Future directions in crew resource management training

CRM training has achieved notable success, but if the technique is to reach its potential, there is a need for further development of training curricula and instructional methods.

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In the human factors of crew coordination and communication, now known as crew resource management (CRM) training, has become worldwide in the last decade. Our research group has been studying the impact of CRM throughout this period. Our data show that initial and recurrent training in these concepts, combined with practice in line oriented flight training (LOFT), and continuing feedback and reinforcement, lead to continuing improvement in crew performance over time.

The notable successes of CRM training should not be interpreted as meaning that CRM training is now fully developed and optimally effective. The data show large and significant differences between organizations in the impact of training and in the levels of performance achieved. Even within organizations, large variability in performance continues to exist and recognizable subcultures that differ in human factors practices can be identified. The implementation of CRM will not be complete until acceptance of its concepts is more uniform among the organizations that use it.

Just as CRM training has evolved over time, the research associated with it has changed in direction and focus. We are no longer concerned with the basic question of whether human factors training has a measurable impact, but rather with a new set of questions that have arisen from the earlier investigations.

It is important to recognize that most new CRM courses are very different from early programmes that were derived from corporate management development training. We are now encountering a "third generation" of CRM programmes that focus on specific behaviours and behavioural strategies and take a systems approach to human factors. However, the success of CRM does not mean that the technique has reached its potential. There is a need for further development of training curricula and instructional methods.

One of the most important insights reflected in the new programmes is that CRM concepts and training should not be limited to the flight deck. In the course of their work, crews interact with a number of outside groups - flight attendants, air traffic controllers, mechanics, dispatchers, ground operations personnel, etc. Many of the observed problems in the aviation system involve the interfaces among these groups (for example, miscommunication and misunderstandings between pilots and air traffic controllers). A number of new courses incorporate these ideas, providing, for example, specialized training for first officers upgrading to captaincy. This captaincy course concentrates on the interface of the cockpit crew and especially the captain with other organizational elements, as shown in Figure 1. It also focuses on improving specific behaviours by the captain that were discovered in our research to be the most important determinants of crew effectiveness. These are the use of briefings as a means of building the team concept, communications and decision making, interpersonal skills, and leadership.

We have been studying the impact of LOFT in a number of airlines and have found that crews rate this training highly for both human factors and technical purposes. However, we have also observed considerable unevenness in the quality of scenario designs, inadequate and incomplete briefings and debriefings, instructor focus on technical rather than human factors elements, and failure to simulate the air traffic environment realistically. The flaws in LOFT execution do not negate its current usefulness; they only indicate how much more can be achieved. An important research question, especially for airlines that lack extensive simulator facilities, is whether we can achieve the same impact in a training device as in a high fidelity simulator. We need also to understand the utility for human factors training of more limited simulations that do not encompass a full mission.

As demonstrated in analyses of communications during accidents and in LOFT research, crews must simultaneously cope with multiple tasks at the group level and differ greatly in the demonstrated ability to do this. Additional research is needed to understand the concept of multi-tasking and to determine if CRM training can help...
crews become more effective in handling multiple tasks. Another area of importance is operations involving ultra-long flights that require augmented crews, especially in advanced-technology transports. Such extended teams raise issues of leadership, shift changes, and the utilization of extra crew members in emergency situations. Research into these issues could result in new guidelines for operations and specialized new CRM training.

CRM training has developed outside the domain of traditional technical training and checking. This strategy has been highly effective, but it has hindered the integration of technical and human factors training. Many participants conceive of CRM as something outside of and in addition to their technical training and evaluation. CRM concepts need to be fully integrated with all aspects of training and checking. One strategy for integration that is proving successful is to provide instructors and check airmen with advanced CRM training that concentrates on evaluating performance and debriefing and reinforcing effective behaviour.

We now realize that technical expertise, aptitude and training are not sufficient to make an optimally effective aviator. Pilots need strong interpersonal skills as well as technical competence. Indeed, personality factors may limit the effectiveness of CRM training. We must devote energy to research into improving selection strategies if we are to optimize the aviation system, and this research must consider the impact of new technology such as the "glass cockpit" on crew motivation and satisfaction.

Evaluation is a critical element in making CRM effective. We need to assess crew performance in the ability to reinforce effective behaviour and to determine what areas need particular attention in training. While encouraging progress has been made in developing evaluation methodologies, much remains to be done to improve instructor and evaluator skills.

It is also crucial that we understand how human behaviour is manifested in abnormal circumstances such as those surrounding accidents and incidents. S. Predmore, a specialist in human factors, has refined a methodology for classifying and coding crew verbal behaviour from cockpit voice recorder tapes and transcripts. Similarly, digital flight data recorders provide an objective record of control inputs and aircraft performance. These analyses, particularly of crews showing very effective responses to catastrophic mechanical failures, demonstrate that CRM concepts apply generally to extreme situations. However, we also need a better understanding of human factors issues in all incidents that occur in the system. No approach currently in use seems to be able to capture all of the relevant human factors components. This should be a primary goal for research.

The model of crew performance shown in Figure 2 emphasizes the multiple factors that influence the way groups behave and ultimately the outcome of each flight. A particularly important and often ignored element of the model is the influence of organizational and national cultures on crew behaviour. Some human factors specialists stress the importance of understanding cross-cultural issues when examining the aviation system. As we become a global village and begin to see further integration of crews from differing cultures, we need to be sensitive to these issues and to develop training strategies that are sensitive to cultural differences. Consider, for example, the fact that cultures differ greatly in relationships between subordinates and superiors and in their individualistic versus collectivist orientation. It seems likely that a better understanding of such cultural issues will allow us to make training in leadership and communications more effective in cultures that differ in these dimensions. Our research group has made cross-cultural investigations a central part of its research.

CRM provides an excellent example of the interplay between basic and applied research. Many of the findings that came from basic research into attitudes and group dynamics have been translated into specific practices in the aviation community. We have reached a turning point in the development of CRM where we need both to broaden our scope and to build on the solid base that has been established. It is unfortunate that the severe, international economic crisis, particularly in aviation, poses a threat to further work. It is our responsibility to disseminate the message that the pay-offs from investments in this area will be great in terms of the safety and effectiveness of the aviation system.

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