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ACCIDENT INVESTIGATION AND PREVENTION (AIG) DIVISIONAL MEETING (2008)

Montréal, 13 to 18 October 2008

Agenda Item 1: Annex 13
1.2: Chapter 5 of Annex 13

INVESTIGATION OF ACCIDENTS AND SERIOUS INCIDENTS — USING THE THREAT AND ERROR MANAGEMENT (TEM) FRAMEWORK IN THE CLASSIFICATION AND INVESTIGATION OF RUNWAY INCURSIONS

(Presented by the International Federation of Air Traffic Controllers' Associations)

SUMMARY

This paper proposes to investigate all runway incursions, regardless of the severity of the outcome of the events. It furthermore proposes to develop a classification scheme for runway incursions that is not based on the severity of the outcome, but on the Threat and Error Management (TEM) framework.

Action by the meeting is in paragraph 3.

1. INTRODUCTION

1.1 ICAO Circular 314 provides an introduction to the Threat and Error Management (TEM) framework applied to Air Traffic Control. In the following three paragraphs, selected text from Circular 314 is quoted that is considered relevant for the discussion of this working paper.

> "There are three basic components in the TEM framework, from the perspective of air traffic controllers: threats, errors and undesired states. The framework proposes that threats and errors are part of everyday aviation operations that must be managed by air traffic controllers, since both threats and errors carry the potential to generate undesired states. Air traffic controllers must also manage undesired states, since they carry the potential for unsafe outcomes. Undesired state management is an essential component of the TEM framework, as important as threat and error management. Undesired state management largely represents the last opportunity to avoid an unsafe outcome and thus maintain safety margins in ATC operations."

> "Undesired states are defined as 'operational conditions where an unintended traffic situation results in a reduction in margins of safety'. Undesired states that result from ineffective threat and/or error management may lead to compromised situations and reduce margins of safety in ATC operations. Often considered the last stage before an incident or accident, undesired states must be managed by air traffic controllers."
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> "The notion of undesired states is unique to the process of monitoring safety in normal operations. An undesired state is transient in nature – it only exists for a limited period of time, after which the undesired state becomes an outcome (that is, either a resolved or managed situation, an incident or an accident). Conventional safety data collection systems only become active after an outcome is classified as potentially consequential to safety, i.e. after an incident or accident has taken place, or some infringement of regulations, procedures, or instruction has occurred. Nothing can be done to change an outcome, for an outcome is an end-state."

1.2 In IFATCA's vision the TEM framework should be used to review the existing system(s) for classifying and investigating runway incursions, thus contributing to the robustness of aviation safety management systems.

2. DISCUSSION

2.1 When analyzing runway incursions with the Threat and Error Management (TEM) framework from an Air Traffic Control (ATC) perspective, every runway incursion is an undesired state – that is, until the situation turns into an "outcome", i.e. an end state that can't be changed anymore.

2.2 In the time that the undesired state exists there may or there may not be opportunities for the persons involved (pilots, air traffic controllers, vehicle drivers and/or pedestrians) to manage the situation and influence the outcome of the event.

2.3 Emerging technological tools for ATC, such as runway incursion alerting systems, are meant to assist air traffic controllers in detecting the undesired state as early as possible. It is important to realize that these systems do not prevent runway incursions from occurring, they only alert controllers that an incursion is in progress. The value of these systems is that they may provide more time to manage the undesired state (and thus hopefully achieve an inconsequential outcome), yet they do not contribute to preventing runway incursions from occurring.

2.4 The TEM framework proposes that the threats and errors that are linked to the undesired state (i.e. the incursion) are the main areas where preventive measures should focus on, regardless of the outcome of the event.

2.5 The currently used system to classify runway incursions (severities A-E) is solely based on the outcome of the event. This classification system is often used to determine the degree in which the event will be investigated (A = usually a thorough investigation; D = maybe no investigation at all).

2.6 From a safety management viewpoint, however, it would be more beneficial to investigate **all** runway incursions in order to determine the threats and errors that are linked to these events, and propose and implement countermeasures. By reducing the number of threats in the runway environment, the number of related errors will become less and subsequently, the number of related undesired states (runway incursions) will also be reduced.

2.7 Also from a safety management viewpoint, it may be more beneficial to use a classification system that considers the undesired state rather than the outcome. When used internationally, such a classification system would enable a more detailed comparison and analysis of runway incursions and assist in determining which countermeasures are the most appropriate for a given situation.

3. ACTION PROPOSED

3.1 The meeting is invited to:

a) discuss a mechanism that would support the investigation of **all** runway incursions in order to identify the threats and/or errors that are linked to the undesired state; and

b) ask ICAO to develop an alternative classification system for runway incursions, based on the TEM framework, and amend relevant existing documents accordingly. (See the Appendix to this paper for an example of such a classification system.)

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APPENDIX

EXAMPLE OF A TEM BASED CLASSIFICATION SCHEME FOR RUNWAY INCURSIONS

The items describe the progress of the undesired state (runway incursion) until its detection.

1 Aircraft or vehicle enters the runway as cleared by ATC and as intended by pilot or driver, but crosses a stopbar.

2 Aircraft or vehicle crosses a stopbar but holds clear of the runway (at the runway holding point marking).

3 Aircraft or vehicle enters the runway without clearance from ATC in a situation where there is little or no chance of operational consequences. ATC is aware of the event when in progress and stopped the aircraft or vehicle, or could have stopped the aircraft or vehicle if necessary.

4 Aircraft or vehicle enters the runway without clearance from ATC in a situation where there is little or no chance of operational consequences. ATC is not aware of the event until the aircraft or vehicle is on the runway.

5 Aircraft or vehicle enters the runway without clearance from ATC in a situation where there could be operational consequences. ATC is not aware of the event until the aircraft or vehicle is on the runway.

6 Aircraft or vehicle enters the runway in a situation where there are operational consequences (because another aircraft had been cleared to use the same runway). This is noticed by ATC, the vehicle driver or the pilots, and action is taken to minimise the consequences.

7 Aircraft nearly taking off or landing on a closed runway, or on a runway other than the one assigned by ATC. This is noticed by ATC or the pilots of the aircraft, and action is taken to minimise the consequences.

8 Aircraft or vehicle enters or uses the runway in a situation where there are operational consequences (because another aircraft or vehicle had been cleared to use the same runway, or because the runway was closed or different than the one assigned by ATC). This is not noticed by ATC, the vehicle driver or the pilots in time to allow action to change the outcome.

1 to 8 indicates a decreasing window-of-opportunity to manage the undesired state (and avoid a consequential outcome).

Areas of associated threats and errors: aerodrome lay-out, infrastructure, signs/markings/lighting, maps, communication, crew coordination, surveillance, monitoring, etcetera.

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