CIVIL AVIATION AUTHORITY PAKISTAN
FLIGHT STANDARDS DIRECTORATE

This Information Bulletin, adopted by Flight Standards Directorate aims to keep members of Pakistani Civil Aviation community updated on latest items of common interest and developments within the aviation industry. It is anticipated that, the bulk of material would be of relevance to AOC, Training, Standards and helpful to the Safety Managers who implement their policies.

The Bulletin is designed to serve the objective of Flight Standards Directorate that is "To improve upon Safety Standards".

INFORMATION BULLETIN

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HAZARD IDENTIFICATION

Hazard

A hazard is anything with the potential to cause harm.

A hazard is any condition, event, or circumstance which could induce an accident.

A hazard is any existing or potential condition that can lead to injury, illness, or death to people; damage to or loss of a system, equipment, or property; or damage to the environment. A hazard is a condition that is a prerequisite to an accident or incident.

Hazard Identification

Hazard identification is the process used to determine all possible situations, events and circumstances that may expose people to injury, illness, disease or death or may cause damage or loss of equipment and property, or damage to the environment.

Objective

Hazard identification is conducted in order to identify the hazards in the organizational systems and operational environment and facilitate the control of these hazards.

ICAO Requirements

Recently approved changes to several Annexes of the Chicago Convention introduce harmonized requirements for the implementation and operation of safety management systems (SMS) by aircraft operators and aviation service providers. Within the organizational framework of the SMS, operators/service providers "shall develop and maintain a formal process for effectively collecting, recording, acting on and generating feedback about hazards in operations, based on a combination of reactive, proactive and predictive methods of safety data collection".

Hazard Identification Sources

- *Safety Reporting - includes safety occurrence reporting through mandatory and voluntary reporting schemes;*
- *Internal investigation of safety occurrences;*
- *Safety occurrence trend analysis;*
- *Information provided by personnel, from operational perspective and training;*
- *Analyzed data from automated data collecting tools (e.g. flight data analysis (FDA) in the airline industry);*
- *Results from safety surveys and operational oversight safety audits carried out internally (by the operator/service provider) and by States;*
- *Monitoring of "day-to-day" normal operations and environment;*
- *Official State investigation results of accidents and serious incidents; and*
- *Information-exchange practices between operators/service providers.*

(Note: The list of sources listed above is by no means full and comprehensive.)

Hazard Identification Methods

Depending on the hazard identification sources and the approach to hazard identification, two groups of methods for identifying hazards can be defined:

- *Reactive hazard identification methods - hazards are recognized through trend monitoring and investigation of safety occurrences. Incidents and accidents are clear indicators of systems' deficiencies and should be therefore investigated to determine the hazards that played role in that event.*
- *Proactive hazard identification methods - hazards are identified analyzing systems' performance and functions for intrinsic threats and potential failures. The most commonly applied proactive methods are the safety surveys, operational safety audits, safety monitoring and safety assessments. Other proactive hazard identification methods, such as FDA, Line Operations Safety Audit (LOSA) and Normal Operations Safety Survey (NOSS) are specifically targeted at identifying hazards related to human performance.*

In real life scenarios, both reactive and proactive methods provide an effective means of hazard identification. Incident investigation is still one of the largest contributors in identifying hazards. In successful safety management systems, the proactive approach for hazard identification is utilized extensively, so the hazard is recognized and addressed before it could turn into an occurrence.

According to the Future Aviation Safety Team (FAST) three complementary approaches should be used to identify hazards that affect safety of the global aviation system:

- *The "Historic" approach is based on accident and incident investigation and analysis. It uses proven investigative techniques to discover all facts pertinent to a past aviation incident or accident, and thus identify opportunities for improvements meant to avoid future, similar accidents.*

- *The "Diagnostic" approach is targeted at identifying accident pre-cursors within the larger collections of information in various aviation safety reporting systems. There are many diagnostic processes being developed for application to the global aviation system.*

- *A "Prognostic" or "Predictive" approach is aimed at discovering future hazards that could result as a consequence of future changes inside or outside the global aviation system, and then initiating mitigating action before the hazard is introduced. Prognostic hazard identification informs design processes so that the hazards can be eliminated from the future, avoided in the future, or mitigated in the future.*

Scope of Hazards in Aviation

The scope of hazards existing in aviation operation environment is very wide. That is why hazard identification is a complex process as it considers extensive range of possible sources of failure. Depending on the nature and size of the organization, its operational scope and environment there are different factors to consider during hazard identification. The following factors listed in ICAO Doc 9859 Safety Management Manual are examples of common hazard sources in aviation:

- *Design factors, including equipment and task design;*

- *Procedures and operating practices, including their documentation and checklists, and their validation under actual operating conditions;*

- *Communications, including the medium, terminology and language;*

- *Personnel factors, such as company policies for recruitment, training and remuneration;*

- *Organizational factors, such as the compatibility of production and safety goals, the allocation of resources, operating pressures and the corporate safety culture;*

- *Work environment factors, such as ambient noise and vibration, temperature, lighting and the availability of protective equipment and clothing;*

- *Regulatory oversight factors, including the applicability and enforceability of regulations; the certification of equipment, personnel and procedures; and the adequacy of surveillance audits; and*

- *Defences, including such factors as the provision of adequate detection and warning systems, the error tolerance of equipment and the extent to which the equipment is hardened against failures.*

Hazard Classification

Each hazard that is identified is to be evaluated and classified. This is done in order to determine whether the hazard is individual (i.e. bear consequence for specific operation/s) or systemic. Hazards are classified in terms of severity of consequences arising in case of occurrence and are recorded in a hazard log. This process is documented and organized into a database which facilitates the storage and retrieval of hazard data.

Hazard classification matrices are used by the operators/service providers and aircraft manufacturers for evaluating hazards. Hazards are assigned to 5 generic classes depending on their effect. It should be noted that the exact description of the possible effects may differ depending of the types of the aviation service provided.

The table below is an example of hazard severity classification matrix, provided in EUROCAE ED -78A.

Hazard Class	1 (most severe)	2	3	4	5(least severe)
Effect on Operations	Normally with hull loss. Total loss of flight control, mid-air collision, flight into terrain or high speed surface movement collision.	Large reduction in safety margins or aircraft functional capabilities.	Significant reduction in safety margins or aircraft functional capabilites.	Slight reduction in safety margins or aircraft functional capabilities.	No effect on operational capabilities or safety.
Effect on Occupants	Multiple fatalities.	Serious or fatal injury to a small number of passengers or cabin crew.	Physical distress, possibly including injuries.	Physical discomfort.	Inconvinience.
Effect on Air crew	Fatalities or incapacitation.	Physical distress or excessive workload impairs ability to perform tasks.	Physical discomfort, possibly including infuries or significant increase in workload.	Slight increase in workload.	No effect on flight crew.
Effect on Air Traffic Service	Total loss of separation.	Large reduction in separation or a total loss of air traffic control for a significant time.	Significant reduction in separation or significant reduction in air traffic control capability.	Slight reduction in separation or slight reduction in air traffic control capability. Significant increase in air traffic controller workload.	Slight increase in air traffic controller workload.

Operational Safety Assessment Hazard Classification Matrix

Another important characteristic of hazards is their likelihood (frequency) of occurrence. The hazard severity and its likelihood of occurrence are used to assess the risk that a hazard can pose to the provision of an aviation service, in particular to aircraft operations and eventually to human life.

A structured approach to the identification of hazards ensures that, to the extent possible, all potential hazards are identified and assessed. The assessment of hazards should take into consideration all possible outcomes - from the least likely to the most likely. Hazard identification determines to a great extend the effectiveness of an organization's risk management process, as it provides the input for the other two risk management components, notably the Risk Assessment and Risk Mitigation.

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