the Organization's culture; and

d) A system that can operate at relatively low cost.

8.3.4 Safety databases are a Strategic element of an Organization's Safety Management activities. The Data are vulnerable to corruption from many sources, and care must be taken to preserve its integrity. Many employees may have access to the database for inputting data. Others will require access to the Data for the performance of their Safety duties. Access from multiple sites of a networked system should be limited to avoid vulnerability of the database.

8.3.5 Given the potential for misuse of Safety Data that may have been compiled strictly for the purpose of Hazard Identification, the database must be protected. Protection considerations include:

a) Adequacy of "access to information" laws vis-à-vis Safety Management requirements;

b) Organization policies on the protection of Safety Data;

c) De-identification, by removing all details that might lead a third party to infer the identity of individuals (for example, flight numbers, dates/times, locations and aircraft type);

d) Security of information systems, data storage and communication networks;

e) Limiting access to databases to those with a "need to know"; and

f) Prohibitions on unauthorized use of data.

9.0 HAZARD ANALYSIS

9.1 Hazard analysis is a three-step process:

a) **First step**. Identify the generic Hazard (also known as Top Level Hazard, or TLH).

b) **Second step**. Break down the generic Hazard into specific Hazards or components of the generic Hazard.

c) **Third step**. Link specific Hazards to potentially specific consequences, i.e. specific events or outcomes.

d) The following example is provided to illustrate the notions of generic Hazard, specific Hazard and consequences.

"An international airport that handles 100,000 movements per year launches a construction project to extend and re-pave one of two crossing runways".

The following three-step Hazard Analysis process would apply:

i) ***Step A.*** State the generic Hazard (Hazard statement or TLH),

   a. Airport construction.

ii) ***Step B.*** Identify specific Hazards or components of the generic Hazard,

   a. Construction equipment,

   b. Closed taxiways, etc.

iii) ***Step C.*** Link specific Hazards to specific consequence(s),

   a. Aircraft colliding with construction equipment (construction equipment),

   b. Aircraft taxiing into the wrong taxiway (closed taxiways), etc.

9.2 In conducting the Hazard Analysis, two basic premises of Safety Management must be considered:

a) Hazards are potential vulnerabilities inherent in socio-technical production systems. They are a necessary part of the system as a result of the capabilities they provide or can potentially provide the system to deliver its services. Aviation workplaces therefore contain Hazards which may not be cost-effective to address even when operations must continue; and

b) Hazard identification is a waste of effort if restricted to the aftermath of rare occurrences where there is serious injury or significant damage.

9.3 A structured approach to the identification of Hazards ensures that, as much as possible, most Hazards in the system's operational environment are identified. Suitable techniques for ensuring such a structured approach might include:

a) **Checklists.** Review past experiences and available data from similar systems and draw up a Hazard Checklist. Potentially Hazardous areas will require further evaluation.

b) **Group review**. Group sessions of experienced operational and technical personnel facilitated by the Safety Manager may be used to review the Hazard Checklist, to brainstorm Hazards more broadly, or to conduct detailed scenario analysis.

9.4 All identified Hazards should be assigned a Hazard Number and be recorded in a Hazard Log. The Hazard Log should contain a description of each Hazard, its consequences, the assessed likelihood and severity of the Safety Risks of the consequences, and required Safety Risk controls, most usually, mitigation measures. The Hazard Log should be updated as new Hazards are identified and proposals for further Safety Risk controls (i.e. further mitigation measures) are introduced.

10.0 DOCUMENTATION OF HAZARDS

10.1 The formal documentation of Hazards is an essential requirement for Hazard Identification. Safety information (i.e. analyzed raw data) and Safety intelligence (i.e. Safety information that has been corroborated and further analyzed by adding context) combine to generate Safety knowledge that must formally reside in the Organization, not in the exclusive custody of individual members of the Organization. A formal repository of Safety knowledge is a safeguard against volatility of the information. In addition, an Organization that has historical Safety knowledge will make Safety decisions based upon facts and not opinions.

10.2 Appropriate documentation management regarding Hazard identification is important as a formal procedure to translate raw operational Safety information into Hazard-related knowledge. Continuous compilation and formal management of this Hazard-related knowledge becomes the "Safety library" of an organization. In order to develop knowledge on Hazards and thus build the "Safety library", tracking and analysis of Hazards are facilitated by standardizing:

a) Definitions of terms used;

b) Understanding of terms used;

c) Validation of Safety Information collected;

d) Reporting (i.e. what the Organization expects);

e) Measurement of Safety Information collected; and

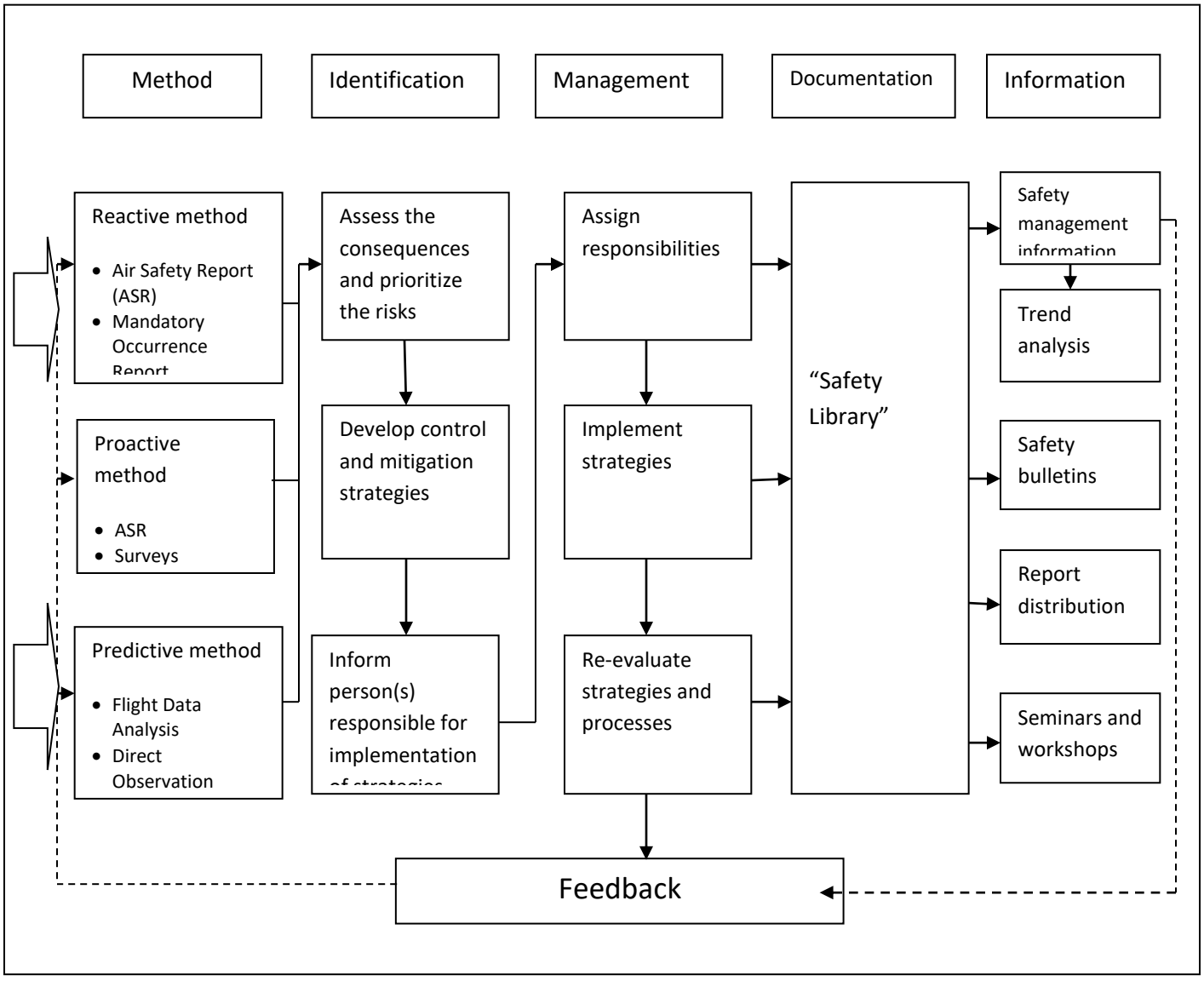
f) Management of Safety Information collected.

10.3 *Appendix A* to this Advisory Circular illustrates the process of Hazard Documentation. Following collection and identification, Hazard Information is assessed in terms of consequences, and priorities and responsibilities regarding mitigation responses and strategies. The product of the "Safety Library" is not only the preservation of the corporate Safety memory, but the Safety Library becomes a source of Safety Knowledge to be used as reference for Organizational Safety decision making. The Safety Knowledge incorporated in the "Safety Library" provides feedback and control reference against which to measure Hazard Analysis and consequence management and the efficiency of the sources or methods of Safety Information collection. It also provides material for Safety trend analyses, as well as for Safety education purposes (Safety bulletins, reports, seminars and the like).

Director Safety Regulation

APPENDIX A

DOCUMENTATION OF HAZARDS



- *"Indicates a "Hazard"*