International Civil Aviation Organization

A40-WP/96
TE/28
26/7/19

WORKING PAPER

ASSEMBLY — 40TH SESSION

TECHNICAL COMMISSION

Agenda Item 30: Other issues to be considered by the Technical Commission

INSIGHT HUMAN AND ORGANIZATIONAL FACTORS ANALYSIS IN AIRCRAFT ACCIDENT AND INCIDENT INVESTIGATION

(Presented by the United Arab Emirates)

EXECUTIVE SUMMARY

This working paper presents a proposal to establish a repository on the ICAO website to facilitate the exchange of information, knowledge, and experience among States' aircraft accident investigation authorities, the State Safety Programme (SSP) personnel, human factors specialists, psychologists, aeromedical examiners, aviation pathologists, research centres and institutions, etc. in human and organisational factors analysis relevant to aircraft accidents and incidents, hazard identification, and risk management.

Action: The Assembly is invited to:

a) note the contents of this working paper;
b) request ICAO to consider facilitation of regular sharing of information, knowledge, and experience related to human and organisational factors analysis in relevance to aircraft accident and incident investigation, hazard identification, and risk management. This facilitation is recommended to be via a repository hosted on the ICAO website, and administered as per ICAO datasets policies; and
c) encourage States to share information, knowledge, and experience related to human and organisational factors analysis in relevance to aircraft accident and incident investigation, hazard identification, and risk management, through the ICAO repository.

Strategic Objectives:	This working paper relates to the Safety Strategic Objective.
Financial implications:	Not applicable
References:	Doc 9756, *Manual of Aircraft Accident and Incident Investigation*, Part III — *Investigation* and Part IV — *Reporting* Doc 9859, *Safety Management System (SMS)* Digest No. 7 − *Investigation of Human Factors in Accidents and Incidents* *Guidelines for Investigation of Human Factors in Accidents or Incidents* developed by the International Society of Air Safety Investigators (ISASI)

1. INTRODUCTION

1.1 For an investigation to be effective, the root causes must be identified and safety recommendations must be determined based on identified systemic deficiencies.

1.2 Aviation safety has gone through four specific eras, and each era had its own individual philosophy, tools of analysis, and methodologies of safety improvement. Aircraft accident and incident investigation is now more connected to other branches of science especially in the disciplines of human psychology and organisational behaviour. This interconnection has made a significant contribution to improving air safety, even at a time of great expansion of the industry.

1.3 According to ICAO, four main eras in aviation safety can be described as:

a) *Technical* — in the first six decades of the twentieth century, many accidents were linked to technical factors. That understanding had directed the focus of investigation into improvement of technical factors (aircraft engines and systems, for example). The last decade of that era experienced improvement of the technical aspects of aviation.

b) *Human factors* — the improvement in technical reliability of aircraft resulted in a reduction in accident frequency, and this led to human factors becoming the focus in the search for further safety improvement. The initial result was a tendency to focus on the individual, without fully taking into consideration the operational and organizational context. Human factors, with an emphasis on the individual, continued until the early 1990s around which time it was acknowledged that individuals operate in a complex environment that includes multiple factors which could affect behaviour.

c) *Organizational* — in mid-1990s, the concept of an "organizational accident" was introduced, where the organizational culture and policies have an effect on safety risk controls. This approach enhanced routine safety data collection and analysis using *reactive* and *proactive* methodologies which enabled organizations to monitor known safety risks and detect emerging safety trends. This formed the initial foundation for the establishment of the Safety Management System (SMS).

d) *Total system* — by the beginning of the 21st century, the principles of the State Safety Programme (SSP) and the SMS had been established and were starting to reap safety benefits. However, this approach still focuses on individual safety performance and local control, with minimal regard for the wider context of the total aviation system and is not a complete solution for safety deficiencies. The steady, compounding evolution of safety has led States and service providers to a point where they are giving serious consideration to the interactions and interfaces between the components of the system: people, processes, and technologies. This has led to a greater appreciation for the positive role people play in the system.

2. DISCUSSION

2.1 The accident investigation contribution to safety improvement has gradually evolved to accompany the different safety eras. The investigation techniques for human and organisational factors are discussed in ICAO Doc 9756, Part III, and Part IV, which give special attention to both aspects. According to ICAO guidance material as depicted in Part IV, human factors aspects is a suggested heading in the Final Report. For the same aspect, Part IV contains a selection of human factors terms that can be encountered during an investigation. A good understanding of these terms will facilitate a successful human factors investigation.

2.2 The Final Report format, according to Annex 13 — *Aircraft Accident and Incident* Investigation, contains section 1.17 − *Organizational and management information*, which is dedicated to provide, when relevant to the accident, pertinent information on any organization and its management whose activities may have, directly or indirectly, influenced the operation of the aircraft. An organisation may be air operator, maintenance organization, aerodrome, the regulator, etc. The document also suggests example factors that may be discussed in the Final Report, and among these factors are the safety culture, resources and financial viability, management policies and practices, internal and external communications, certification, safety oversight, and regulatory framework.

2.3 A search of many States investigation Final Reports, taking into account keywords relevant to human and organisational factors, indicates that a considerable number of Final Reports lack insightful analysis of these factors, either by not having material relevant to them, or by discussing these factors based on cherry picking or canned conclusions and sometimes the use of copied causes and contributing factors from similar cases. Some of the reports do not have sufficient rationale to support conclusions.

2.4 Humans have a direct effect on organization’s safety performance, and the organizational approaches to managing safety have to consider this fact and how humans interact with their environment. The organization must give consideration to identifying and mitigating risks as well as to optimizing the human contributions to organizational safety.

2.5 Identifying the interrelation between human and organisational factors is a key player in remedial actions, and this can be explored if the accident investigation authority provides the necessary tools allowing the investigators to collect data with a high level of freedom, carry-out an in-depth analysis of the data, and draw conclusions. This function of accident investigation is the most difficult part because it requires an accurate identification of the human state that led to errors in the accident or incident, and how these errors are linked to organisational factors. This methodology is applicable across all organizations that may have contributed to the accident or incident.

2.6 Some Final Reports lack sufficient information and analysis of the role of organizational performance in promoting safety among employees. These reports, for instance, do not contain sufficient analysis as to how flight crewmembers are introduced to a change in procedure, or why a crewmember was not performing as required in the final minutes before an accident. The root causes of such commission or omission errors were not examined to determine whether a systemic deficiency in the air operator’s organization was a contributory factor. This lack of depth in investigating organizational aspects of accident or incident causation may prevent many lessons from being learnt on the human and organisational factors aspects.

2.7 According to Digest No. 7 − *Investigation of Human Factors in Accidents and Incidents*, accident investigation reports usually depict clearly what happened and when, but in too many instances they stop short of fully explaining how and why the accidents occurred. Attempts to identify, analyse, and understand the underlying problems that led to the breakdowns in human performance, and thus to the accidents, are sometimes inconsistent. Some States may lack human factors investigation expertise and may not have in place sufficient expertise in the disciplines of human factors, psychology, aviation pathology, etc. A State may also lack a database for building its experience in hazard identification and risk assessment.

2.8 What makes the investigation into human and organizational factors unique is the need to employ recognized models such as Reason, Bow-Tie, SHELL, Practical Drift theory developed by Scott A. Snook, etc. The objective of the investigation is to reach, with a high level of confidence, a conclusion on systemic deficiencies and develop relevant risk-based safety recommendations.

2.9 An effective investigation is one that can measure the safety risk controls developed and maintained by the organization to maintain a balance between safety and the economy of operations within a "safety space". "This balance is equally applicable to the State's management of safety, given the requirement to balance resources required for State protective functions that include certification and surveillance." (Paragraph 2.4.4 of Doc 9858).

2.10 The unique interface between the human and organisational factors on one side and the safety management system on the other, would require a comprehensive reporting system and risk analysis. This will require the State to promulgate legislation that allows for uninterruptable reporting of safety risk potentials, through mandatory and voluntary reporting, and qualify the investigators to investigate the human and organisational factors and link the two with the organisation's SMS and with the SSP. In many cases, the expertise of human factors specialist will be needed to assist the investigator with the analysis.

2.11 Legislation is required to vest the investigators with the necessary power to access various State-level entities that may possess data relevant to the investigation. This empowerment may cover access to medical files, personal files, management inquiries, etc. The legislation should consider the balance between privacy of information and the investigation needs.

2.12 Global cooperation for improving the capabilities of States in human and organisational factors investigation and safety risk management could be a solution. One of the cooperation application mechanisms is a repository for human and organisational information, knowledge, experience, released accident and incident investigation Final Reports and risk assessment reports issued by States, etc. The ICAO website may be the most practicable place for hosting the repository.

2.13 Example materials that can be contained in the repository are:

- Example human factors indicators that can be observed at the accident site; from reviewing medical files, training files, rosters; from the flight data recorders; from the various statements and interview, etc., and how this data is analysed for human factors conclusions.

- Examples, from actual occurrences, or studies, research, articles, papers, etc. of linkages between human and organisational factors and how risk controls and safety barriers were deficient in preventing the occurrence or reducing the consequences.

- Dialogue platform for investigation and safety risk management, and how each side can feed data and information to the other. This may take cases from recently published accident and incident investigation Final Reports, and initiate discussion on the existing facts and analysis relevant to human and organisational factors.
- Knowledge and information gathered from the latest training courses, seminars and workshops relevant to human and organisational factors investigations and the associated working papers presented in such activities.

2.14 The repository should be accessible to States' accident investigation authorities (AIAs) and SSP personnel, human factors specialists, psychologists, aeromedical examiners, aviation pathologists, research centres and institutions, etc. who may contribute to enriching the available knowledge and information and provide consultancy, on a voluntary bases, to States on these subjects. This repository should be a robust platform and should facilitate consultancy services to less-resourced States. Authentication of the identity of the specialists from the various disciplines can be managed by a well-defined system as per the ICAO accessibility rights policies.

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