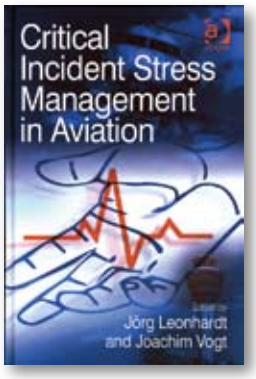
Stress Test

It isn't only airlines that need to be prepared to manage the stress of a critical incident.



BOOKS

Critical Incident Stress Management in Aviation

Leonhardt, Jörg; Vogt, Joachim (editors). Aldershot, England, and Burlington, Vermont, U.S.: Ashgate, 2006. 194 pp. Figures, tables, references, appendixes, index.

A serious aircraft accident is universally shocking, perhaps most of all to people who work in the aviation industry, says Jeffrey T. Mitchell, Ph.D., a professor of health services, in one chapter of this book. "They also feel responsibility and guilt because they design, manufacture, maintain, operate, communicate with, and control the aircraft that criss-cross the sky," he says. "The media, politicians, the public and, sometimes, even the airline's corporate leadership are quick to place blame on the employees of an airline and hold them accountable."

Distress quickly cascades through the industry after an aviation disaster. "Gate agents have a hard time facing the public," Mitchell says. "Pilots and flight attendants may not wish to fly [aboard] the same type of aircraft that crashed, especially if the type of aircraft has a history of several crashes. Ground and maintenance crews and air traffic controllers review their procedures to see if they may be at fault. Few within the industry feel at ease with their work in the months after a catastrophic incident."

But it isn't only the large-scale accidents widely reported in the media that can be emotionally jarring for aviation personnel, he notes. Passengers become ill or are injured. Occasionally one dies aboard the aircraft during an otherwise normal flight. Severe turbulence, threatening or violent passengers, upset passengers — all take a toll on flight attendants. Even pilots, despite their typical self-confidence and equanimity, can experience significant stress from "close calls," equipment failures, severe weather or hard landings.

"The aviation industry, at all levels, needs quality crisis support programs to assist its employees and keep them functioning at peak performance levels," says Mitchell. "That means peer and professional crisis responders must be properly trained and organized to respond quickly to an individual or group crisis and to provide the right support services at the right time and under the right circumstances."

The editors say that this volume was needed because most other information sources about critical incident stress management (CISM) relate to fire fighters and emergency rescue personnel. But crisis management in aviation also involves air traffic control, airports and airlines — each of which must coordinate its efforts with the others in many accidents and incidents.

Each of these "protagonist" organizations, as the editors call them, has its own "special organizational requirements, implementation and structure of CISM, rules and procedures, advantages, benefits and experiences." Representatives of each type of organization contributed chapters to the book, addressing CISM from their own perspectives.

For an air traffic controller, says Leonhardt, a psychologically critical incident need not be an accident or even a near-accident. A loss of required separation between aircraft, even if the standard allows enough margin for error

that there is no serious danger, can result in a stress reaction. The controller's self-respect may suffer — after all, the essence of the profession is maintaining aircraft separation. In addition, controllers are selected partly because of their exceptional ability to visualize aircraft spatial relationships and project them into the future.

"The [controller's] *inner eye* is viewing a catastrophe, and the fantasy completes the inner picture," Leonhardt says. "In training and professional experience, the [controller] develops pattern recognition for potentially critical situations."

Counselors or others who would relieve the controller's stress may do more harm than good if they do not understand the profession's frame of mind and value system. Even psychologists, if they try to relieve the tension from the incident by pointing out that no harm occurred and none was likely, fail to understand that in the controller's "picture completing" imagination a "disaster" did happen. It is a longstanding axiom of psychology that people can react emotionally to mental cues as strongly as to real events.

A chapter by Walter Gaber and Annette Drozd about the CISM team at Frankfurt (Germany) Airport describes the planning and organization needed to cope with a crisis such as an accident at or near a large international airport. Generally, there will be many family members and friends of the victims who have come to the airport to drop off or greet passengers.

"This means that at least three times the number of people (900 to 1,200 persons per aircraft) will have intensive emotions in different constellations at any time of the day or night at the airport," the authors say. "These persons require the care of a continuously operating care team in order to keep [them] informed as best as possible. They must be isolated from the press and other persons at the airport in order to be provided with bad news or to be joined by their family members. Helpers having to give bad news must be trained for this. Furthermore, a sufficient number of helpers must be on hand."

In this era of globalization, victims and families are likely to represent many religions, and the crisis management group must have a comprehensive list of counselors they can call on. By the same token, an accident probably will affect people of different nationalities. "It is a big asset of an international airport to be able to utilize its workforce, which is also made up of various cultural backgrounds," Gaber and Drozd say. "Even if these colleagues are not already members of the care teams, their presence alone would be of major assistance in dealing with affected foreigners because by translating or helping with minor tasks, the grief and suffering of affected persons could be minimized."

REPORTS

Evaluation of the Human Voice for Indications of Workload Induced Stress in the Aviation Environment

Hagmueller, M.; Rank, E.; Kubin, G. EEC Note No. 18/06. December 2006. 87 pp. Figures, tables, annexes, references. Available via the Internet at <www.eurocontrol.int/eec/public/standard_page/2006_note_18.html>.

According to an established psychological principle called the Yerkes-Dodson law, cognitive arousal — alertness and readiness to respond — is related to performance. But it is not a one-to-one relationship. Up to a point, the greater the arousal, the better the performance; beyond that optimum point, however, further arousal results in decreasing performance.

"So, for an optimal safety of the human ATC [air traffic control] task, an operator ideally needs moderate workload," the report says. "Therefore, it is common ATC practice to modulate the size of a control sector during the day, depending on the traffic load. … The aim is to hold the workload for the controller continuously at a moderate level."

Currently, a supervisor determines subjectively the need for combining or splitting sectors, based on experience and administrative constraints. But the assessment of a "moderate" workload for a controller is difficult because the controller's stress level is affected by factors such as health and the environment.

"A real-time tool to evaluate objectively human stress indicators under a given workload, to keep

the human at the optimal performance, could help to increase ATC safety," says the report.

Such a tool might be the human voice as it registers stress reactions through modification by respiration rate and blood pressure. This form of monitoring would have the advantage of requiring no sensors attached to the controller's body or intrusive video surveillance.

"The central part of this document is chapter 4, where we present a literature review of work on analysis and classification of speech under stress," the report says.

So far, research on voice and stress has used a very broad definition of stress, not necessarily related to workload, the report says. At this stage, analysis of voice to determine workload stress presents various confounding factors — for example, a controller might feel stressed about domestic problems rather than workload. The report notes, however, that "while the overall performance of speech-based classification is far from satisfactory, it is still not so different from the performance reported for non-speech-based methods."

Revisiting the 'Swiss Cheese' Model of Accidents

Reason, J.; Hollnagel, E.; Paries, J. Eurocontrol Experimental Centre. EEC Note No. 13/06. October 2006. 35 pp. Figures, annexes, references. Available via the Internet at <www.eurocontrol.int/eec/public/standard_page/2006_note_13.html>.

"In 1990, James Reason, then a professor with the University of Manchester, provided a crucial contribution to the concretization of this idea by proposing a 'model' of how accidents could be seen as the result of interrelations between real time 'unsafe acts' by front line operators and latent conditions," the report says. "This model turned out to be highly pedagogical [teachable], and a large number of safety analysts around the world quickly started to use it in different industries."

Typical interpretations of Reason's model describe multiple levels of defense, or barriers, between errors or failures and an accident. The barriers have been pictured as a series of slices of Swiss cheese, a metaphor that Reason did not coin. Weaknesses, including latent ones, that can contribute to an accident are signified by the holes in the slices, which must be aligned for a cause to penetrate the defenses and an accident to occur.

"While much of the accident investigation community swiftly adopted the Swiss cheese model (SCM), not least in the aviation domain, the enthusiastic use sometimes relied on interpretations of the model's semantics that went rather far beyond what was initially intended," the report says. "The aim of this report is therefore to discuss the relevance and limitations of using the SCM, particularly from an air traffic management accident investigation perspective."

Reason has revised the SCM, most recently in the Mark III version of 1997, which the report says includes "significant changes." One is an explanation of how the weaknesses in the layers of defense arise:

"Short-term breaches may be created by the errors and violations of front-line operators. Longer-lasting and more dangerous gaps are created by the decisions of designers, builders, procedure writers, top-level managers and maintainers. These are now called latent conditions rather than latent errors or latent failures. A condition is not a cause, but it is necessary for a causal factor to have an impact. Oxygen is a necessary condition for fire; but its cause is a source of ignition. The use of this term allows us to acknowledge that all top-level decisions seed pathogens into the system, and they need not be mistaken.

"Allocating resources between departments is rarely done by giving out equal shares; some departments get more than others for what are judged to be sensible reasons at the time. But those with smaller slices of the resource cake will often have poorer equipment, extra time pressure, under-manning and other error-provoking factors. The existence of latent conditions is a universal in all organizations, regardless of their accident record."

The report notes published criticisms of the SCM. Human factors researcher Sidney Dekker, for instance, said that "the Swiss cheese analogy is useful to think about the complexity of failure, and, conversely, about the effort it takes to make and keep a system safe. … But the analogy itself

does not explain: where the holes are or what they consist of, why the holes are there in the first place, why the holes change over time, both in size and location, [and] how the holes get to line up to produce an accident."

Reason has speculated that "the pendulum may have swung too far in our present attempts to track down possible errors and accident contributions that are widely separated in both time and place from the events themselves."

WEB SITES

Aircraft Crashes Record Office (ACRO), <www.baaa-acro.com>

ACRO was founded in Geneva in 1990 with the goal "to record all information regarding commercial aircraft accidents worldwide since 1918 to today." According to the Web site, ACRO already has collected documentation and photos of more than 16,200 accidents.

The accident statistics section lists accidents from the database by several categories — country, airline, aircraft type, registration, fatality count and year. The accident news section lists recent accidents and provides basic information about the aircraft, passenger and crew data, and a brief news report.

Accident photos in color and black-and-white can also be accessed directly by the year an accident occurred. Not all years have accident photos. The oldest photo — a Caudron C.61 from the Czech Republic — dates from 1926 and shows the biplane with front-end damage, resting inverted.

The database is not all-inclusive and does not link to factual accident reports, but researchers may find this to be a convenient starting place with some attractive design features, such as airline logos. The Web site is in English and French.

U.S. Department of Transportation (DOT), Online Digital Special Collections Library, <dotlibrary.specialcollection.net>

The DOT has digitized several collections of archival library materials, including a large number of historic aviation documents, to preserve them and make them accessible to aviation enthusiasts.

Civil aviation materials are from U.S. regulatory and investigative agencies — the Federal Aviation Administration, the National Transportation Safety Board and their predecessors.

A visit to the history section of the FAA's Web site <www.faa.gov/about/history/brief_history> will help researchers understand the evolution of these groups and their respective documents.

Special collections include the following:

- Historic aviation accidents, 1934–1965;
- Civil aeronautic manuals;
- Civil Air Regulations administered by the Bureau of Air Commerce and the Civil Aeronautics Board;
- Civil Aeronautics Regulations administered by the CAA;
- Historic Federal Aviation Regulations, Part 121 and Part 135; and
- Superseded advisory circulars, dated 1957 and 1962–2000.

For many in the aviation field, the most useful will be the reports of historic accidents and incidents. Full-narrative accident reports, some with figures, appendixes and updates, have been scanned and/or reproduced. This collection supplements the NTSB aviation accident and incident database (1962–present) at the NTSB Web site <www.ntsb.gov/aviation/aviation.htm>.

As a result of today's technology, many materials in these special collections are available in two formats — scanned images of originals and versions reproduced as editable text. Documents can be read online, copied and printed at no charge. ●

— Rick Darby and Patricia Setze