



Cockpit Resource Management — The Only Way to Go

The corporate cockpit is benefitting from safety and efficiency improvements that result from applying an open-minded approach to flight crew management.

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by

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To begin with, just what is cockpit resource management (CRM)? The U.S. Federal Aviation Administration (FAA) defines it as the effective use of all resources available to the crew — hardware, software and all persons involved in aircraft operation — to achieve safe and efficient flight operations. In short, CRM is using everything available to achieve flight goals.

To understand why it is so important now, we should first acknowledge that the introduction of advanced computer-based technology to the flight decks of transport airplanes in recent years has resulted in a dramatic change in the role and expertise expected of cockpit crew members. The FAA has recognized that some training, checking and testing requirements in existing regulations are becoming obsolete for the operation of advanced technology aircraft. Both industry and government now agree that training should emphasize crew coordination and effective management of crew resources.

Although CRM initially was applied to the air carrier cockpit, corporate flight operators can likewise benefit from improvements in cockpit coordination. The bottom line is the same: better use of available resources in the cockpit.

Traditionally, training and checking have been weighted toward the pilot in command, with little attention being

given to other crew members. This has led to pilot training and checking on an individual basis, in an environment which is not crew task-oriented. Flying skills and systems knowledge were emphasized, but communications skills, coordination and decision making were neglected.

Evidence accumulated in the last decade suggests that a high percentage of air carrier incidents and accidents have been caused, at least in part, by a failure of the flight crew to use readily available resources. U.S. National Aeronautics and Space Administration (NASA) studies performed during this time indicate that more than 60 percent of fatal air carrier accidents were not directly linked to mechanical failure or lack of pilot skills, but rather to a breakdown in cockpit communication. These NASA studies emphasize a deficiency in present-day recurrent training in areas related to human factors.

In June 1988, the U.S. National Transportation Safety Board Board (NTSB) issued a safety recommendation stemming from the investigation of a fatal crash that had occurred the previous year (NTSB Safety Recommendation A-88-71 relating to a Northwest Airlines accident in 1987). Both pilots had received single crew member training in their last simulator and proficiency checks. Their last CRM training was three and a half hours of ground school (general) CRM training in 1983. As a

result of its investigation, the NTBS recommended that all Part 121 carriers [defined in U.S. Federal Aviation Regulations (FAR)] “... review initial and recurrent flight crew training programs to ensure that they include simulator or aircraft exercises which involve cockpit resource management and active coordination of all crew member trainees and which permit evaluation of crew performance and adherence to those crew coordination procedures.”

This recommendation was bolstered by the findings of the Joint Government/Industry Task Force On Flight Crew Performance (created at a meeting of airlines and FAA Administrator, August 1987). The task force was comprised of representatives from major air carriers and air carrier associations, flight crew member associations, commuter air carriers, regional airline associations and government organizations. Working groups in three major areas — man/machine interface, flight crew member training and operating environment — submitted their reports and recommendations to the task force. These became the substance of recommendations that were presented to the FAA Administrator in June 1988, some of which were:

- Require those Part 135 commuters whose operations require two pilots to comply with Part 121 training, checking, qualification and record keeping requirements.
- Provide for a Special Federal Aviation Regulation (SFAR) and Advisory Circular to permit development of innovative training programs.
- Establish a National Air Carrier Training Program Office, which provides training program oversight at the national level.
- Require second-in-command pilots to satisfactorily perform their duties under the supervision of check airmen during operating experience.
- Require all training to be accomplished through a certificate holder’s training program.
- Provide for approval of training programs based on course content and training aids, rather than using specific programmed hours.
- Require cockpit resource management training, and encourage greater use of line oriented flight training (LOFT).

Specific recommendations regarding regulatory changes were also submitted, to be incorporated into an SFAR and Advisory Circular. These, the task force suggested, should be proposed in a subsequent rulemaking action.

In response, the FAA issued SFAR No. XX, Advanced Qualification Program, Notice of Proposed Rulemaking. (This SFAR was published in the U.S. *Federal Register*, Vol. 54, No. 34, February 22, 1989, page 7671.) It provides a voluntary alternative method for meeting the training, evaluation, certification and qualification requirements in FAR Parts 61, 63, 65, 121 and 135. It applies to all certificate holders requiring an approved training program under FAR Parts 121.401 and 135.341, and all certificate holder personnel subject to those training program requirements.

CRM In Corporate Cockpits

The author believes that the spirit and intent of the SFAR is to encourage all two-pilot aircraft operators to adopt CRM training and that, although FAR Part 91 is not included in the SFAR, it could also apply to corporate operators. The FAA’s proposed voluntary alternative is called an “Advanced Qualification Program (AQP).” Guidance for approval for an AQP is provided in Advisory Circular 120-XX, Advanced Qualification Program. More on AQPs later.

The initial goal of the SFAR is to improve flight crew performance by providing alternate means of complying with current FARs that may inhibit innovative use of modern technology. The SFAR would provide flexibility, by acceptance of training curriculums that depart from present requirements, that would allow certificate holders maximum use of flight simulators and other flight training devices.

There are important benefits that should be recognized. For example, under present rules, training and qualification requirements vary with respect to the balance between training and checking. Some put more emphasis on evaluation, to the detriment of training. The SFAR is intended to ensure that each crew member receives a proper balance between the two.

Another welcome benefit is that the SFAR does not require a specific number of programmed hours. Instead, emphasis rests on the concept of training to proficiency, crew member performance and subject content.

Since some of the maneuvers and procedures required in current FAR tables cannot be performed in the new generation aircraft, others, more comprehensive and relevant to current aircraft technology and operational capability will be added. Useful, practical training to a performance standard will replace rote fulfillment of the requirements to pass a final test. Hence, the new flexibility allows the development of curricula with planned hours and specific activities that ensure proper training for specific job tasks. Overall, the FAA expects that flight

crews qualified under an advanced qualification program will exhibit superior performance because they will have received cockpit resource management training and other training more specific to the aircraft they fly on the job.

Under FAR Parts 121 and 135, the SFAR will require additional training in CRM, and increased training and evaluation for second-in-command pilots. This will ensure that the person is technically skilled and can demonstrate those skills in a typical or simulated operational environment. The pilot would have to show both individual technical competency — piloting and other skills — and overall crew-oriented operational competency. This will ensure adequate cockpit resource management skills.

Cost savings in training programs are possible. Training will be related to individual proficiency instead of a set number of hours, and the frequency of recurrent training for pilots-in-command could be reduced. Large Part 121 carriers could realize a net savings of more than \$7 million, and for large Part 135 operators the savings could exceed \$4 million. These FAA study estimates are net savings, after possible increased training costs resulting from the SFAR are deducted.

But the primary benefit would be reduction of the number of aircraft accidents in which cockpit coordination problems surface as the probable cause. A review of NTSB aviation accident data reveals that during the past 20 years there were 14 such accidents involving FAR Part 121 carriers, and 15 accidents involving FAR Part 135 carriers. These accidents resulted in 661 fatalities, at a cost of \$779 million, or \$39 million per year.

These cockpit coordination accidents appear to have occurred at a consistent rate of 0.83 accidents per 10 million instrument flight rules (IFR) departures for FAR Part 121 carriers. For Part 135 carriers, accidents of this nature declined in the 1970s and leveled off in the 1980s at 4.73 per 10 million IFR departures. Applying accident rates to forecasted departures between 1989 and 1999, the projected number of FAR Part 121 accidents in this category for the next 10 years is 11.9, and for FAR Part 135 carriers it is 21.4. The economic losses would be more than \$690 million, or an annual loss of almost \$83 million.

Implementing CRM Training

We have already seen that an advanced qualification program is the key element in the SFAR. FAA Advisory Circular 120-XX, part of the SFAR, provides guidance for FAA approval of an AQP. It describes one acceptable means of complying with the SFAR, but alternate means proposed by the applicant also will be given consideration.

Certificate holders may conduct some or all of their training under an approved AQP (except hazardous materials and security training). To receive approval, they must have the facilities and equipment necessary to support the training, evaluation, certification and other competency activities provided for in the AQP. However, they may use third-party training organizations, called "training centers," to provide cockpit management training. The training center may be a certificate holder, an aircraft manufacturer or any noncertificate holder that provides training to a certificate holder.

Regarding CRM training in particular, one major U.S. airline has already spent more than \$17 million developing its own in-house program. Several other airlines, including a major airline in Europe, have developed CRM programs which are available to others for a fee. And in addition, there are several non-certificate holders that make CRM training available on a contract basis. These training centers have developed training programs particularly fitted to the needs of corporate and air taxi operators, as well as to airlines. Thus, there is a variety of assistance available, and contracted CRM training can be tailored to match the needs of the client organization.

Courses Utilize Workshops

For example, some programs use workshops as the primary means of CRM training. These workshops may be conducted by the contract training center, or by the organization, after one or more of their own personnel are trained as instructors. Workshops can last from two to five days or more, again, tailored to the desires of the organization. The program may use a workshop to introduce the training, the remainder of the training being accomplished via individual self-study programs over an extended period of time. Each pilot completes the study units, mailing in his audio tape or written response to discussion questions provided by the training center. The pilot has one-on-one support and guidance from a training center instructor, and he may even pose questions to the center's technical board for resolution of controversial problems.

For this latter type of training, the organization is required to provide a program coordinator, appointed from its own resources. This usually is an operations staff member, responsible for providing direct liaison with the training center and administering the program internally.

The principal mode of instruction of one non-certificated training center involves specific behavioral objectives (SBOs), which provide the structure for coping with inflight situations that demand action. The SBOs define exactly what the pilot should do, what junior crew members should monitor and support, and what the supervisory pilot should observe, evaluate and instruct to achieve

effective cockpit management. Since acquiring and accepting SBOs requires introspective thought developed during a period of time and experience, this company's CRM training employs programmed study extended over a one-year period, sequenced at one study unit per month. The philosophy is that a pilot has to think about the new concepts that he is learning before finally accepting them. Only then, this company contends, is lasting behavioral change achieved.

It is important to recognize that cockpit resource management training is not a hastily thrown together response to a newly discovered need. Many of the programs offered today are the result of painstaking research and development during the past decade. The credentials of the technical boards that devise the training curricula are excellent and they include recognized experts in the field of aviation psychology, cockpit communication, cockpit workload and cockpit design, interpersonal relationships, and sociology.

Because CRM programs are aimed at professional pilots, training centers normally convert the input from their technical board into pilots' vernacular. The actual writing of their texts and audio scripts is done by professional pilots, using terminology that cockpit crew members are comfortable with. This is important, because for CRM to generate improvement in flight safety and efficiency, crew members must be provided the management tools they can understand willingly accept. As previously noted, the objective is to create positive and lasting behavioral change during all flights.

Perhaps the major accomplishment of CRM training is that it brings organization to the pilot's information bank. A frequently heard comment from CRM training attendees is: "So that's why I keep having those problems."

One CRM instructor stated: "We are working with professionals who already have a tremendous store of knowledge. We add a little, but mostly we organize it better so they can use it to get the job done efficiently."

Taking a Look at the CRM Curriculum

To see exactly what CRM training consists of, let us examine a typical curriculum. The first two sessions, or study units, are usually introductory, defining CRM, the general functions of management, responsibility for CRM leadership and delegation of authority. Attitudes and skills are discussed, with emphasis on the need for physical, technical and management skills to be developed. The point is made that the cockpit manager's performance is directly linked to his attitude toward cockpit management.

Next, an explanation of the management tools available

to cockpit managers is presented. These tools include cockpit communication, briefings and debriefings, and the challenge and response environment in the cockpit. This is not the familiar checklist challenge and response, but how and why crew members must be alert to challenge the decisions, actions and procedures of other crew members whenever they perceive a conflict with good procedure or safety practice. Only in this environment can effective monitoring and support of another crew member's performance be accomplished.

The value of having a short-term strategy for dealing with a specific problem on a particular flight is explained, and the steps to employ in developing and using the strategy are presented. The importance of a balanced relationship between cockpit authority and junior crew member assertiveness in achieving a real team operation is stressed.

Using New Techniques

The curriculum could continue with discussion of how these management tools are to be used. Cockpit management styles are examined, from the performance of the goal-oriented manager to that of the team-oriented manager. This session shows how the goal-oriented style tends to concentrate on attaining operational aims at the expense of maintaining a good interpersonal relationship with the crew. This, of course, would inhibit any advantage to be gained in a challenge and response operational environment. The completely team-oriented manager, on the other hand, sometimes is viewed as lacking in the proper level of assertiveness in his efforts to nurture team work. This could cause crew members to question the manager's leadership commitment, complicating the attainment of flight goals. A balance between the two extremes of management styles is what attendees are encouraged to seek.

One corporate pilot said of his CRM training, "... one thing that I see is that I have not given up my authority, and in fact, it has enhanced my authority ... the trip goes a lot better because they [other crew members] feel more comfortable bringing forth input, and they don't have to do it in an aggressive, ticked-off manner ..."

A copilot reflected, "... cockpit management gives a copilot like myself the opportunity to initiate a conversation because it's done in the [interest] of cockpit management."

Controlling cockpit workloads is a very important part of CRM training. Recognition of the clues of a workload level that is too high or too low and the characteristics of both extremes is explained. Similarly, the state of the cockpit atmosphere, from the desired comfortable, attentive environment, to the very dangerous and confused

“getting behind the airplane” feeling is covered. The factors that create these atmospheres and methods of maintaining a proper state or getting out of an unwanted cockpit situation are discussed.

A comprehensive and well-planned CRM training curriculum could conclude with sessions on human error, judgment and decision making, and leadership in emergency situations. With these three vital subjects concluding the curriculum, CRM training can encompass all of the specific tools that crew members should use to get the most from their available resources.

Prospective attendees need not be concerned about “going back to school.” Information generally is presented at carefully planned intervals, allowing acquired knowledge to develop skills, which, in time form supportive attitudes. Multiple learning techniques are used. Because each crew member learns best in his own way, information is presented in a variety of ways: written texts, audio tapes, case studies, hands-on LOFT, individual and team discussion questions, and supplemental reading.

To bridge the gap between accumulating knowledge and applying it in the cockpit, some programs offer one-on-one guidance and support from instructor members of the training centers. Thus, as training progresses, and the attendee has the opportunity to test the new learning in his operational environment, he is aided by interaction with a competent CRM instructor.

Who Needs CRM Training?

Two questions that are often asked are: “Why must all organization pilots be trained?” and, “Why can’t we just identify the inexperienced or weak pilots and give them the CRM training?” The answer to both questions is simple: until recently, the industry has never adequately trained crew members in cockpit management. The progression from right to left seat, or from the flight engineer to copilot usually resulted when enough time, seniority, experience and technical skills were accumulated. But when the move was made, little attention was given to teaching candidates their new cockpit management responsibilities. That is why the FAA and most training centers insist on training all organization pilots, not just those who aspire to change seats, or those who may appear to be weak. Sometimes the most experienced, highly qualified pilots are those most in need of CRM training.

For those who still have doubts, here is another question: “Why do skilled pilots have accidents?” For the answer we will have to go back in time, when the macho, do-it-all-himself pilot was highly sought. This pilot was in demand because he had admirable qualities — a high

degree of proficiency and flying skills, technically oriented, strong authority figure. In many cases, that’s what it took to fly airplanes in earlier days. Those qualities are still admirable, and no one wants to discourage them. The problem is that this kind of pilot, sometimes called the “one-man-band pilot,” usually does not make good use of his crew and other resources. He may want to use them but he does not know how; he has never been trained to do that. His reputation as a fine pilot, a strong personality, one who prefers to do it all himself, precedes him, often discouraging other crew members from volunteering their support. He may not even know it, but the other crew members usually are reluctant to challenge him, which destroys their monitoring and support effectiveness. So we find some excellent pilots with exceptional reputations having “unexplainable” accidents.

Only by training all an organization’s pilots can we expect the captain to solicit and accept monitoring and support, and junior crew members to provide that vital function. By insisting that all staff and administrative pilots also receive CRM training, we ensure positive support from the total organization.

Gaining FAA Approval for Training

What will the FAA require for approval of an advanced qualification program, under the Special Federal Aviation Regulation? Keep in mind that an AQP is an alternative means of qualifying, training, certifying and otherwise ensuring the competency of crew members and other operations personnel subject to FAR Parts 121 and 135. The goal of an AQP is to encourage instructional innovations to achieve higher standards of crew performance. The objective is to provide more effective training to enhance professional qualifications. The SFAR allows innovations to be made to support these goals and objectives. An AQP may include curricula that comply with current FARs as well as with SFAR requirements. This permits the certificate holder to have flexibility in revising existing programs.

AQPs are expected to contain at least three curricula:

- **General Indoctrination.** For new hires, this covers company policies and practices, as well as general operating knowledge. Newly hired flight crew members also receive general aeronautical knowledge and a general indoctrination for pilot-in-command and second-in-command duty positions. Instructor indoctrination focuses on methods and theories of instruction, the use of flight training facilities and equipment, methods of evaluating and policies and practices used in conducting ground and flight evaluations.

- **Qualification.** This curriculum prepares crew members, instructors and evaluators to competently perform their tasks. Crew member qualification fully prepares one for a particular position on a specific make, model and series aircraft. It also includes initial supervised operating experience and practical evaluation for certification, if appropriate.

Instructor qualification includes training plus written, oral and practical evaluation to the extent needed to qualify for conducting flight instruction on a particular make, model and series aircraft. It also prepares an instructor for duties other than flight instruction.

Evaluator qualification includes training plus written, oral and practical evaluation needed to qualify an instructor to evaluate on a particular make, model and series aircraft.

- **Continued Qualification.** These curricula include recurrent ground and flight training, recurrent proficiency and on-line evaluations and recency of experience activities. They are developed for all instructors, evaluators and crew members.

Cockpit resource management and line oriented flight training are included in each AQP Qualification and Continued Qualification curriculum. The SFAR requires that training and evaluation appropriate to each duty position be conducted in simulated operation scenarios. Guidelines for LOFT training are provided in FAA Advisory Circular 120-35A.

Those who are involved in CRM training believe that sound cockpit management methods will eventually be required behavior on the flight deck because of their direct relationship to flight safety, flight efficiency and passenger service. When this happens, it is important that the methods be precisely defined so that flight crew members will know exactly what is required of them. Cockpit resource management training has proved to be the best way to ensure this. ♦

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