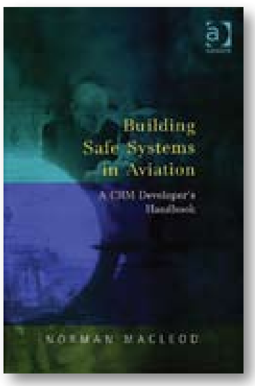
Training Crewmembers in the 'Soft Skills'

Crew resource management (CRM) is a component of technical proficiency, not a separate function, a trainer says.



BOOKS

Building Safe Systems in Aviation: A CRM Developer's Handbook

MacLeod, Norman. Aldershot, England: Ashgate, 2005. 186 pp. Figures, tables, index, references.

"So far, little of what has been done in the name of CRM [crew resource management] training can be said to have delivered results," the author says. "If we follow the narrow guidance on CRM training contained in published syllabi, then there is every chance that what we offer will continue in the grand tradition of systematic impotence."

MacLeod calls CRM the "soft skills," which involve *management* of the technical skills of piloting, such as aircraft configuration and control.

"CRM skills allow the crew to judge the rate of progress toward the desired goal, detect deviations from the desired trajectory, initiate recovery action, develop alternate plans and so on," he says. "When looked at in this context, the traditional separation of CRM from technical proficiency seems fundamentally flawed."

The author believes that CRM needs to be seen as "an integral part of competent workplace performance" and not only as a formula for threat and error management.

"The first observation I would make on the error management model is that it seems to treat safety as a static property of the system," he says. "We set up a series of rules, and, provided they are followed, then the aircraft will remain safe. Unsafety arises when departures from the rules occur. The second point I would make is that an absence of failure does not indicate the presence of safety. Individuals will differ in terms of their basic ability, level of competence, degree of motivation, tolerance of stress and so on. Each combination of qualities and characteristics possesses its own inherent level of risk. Although the observed performance may be compliant, the extent to which the actor contributes to the burden of risk borne by the operation is masked."

After examining the various concepts of CRM, the author says that the primary goal of CRM training is "to develop the social and cognitive skills that are exercised together with technical, systems-related skills in order to achieve safe and efficient aviation." But, he adds, CRM also requires analysis of the organization in which those skills are expected to be practiced.

Beginning with a discussion of the meaning of safety, a term that he says is complex because it involves not only individual acts but also the interaction of individuals and of various factors, he continues with a look at the "fuzzy concept" of a safety culture.

MacLeod describes his methodology for the rest of the book:

"I then want to explore the process of work and how people learn about their jobs. Next … we will look at how we define the desired performance expected of crews. With our behavioral framework … , we will look at translating goals into activities designed to achieve those goals.

"We will examine in detail the methods available for delivering training before, in the final section of the book, I look at the problem of measurement, both in terms of effectiveness of training and in terms of behavior on the line. My goal is to provide facilitators with a complete tool kit in order to support them in shaping CRM to meet their own company's needs."

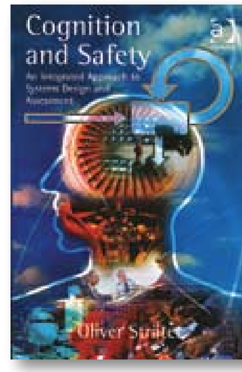
The author considers contradictions and paradoxes that can exist with CRM. For example, most CRM courses include studying accidents and incidents to discover causal factors and learn lessons.

"At the same time, we run the risk of reinforcing the 'otherness' of failure," he says. "Because we ourselves have never had direct experience of the events being analyzed, we can easily attribute the failure to some shortcomings exhibited by the actors in the event and sleep happily in the knowledge that it could never happen to us. …

"How, then, do we take this illogical model into account when developing our courses? First, we need to establish the concept that the laws of probability tell us that we are all equally exposed to a risk. Rarity of an event within our experience does not mean that we are less likely to encounter that event. Probability and consequence have long presented problems for the selection of appropriate case studies to use in training. Pilots, especially, are adept at dismissing the actions of colleagues involved in accidents as aberrations.

"Moreover, the individuals in the classroom would never be so stupid as to commit the mistakes made by the accident crew. It can be very difficult — at times impossible — to get the class to identify cause, as opposed to stating what the crew *should* have done. The more removed the case study in terms of seriousness, geographical location, scale of disaster and so on, the more readily some trainees can deny the lessons to be drawn from the event."

Cognition and Safety: An Integrated Approach to Systems Design and Assessment

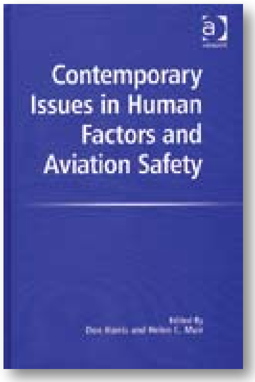


Sträter, Oliver. Aldershot, England: Ashgate, 2005. 288 pp. Figures, tables, bibliography, indexes.

Integrating cognitive issues — those related to thought processes and knowledge acquisition — with system design is the focus of this book by Oliver Sträter of Eurocontrol and the Institute of Technology, Munich, Germany.

"Humans at the working level are forced to make decisions based on constraints from targets set at the management level, the procedures and interfaces given, the required communications with working partners and the operational tasks to be performed," the author says. "This leads to the phenomena of induced mental workload. The term 'induced' comprises the additional effort due to the type of interaction with the system. A frequently stated selling argument [for] automation is that it reduces workload. However, induced workload may cause an even higher net workload for the user than the workload an automated system is designed to reduce. Cognitive psychology consequently becomes a considerable contribution to ensure safety at the working level."

The frequent observation that human error is involved in a large proportion of accidents and incidents is sometimes attributed to the reliability of equipment, from which it naturally follows that human factors plays a large role. The author believes that this is not the whole story and that technology can induce some types of human error. "In particular, those human errors occurring due to problems of the human-machine interaction are often incorrectly assigned as errors of the humans at the working level," he says.



Problems of technology versus cognition are not limited to failures to understand or correctly operate automated systems. In addition, Sträter says, operators sometimes must make judgments while under time and task pressure about the status of a system and its validity in the particular situation, which can lead to two complementary error types:

- "If one fails to notice the automatic function is out of service and should intervene (usually called error of omission)"; and,
- "If one wrongly perceives the automated system as not functioning and acts according to his/her own understanding of the situation, although the automatic system is working properly (usually called error of commission)."

The midair collision between a Tupolev Tu-154 and a Boeing 757 over Germany on July 1, 2002, was an example of the second type of error, the author says: "Nothing would have happened if the controller had not intervened in the automatic procedure." (See *Flight Safety Digest*, March 2004.)

The issues entailed by integrating cognitive psychology and design are discussed under chapter headings that include, among others, "The Cognitive Processing Loop"; "Mechanisms of Cognitive Performance and Error"; "Implications for Cognitive System Design"; "Assessment of Cognitive Performance in Safe Operations"; and "Integration of Cognitive Performance."

Contemporary Issues in Human Factors and Aviation Safety

Harris, Don; Muir, Helen C. (editors). Aldershot, England: Ashgate, 2005. 342 pp. Figures, tables, references, index.

This volume collects papers published during the first four years of publication of the journal *Human Factors and Aerospace Safety*. The papers, now presented as chapters, are classified under the headings of design, operations and training, and air traffic management.

Among the titles are "Head-up Displays and Visual Attention: Integrating Data and Theory"; "Passenger Safety in Future Very Large Transport Aircraft"; "A Review of the Benefits of Aviation Human Factors Training"; "Teamwork at 35,000 Feet: Enhancing Safety Through Team Training"; "Why We Need New Accident Models"; "Controller Workload, Airspace Capacity and Future Systems"; and "Spinning Paper Into Glass: Transforming Flight Progress Strips."

"When the papers are assembled together, it is … noticeable that no longer can the components in the aerospace system be considered in isolation," the editors say. "Safety can only be assured through the integration of its disparate component parts — design, operations, training, air traffic management and passenger safety. All must work together in harmony."

REPORTS

Examining ATC Operational Errors Using the Human Factors Analysis and Classification System

Scarborough, Alfretia; Bailey, Larry; Pounds, Julia. FAA Office of Aerospace Medicine. DOT/FAA/AM-05/25. Final report. December 2005. 35 pp. Available via the Web at <www.faa.gov/library/reports> or through the National Technical Information Service.*

The report describes a study that attempted to systematically examine the underlying human factors causes of operational errors (OEs). The study consisted of three phases: (1) a literature review to identify error models and taxonomies that have been used to classify OEs; (2) selection of an error model or taxonomy for use in the ATC environment; and (3) application of the selected error model or taxonomy to a subset of the items identified by FAA as OE causal factors.

The report says that the Human Factors Analysis and Classification System (HFACS), which "identifies and organizes latent errors using a hierarchical structure involving organizational influences, unsafe supervisory actions, preconditions for unsafe acts and unsafe acts," was found to be a useful taxonomy for classifying the causal factors associated with

OEs. A larger percentage of OEs were classified as skill-based errors than as decision errors.

The study also demonstrated, the report says, that "the 'causal factors' listed in the current OE reporting system [are] lacking in information concerning organizational factors, unsafe supervisory acts and the preconditions of unsafe acts. It is recommended that greater attention be placed on developing a more comprehensive human factors assessment of OE causes across all levels."

Reexamination of Color Vision Standards, Part I: Status of Color Use in ATC Displays and Demography of Color-Deficit Controllers

Xing, Jing; Schroeder, David. FAA Office of Aerospace Medicine. DOT/FAA/AM-06/2. Final report. February 2006. 19 pp. Available via the Web at <www.faa.gov/library/reports> or through the National Technical Information Service.*

FAA standards are used to screen air traffic controller applicants for color deficiency (deficits in color perception) because some job tasks require controllers to discriminate colors. The existing standards were based on analysis of tasks performed in the 1980s, and during the past decade, the use of colors in ATC has increased significantly. In addition, the rapid development of display technologies, the lack of consistent color design among different equipment manufacturers and displays that allow users to define their own color schemes mean that colors used to show the same information vary considerably in ATC facilities.

The report is the first step in an effort to re-examine the color vision standards used for selecting FAA controllers.

The researchers first performed a medical database study to identify the number of controllers with a color deficiency and determined that it was less than 1 percent of controllers in the current workforce. They then investigated the status of color use in ATC displays at three control towers, three terminal radar approach control (TRACON) facilities and three en route centers.

The report summarizes the main findings as follows:

- "All the basic colors and some non-basic colors are being used in ATC displays;
- "Critical information typically involves the use of red or yellow colors; [and,]
- "Colors are used mainly for three purposes: drawing attention, identifying information and organizing information."

The results raise questions about the adequacy of current FAA job-related color vision tests, the report says.


Reexamination of Color Vision Standards, Part I: Status of Color Use in ATC Displays and Demography of Color-Deficit Controllers

REGULATORY MATERIALS

Fatigue, Fail-safe, and Damage Tolerance Evaluation of Metallic Structure for Normal, Utility, Acrobatic, and Commuter Category Airplanes

FAA Advisory Circular (AC) 23-13A. Sept. 29, 2005. 74 pp. Figures, tables, references, appendixes. Available from FAA via the Web at <www.airweb.faa.gov> or the U.S. Government Printing Office.***

This AC presents an acceptable means of showing compliance with FARs Part 23, *Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Category Airplanes*. It provides information about approval of continued operational flight with known cracks in the structure of small airplanes, regardless of their certification basis. This AC clarifies the use of AC 20-128A, *Design Considerations for Minimizing Hazards Caused by Uncontained Turbine Engine and Auxiliary Power Unit Rotor Failure*, in the evaluation of rotorburst structural hazards in small airplanes. This AC consolidates existing policy documents and some technical reports into one document.

This AC supersedes AC 23-13, *Fatigue and Fail-Safe Evaluation of Flight Structure and Pressurized Cabin for Part 23 Airplanes*, dated April 15, 1993.

WEB SITES

Flight Safety Foundation, <www.flightsafety.org>

We would like to call attention in this first *Aviation Safety World* to the Web site of the magazine's publisher, Flight

Safety Foundation. Call us immodest if you want, but we think that it's an extraordinary resource.

The Web site contains the archives of FSF publications in PDF format, going all the way back to the 1980s, including a search engine. Titles include *Flight Safety Digest*, *Accident Prevention*, *Aviation Mechanics Bulletin*, *Cabin Crew Safety*, *Airport Operations*, *Human Factors & Aviation Medicine*, and *Helicopter Safety*.

A subject-specific resource guide is available to researchers at the aviation-related sites page within the Library section. It is a brief, concentrated collection of links to other Web sites that also focus on aviation safety.

The research guide is divided into categories that include accident and incident information; civil aviation authorities; regulations, standards and recommended practices; and data and statistics. Most entries link to primary sources of information at government and non-government sites. For example, researchers can link to accident reports, civil aviation rules and procedures, and transportation safety statistics from many countries.

Authoritative sources from around the world are represented. Most sources offer English as a language choice for viewing their web sites.

A limited list of aviation association and commercial metasites are included. (A metasite contains significant and varied amounts of information on a common theme — in this case, aviation safety.)

CHIRP, <www.chirp.co.uk>

CHIRP, managed by The CHIRP Charitable Trust, is a confidential, independent and voluntary incident-reporting program funded by the U.K. Civil Aviation Authority. "The objective of CHIRP is to promote safety in the aviation and maritime sector for employees and others by obtaining, distributing and analyzing safety-related reports which would not otherwise be available; [while] at all times keeping the identity of the reporter confidential," says the site.

Individual entries (comments and questions) in CHIRP's publication, *Feedback*, may be followed by responses from appropriate government departments. Aviation reports are categorized as air transport, cabin crew or general aviation. All information pertains to the United Kingdom, but the information revealed in the reports may be useful to anyone interested in aviation safety.

Feedback is available in full-text, dating back to 1996. Quarterly issues contain figures, tables and photos.

—Rick Darby and Patricia Setze

Sources

* National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161 U.S.
Web: <www.ntis.gov>

** U.S. Department of Transportation
M-30
3341 Q 75th Ave.
Landover, MD 20785 U.S.

*** U.S. Government Printing Office
732 N. Capitol St. NW
Washington, DC 20401 U.S.
Web: <www.access.gpo.gov>