NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

April 11, 2017

Attachment 7 - American Airlines Flight Operations Training Manual

(Excerpts)

OPERATIONAL FACTORS/HUMAN PERFORMANCE

DCA17FA021

Chapter 1: Threat & Error Management

1.1 General

Source: AQP and CRM

Threat & error management (TEM) is intended to fully integrate technical and crew resource management (CRM) skills. TEM uses both an acronym, ABCs, and a simple graphic (see Figure 1.1 Threat & Error Management Target) to provide crews with a method to visualize and remember threat and error management concepts.

• Note •

Crews will follow CRM principles during line operations.

1.1.1 ABCs

A

Learn to **A**ctively **A**ssess conditions for threats (such as high task loading and crew factors) and errors so that any consequences can be mitigated and/or additional barriers erected to maintain a safe operating margin. At least one pilot should always be monitoring during low workload and both pilots should be monitoring as much as possible during high workload and in areas of vulnerability. Think if what you are doing, or about to, is sensible?

For example: a clearance to descend to 2000 feet 40 miles out of Charleston, SC versus Charleston, WV.

B

Understand the concept of managing available resources to **B**alance "**B**arriers" to avoid and trap errors.

C

Learn to effectively **C**ommunicate any threats and errors along with strategies to minimize their effects.

S

Understand the importance of following standard operating procedures (**S**OPs). Crews who *intentionally* erred by not following SOPs are more likely to commit another error. SOPs establish a consistent baseline for performance.

1.1.2 TEM Target

Threat and error management uses a green-yellow-red "target" to help visualize the potential for error. These 3 colors provide an easy way for the crew to communicate their perceived margin of safety and identify the need to take action.

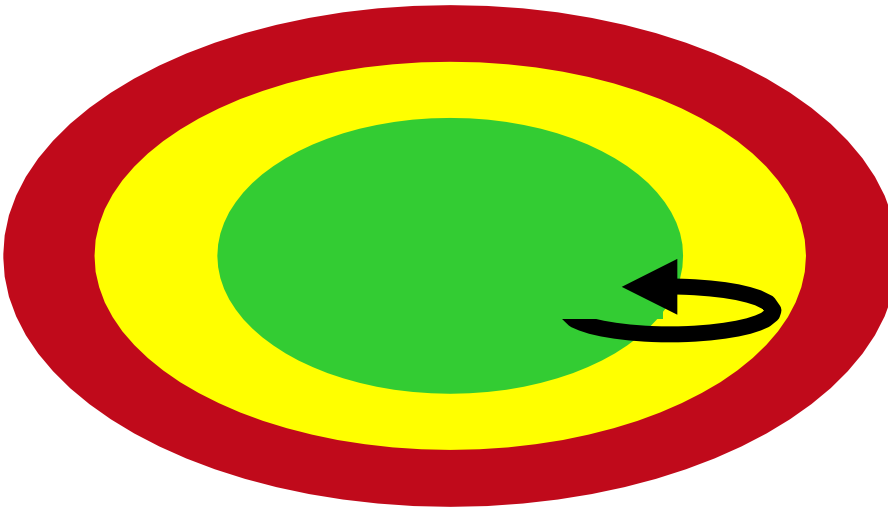

Figure 1.1 Threat & Error Management Target

Green. In the *central* green area, resources are used in a way to easily recognize and/or correct errors.

Yellow. In the *middle* yellow band, errors will occur and some may be ignored or not recognized but the errors are small and margin of safety remains adequate. Application of the ABCs will quickly get the crew back in the green.

Red. In the *outer* red band, errors will occur and not be caught. The errors become cumulative and the margin of safety is inadequate. Accomplishment of the ABCs by both pilots is vital to reestablish an adequate margin of safety.

Ineffective use of the ABCs can quickly get you in the red. *Effective* use of the ABCs will help identify threats and errors to keep you in the green or return you to the green.

1.2 Threats and Errors

1.2.1 Threats

Threats are anything that increases the potential for error. Some examples of obvious threats are weather, ATC and aircraft malfunctions. Two not so obvious threats are crew factors and task loading, which are discussed below.

Crew Factors

Crew factors include such items as boredom, distraction, hunger, drowsiness, stress, illness, and attitudes. These physiological and psychological elements of the crew can have a double impact, they may:

- increase the crew's workload or
- simply increase the likelihood an error will occur.

During high task loading, crew experience can also impact the potential for error.

Task Loading

Another threat that may increase the potential for error and impact the margin of safety is task loading. Task loading is simply a ratio of the number of tasks that need to be performed to the amount of time available for doing them (more tasks with less time = high task loading). Recognition of task loading is important in that the tendency toward error increases as task loading increases. Crews should be aware that different phases of flight naturally have different levels of task loading (i.e., the task loading during pre-departure is much higher than during cruise). Also, every flight provides threats which increase the pilots' task loading.

Crew awareness of task loading is important because it is directly related to the possibility errors may occur. During periods of high task loading the crew should ensure they are balancing available resources to eliminate or capture errors. Conversely, if a crew notices errors are being made, they may want to evaluate the task loading status to determine if they need to make adjustments in workload management.

Simply put:

$$\textbf{task loading} = \frac{\textbf{number of tasks}}{\textbf{amount of time available}}$$

1.2.2 Errors

Studies

We all acknowledge errors occur, but we must also realize how difficult it is to detect these errors. Error detection is a direct reflection of our monitoring skills.

— An NTSB study showed 84% of the reviewed accidents involved inadequate crew monitoring or challenging.

— A Flight Safety Foundation's Approach and Landing Accident Reduction study showed 63% of the reviewed accidents involved inadequate monitoring and cross-checking.

— Data collected in over 3000 line operations safety audits (LOSAs) showed 62% of errors went undetected by flight crew.

Detection

Errors must be detected before they can be corrected!