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SPECIAL COMMITTEE REPORT

Cockpit Resource Management

As directed by the Executive Council of the Aerospace Medical Association, the Sub-Committee on Cockpit Resource Management prepared the following report on Cockpit Resource Management and Advanced Qualification Program for the Aerospace Human Factors Committee. This position paper has been approved by the Aerospace Medical Association Executive Council to become a policy of the AsMA.

This paper represents an Aerospace Medical Association (AsMA) position on the topic of cockpit resource management (CRM) and the proposed Advanced Qualification Program (AQP). The focus of this paper is based on a review of the Federal Aviation Administration's (FAA) Advisory Circular, 120-51 dated 12/1/89, describing CRM training and the Notice of Proposed Rulemaking under 14 CFR part 61 for an Advanced Qualification Program.

The Aerospace Medical Association is dedicated to aviation safety through research, practice, and application. Therefore, we believe it appropriate that we comment as an organization in a substantive manner, on the documents cited above.

HISTORY

With the advent of the jet transport, the incidence of aircraft accidents has steadily declined. At least, accidents due to mechanical failure and weather have declined. However, in the area of human error, not only have accidents not declined, but there is some indication that they will increase. A recent, unpublished study by the Boeing Aircraft Corporation's Commercial Airplane Division indicates that the actual number of accidents will increase unless there are reductions in human errors. This is, in part, a consequence of the increase in numbers of aircraft flying. When consideration is given to the increasing percentage of larger aircraft, the potential for more deaths must be considered.

A series of accidents in the 1960's and 1970's promoted the research that led to the first CRM programs. Lauber (1987) described interviews conducted with airline pilots by NASA personnel (Billings, Cooper and Lauber). The interview data had a consistent theme of dissatisfaction on the part of airline pilots with the lack of training in the areas of decision-making, leadership, and communications. Cooper, White, and Lauber, (1980) found that between 1968 and 1976 more than 60 accidents involved problems with decision-making, leadership, pilot judgment, communications, and crew coordination. The classic study of Smith (1979) found performance differences between crews that worked well together, using available resources versus crews that did not.

The types of accidents are illustrated by a few examples. In two accidents, an indication of a nose landing gear not down and locked led to two major airline accidents with considerable loss of life. In both cases the entire crew became absorbed with the landing gear problem. In the first, the autopilot became disconnected and with no one monitoring the aircraft, it slowly descended into the Everglades. In the second accident, one of the crewmembers recognized that the aircraft was about to run out of fuel, but failed to inform the captain of the criticality of the situation. In both cases the captains failed to prioritize their problems.

During the past three decades there have been a number of accidents involving loss of aircraft and lives, where the probable cause or a contributing factor was the failure of the flight crew to interact appropriately. These accidents are characterized by poor cockpit procedures (failure to set takeoff flaps), lack of leadership (failure of the captain to prioritize tasks to insure that someone is flying the airplane, and to use the resources of the entire crew), lack of assertiveness (a copilot and flight engineer who allowed a routine low fuel situation to deteriorate into a fatal accident by not confronting the captain with the reality of their situation), and poor group decision-making (continuing an approach from an unstabilized condition).

The avoidance of several accidents during emergency situations has been attributed, at least in part, to CRM training. One of these involved the loss of a cargo door with subsequent rapid depressurization and loss of two engines. In this incident, an analysis of the cockpit voice recorder (CVR) demonstrated that the crew worked as a team, prioritizing their tasks and solving problems as a group. The crew directly attributed their performance to the CRM training they had received. In one accident involving total loss of hydraulic fluid, the survival of over 100 passengers was partially attributed to CRM training. This is demonstrated by the manner in which the crew sought assistance from both a company training pilot, who was a passenger on the flight, and personnel on the ground, and how these individuals worked together to form solutions to an almost impossible situation.

However, accidents and incidents continue to occur in which there is poor use of CRM. A lack of CRM was a component in at least six recent air carrier accidents. Characteristics of these accidents include poor cockpit procedures which led to attempted takeoffs with the aircraft not configured for takeoff; lack of pre-takeoff briefings which led to poor procedures during an aborted takeoff; an unassertive copilot who sat quietly watching while the captain descended below minimum descent altitude and flew into the ground; and cockpit crewmembers who allowed their air carrier aircraft to run out of fuel while alternative courses of action or the extent of the emergency were not discussed.

With the advent of the glass cockpit and increasing levels of automation, we have entered an arena in which there is much to learn about the cognitive demands put upon aircrews as well as how best to use these "workload reducing" devices. Automation has enabled large transport aircraft to be flown by two- rather than three-person crews. There is evidence that two-person crews establish better communications, which are less likely to break down. However, there is also evidence that the automated cockpit is causing undesirable changes in both communications and workload. Crews tend to talk less in the automated cockpit and spend more time programming equipment (Wiener, 1989). There is evidence to support the hypothesis that performance degrades as the amount of relevant communications decreases (Foushee and Helmreich, 1988). While the automated cockpit greatly reduces workload during the enroute portion of the flight, workload can be higher than in the conventional aircraft during approach and departure (Billings, 1989, Wiener, 1988). These changes are important considerations in the design and evaluation of CRM training.

The cornerstone of CRM training has been crew coordination which includes increasing knowledge of group processes, judgment, and decision-making skills. This training becomes operational in line-oriented flight training (LOFT) (Foushee and Helmreich, 1988), where flight crews solve problems requiring CRM skill during performance of a line-oriented scenario. Personality is an important factor in determining how a flight crewmember will interact with others in the cockpit. Developers of CRM programs recognize the relative permanence of personality, as well as the ethical issues of trying to change personality. CRM programs, therefore, concentrate on modifying behavior by changing attitudes through didactic learning and reinforcement of selected behavioral patterns.

ADVISORY CIRCULAR 120-51 12/1/89

This Advisory Circular is divided into several sections. For the purposes of this position paper, the sections addressed are as follows: background, basic concepts of CRM training, phases of CRM training, the role of CRM instructors and check airmen, and evaluation of CRM training programs.

Background

The background section of this document explains the need for CRM training. However, it accomplishes this only in a very general sense. The advisory circular is the document most likely to be read by flight crewmembers and is, therefore, the place to influence flight crews (and management) on the concept of CRM. This section would be enhanced by the use of examples of accidents and how CRM training or CRM/LOFT reduces or eliminates the possibility of the scenario described leading to an accident.

Basic Concepts of CRM Training

The opening subsection under the title of "general" is excellent and complete. This document offers the opportunity to alleviate many of the anxieties that crewmembers have towards CRM. These anxieties take on several forms that should be addressed in this section.

Many flight crewmembers are concerned that they will not "fit into" a CRM program, that their personality is either unsuited for CRM or that CRM will attempt to change their personality. Crewmembers also fear that training in CRM will be at the expense of their "flying skills." Anxieties about loss of basic flying skills can be exacerbated with the introduction of cockpit automation and "the glass cockpit." Another issue causing anxiety for some captains is the fear of losing authority (Wiener, 1988, Wiener, 1989).

All of these issues can be addressed by adding a few sentences, thereby reducing alienation and enhancing enthusiasm for CRM training. A sentence such as, "CRM concepts will be used to make automation an user-friendly tool of the crew, with the crew in charge of how and when the automation is to be used."

Phases of CRM Training

This section is complete, but consideration should be given to making an explicit statement that the training sessions are ungraded learning sessions and that video tapes will be destroyed. Similarly, a statement should be added that LOFT scenarios used in recurrent training can only be passed as a crew and not as individuals.

The Role of CRM Instructors and Check Airmen

This section is complete with one exception, i.e., that CRM instructors, simulator-check airmen, and line-check airmen must be convinced that CRM is not only necessary, but highly desirable. This may seem self evident, but previous experience has shown this to be a source of problems. The probability of accomplishing these goals is increased by insuring that these personnel not only receive CRM training, but are involved in the evolution of CRM, within the individual airline. Appropriate amounts of line flying, even as a cockpit jumpseat observer, allows these instructors and check airmen to observe problem and witness CRM in the operational world.

Evaluation of CRM Training Programs

In general, this section is both thorough and complete.

Since CRM training contributes to the overall performance of the flight crew, one measure of the effectiveness of CRM training is flight crew performance. The precise contribution of CRM training to flight crew performance, however, has not yet been defined. Consequently, there needs to be an independent evaluation of CRM training that would determine flight crew interactions and attitudes and the changes due to CRM training. The surveys in attachment 1 should be useful for this purpose.

POSITION SUMMARY

The Aerospace Medical Association endorses the concepts of CRM and supports the Federal Aviation Administration in its efforts to encourage the use of CRM. The Advisory Circular 120-51 is an excellent first step. The AsMA urges the FAA to consider the above comments when revising Advisory Circular 120-51, titled Cockpit Resource Management Training.

We applaud the FAA for recognizing that CRM is still in its infancy and that requirements need to be flexible, not only because CRM is in a state of evolution, but because individual users will have different needs and solutions.

ADVANCED QUALIFICATION PROGRAM

The proposed Special Federal Aviation Regulations (SFAR) titled Advanced Qualification Program (AQP) would provide an alternative to the training and qualification requirements in Part 121 Subpart N-Training Programs and Subpart O-Crewmember Qualifications and in Part 135 Subpart H-Training and Subpart E-Flight Crewmember Requirements.

While CRM is certainly one of the foundations of the AQP, AQP entails much more than CRM, as described in the Federal Register, Vol. 54, No. 34, Wednesday, February 22, 1989, on pages 7670 through 7681. Specific details of AQP can be found in the Advisory Circular Draft titled Advanced Qualification Program, published in the above volume of the Federal Register on pages 7681 through 7734. This position paper comments on the AQP. The AsMA makes no attempt to evaluate the details of an AQP but comments on some of the general aspects of AQP.

The AQP is a voluntary program for Part 121 and Part 135 operators who are required to have an approved training program. Each carrier will design its own program to FAA criteria. The program is conceived to expand and replace certain aspects of current Part 121 and Part 135 training and qualification. The two major changes are: 1) maneuvers and procedures, and 2) the use of crew based training and evaluation. New generations of aircraft will require some new maneuvers and procedures and may prohibit others. The value of crew concept training was discussed above under Advisory Circular 120-51.

Characteristics of AQP are flexibility, content-based requirements, balance between training and evaluation, training to criterion levels, and a means for initial Airline Transport Pilot (ATP) certification with the AQP.

The AQP is a step forward in recognizing the need to train crews as a team, to design the training programs to fit the aircraft, to make better use of modern simulator technology for recurrent training to the level of initial qualification, and to insure that flight crews are masters of the technology on their aircraft. Nevertheless, there are some areas of concern. These are itemized below.

The AQP has a provision, whereby the recurrent training cycle can be lengthened to 26 months and further to 39 months. In order to lengthen the recurrent training cycle, it must be demonstrated that crews meet the qualification of the continuing evaluation at the time of the recurrency evaluation. There is an economic incentive to reduce the number of training sessions. However, there is a methodological problem with this type of evaluation. If each of the continuing evaluation qualifications begin with training, then the evaluation at the end of this training does not measure the performance of the crewmember when she or he entered the continuing qualification phase. The end result is that the measure is not of crew performance deterioration, if any, but of whether after recurrency training, the crew meets the established criteria. Until there is objective data to substantiate a longer recurrency training interval, the recycle interval should, therefore, be kept at 13 months.

While evaluation of LOFT/CRM performance is certainly required, it is important to emphasize to crewmembers that LOFT/CRM training cannot be failed. This type of LOFT/CRM training is central to both the learning and acceptance of CRM.

While there are no objections to second-in-command and flight engineer online checks in conjunction with pilot-in-command (PIC) online checks, second-in-command pilots should be checked to the same flight proficiency criteria as the PIC. If a particular pilot operation is required for safe operation of the aircraft, then the second-in-command should be proficient at the operation.

Overall, the AQP could be simplified and clarified. For example, the explanation of certification in section 5 is difficult to follow. The parts of Part 61 which are and are not applicable are not clear. Under certification, is it possible to receive a type rating within the AQP?

Where initial qualification, continuing qualification, and recurrent qualifications are the same, the requirements should be stated once and not in three different sections.

POSITION SUMMARY

The Aerospace Medical Association supports the concepts of AQP, including specifically the ideas of training and evaluation as a crew; training that is aircraft specific and recognizes the changes that automation brings; training that increases the probability that technology will be the tool of the crew; and recurrency training that meets initial qualification criteria and is not perfunctory.

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