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ASRS Sample of Callback (2004)

CALLBACK

From NASA's Aviation Safety Reporting System



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Award Winning Lessons



A certain percentage of the reports submitted to the Aviation Safety Reporting System deal with inadvertent mistakes. While the related error analysis provides valuable material for the "Don't do it this way" school of aviation safety, ASRS also receives many reports that deal with the positive aspects of aviation mishaps. In the following incidents, various abnormal situations were handled with noteworthy competence and skill. All

of the aviation professionals involved are to be commended for their contributions to the "Do it this way" school of aviation safety.

These reports were selected as the best examples among recent incidents that document the value of communication, teamwork, and training when things go wrong.

And the Winners Are...

Best Performance by a Supporting Cast

Being well prepared for their roles enabled this B757 cabin crew to make a major contribution to the success of a dramatic flight despite the foul and noxious setting.



- At FL330 we had a foul, noxious odor in the cockpit. The flight attendants also had a burning, sulfur-like odor in the cabin. They quickly checked to be sure that the odor was not coming from the ovens or from someone smoking in the lavatories. The odor was overpowering, so the decision was made to divert into ZZZ. ATC was notified. The First Officer flew the airplane while I ran the checklists. The time from the first smell to touchdown was approximately 12 minutes. While in the descent, I informed the flight attendants that we might need to do an emergency evacuation and to prepare the cabin. After landing, the smell was getting stronger so I gave the order to evacuate. Our flight attendants did an outstanding job. I talked with the passengers at the emergency wing exits and they were well briefed and understood what they had to do perfectly. The aircraft was evacuated in excellent time, with only minor injuries. Our flight attendants were calm, professional, and completely in charge of the situation.

(The fumes came from an overheated wire bundle that supplied current to the L2

cockpit window for in-flight heating. Apparently the circuit breakers had not opened to cut the current from the errant power source. —Ed)

Best Performance in a Takeoff "Role"

The Captain of this B767 may have had the leading role, but the "behind the scenes" efforts of the controllers and flight attendants deserve equal praise in the smooth handling of this incident



- Pushback and start-up were normal. During takeoff, just after calling out VR, the right engine began compressor stalling. EGT reached a maximum of 710 degrees Centigrade and power diminished. We climbed to 1,000 feet AGL and ran the abnormal procedures. Engine indications were back within limits so it was decided to leave the engine running in idle until after landing. Landing weight was 311,800 lbs and maximum landing weight is 295,000 lbs. Auto brakes were selected at level "4". The Captain did an outstanding job getting the aircraft smoothly on the ground. [There were] no injuries to passengers or crew. The communication between the cockpit crew and all others involved was superb. Kudos to the tower, departure, approach, and ground controllers. The flight attendants were great at keeping us informed about what aircraft conditions they could see and feel and how the passengers were holding up.

Best Performance Based on Audience Reaction

The professionalism of the entire crew of this B767 ensured that the passengers remained calm and confident all the way to the end of a rather lengthy production.



- A passenger came up to the galley and said that he smelled something burning. As I went into the first class cabin there was a strong smell of smoke. I turned off all power to the entertainment and power port systems. When I entered the cockpit, the Captain and First Officer had donned oxygen masks and smoke goggles and smoke was pouring out of the instrument panel. At this point the Captain was far too busy to communicate with me, other than to acknowledge that they were working on the problem. It was at least ten minutes before the Captain and I were able to discuss the situation. During that time the flight attendants did a great job of dealing with a possible crisis with no real answers. When the Captain and I could talk, it was determined that he felt that the source of the smoke and electrical smell had been contained, but that we should make an emergency landing. The crew had turned off all extra power needed in the cabins, there was no way to dissipate the smell and haze, and our nearest airport was one and one-half hours away. The flight attendants remained calm and kept reassuring the passengers that the situation was contained and that we would land safely. We had no lights in the cabin, galleys, or lavatories, no power in the galleys, and of course we had the smell and haze created by the electrical problem. The passengers did not overreact, and no one panicked. I attribute this to the fact that the flight attendants were visible, spent time with each and every passenger, and that the Captain made many announcements to reassure the passengers. The Captain made a beautiful landing and the relief everyone felt being on the ground was expressed by applause. The Captain and First Officer did an outstanding job. The lines of communication were definitely open. Their confidence, expertise, and leadership skills influenced how the rest of the crew reacted to a potentially dangerous situation.

Best Performance in a Medical Drama



The combined efforts of an MD88 crew and Air Traffic Controllers demonstrated how conscientious rehearsals lead to great performances under pressure

- During descent the lead flight attendant called the cockpit to advise that an elderly passenger was pale and not feeling well and that she was going to administer oxygen. We discussed our options and decided to ask for any doctor on board to assist us. A doctor came forward and while he was doing an examination, the passenger began to experience chest pains. We were descending through FL200 on the arrival when the flight attendant told us about the chest pains and that they were going to get out the defibrillator. I declared an emergency and asked for priority assistance. I turned the radios and aircraft over to the First Officer and I began coordinating medical assistance for our arrival. Center and approach control did an excellent job getting us into the airport immediately. The doctor on board determined that it would be safe to take the passenger to a gate and have the paramedics ready there, so I advised [ZZZ] of our intentions. I had the First Officer fly at our maximum speed to about 15 miles from the airport. We slowed, configured, and made an uneventful landing. We were able to get to the gate in two to three minutes and our passenger was assisted there. This emergency demonstrated excellent coordination between the cockpit and cabin crew and between Air Traffic Control and the flight crew. All of the training really pays off under these time compressed and stressful situations.

Best Solo Performance

The brilliant performance of this C206 pilot was enhanced by the superb direction of equally talented controllers



- I experienced electrical output failure of the alternator at 11,000 feet on top of all clouds and in the clear some 150 miles from destination, with 4+ hours fuel on board. Light icing conditions existed in the clouds with low IMC existing below and within a 100 mile radius of my position. I advised Air Traffic Control (ATC), declared an emergency, and presented my plan of action. 1) I requested Center to look for VFR weather within my fuel range. 2) I advised of my flight conditions and announced that I would maintain present heading at 11,000 feet and go off the air for 20 minutes in order to conserve battery power for communication. [I] set the cockpit up for no-electric, partial panel flight with vacuum driven attitude indicator, magnetic compass, wrist watch fastened to the control yoke, two good flashlights (one two-battery pen light and one "D" cell light). Twenty minutes later, with communications back up, ATC had indeed located VMC at [ZZZ1] and Special VFR 4,000 foot overcast at [ZZZ2]. Both stations had advised Center by telephone that they could provide Airport Surveillance Radar (ASR) assistance for descent. I elected to go to [ZZZ2] and requested to remain at altitude to plan a descent pattern that, if necessary, would ensure of the suitability of the weather in the event of complete electrical failure and loss of communications. Center agreed and handed me off early to [ZZZ2] approach control some 60 miles out. Approach was able to let me go off the air and conserve eight more minutes of battery power. Twenty miles out, approach was able to give me a rapid descent into their airspace, making two ASR heading corrections to keep me free of all clouds on a wide downwind leg for Runway 23 and well clear of the normal traffic flow. The ASR controller accomplished this with only the primary target of my airplane. Once on tower frequency and cleared to land, I [turned on the] navigation and rotating beacon lights. The landing was without incident except that the battery power failed completely on clearing the runway. This report is respectfully submitted [to confirm that] Resource Management works, and current safety training initiatives in Resource Management are paying off.

Best Short Subject

This flight crew's swift and decisive performance was right on the mark. The First Officer's screenplay wasn't bad either.

- Taking off on Runway 36 in our B757 jet, right close to V1 and, bang, bang, bang, loud noises and vibrations shatter the plan to go flying. The Captain and I throw a school house-perfect abort CRM rules as we team with the cabin crew and return to the gate with no injury or further incident. The "head wrench" reports that one of our Rolls Royce Rockets sparked and stalled. The End.



Sustained Achievement Award

Every day the vast majority of flights are conducted without any significant airframe, engine, or equipment malfunctions. Given the complexity of modern aircraft, and often tightly scheduled utilization, this record of availability and reliability is a testament to the dedication, skill, and often overlooked efforts of maintenance technicians. ASRS is proud to acknowledge the backstage maintenance heroes for their tireless efforts to "keep 'em flying."



ASRS Recently Issued Alerts On ..	January 2004 Report Intake	
Prisoner transport incident	Air Carrier/Air Taxi Pilots	1,902
BD700 oxygen supply hose failures	General Aviation Pilots	549
MD80 escape slide deployment failure	Controllers	27
Hughes 500C door latch and hinge failure	Cabin/Mechanics/Military/Other	144
Eastern U S airport taxiway signage deficiency	TOTAL	2,622



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ICAO Human Factors Training Manual (1998)
Part 2 Chapter 2 Crew Resource Management (CRM) Training

CHAPTER 2

CREW RESOURCE MANAGEMENT (CRM) TRAINING

2.1 CREW RESOURCE MANAGEMENT (CRM) TRAINING

Background and justification

2.1.1 Over the last fifteen years, an increasing amount of evidence has accumulated suggesting that some 70 per cent of air carrier incidents and accidents have been caused, at least in part, by a failure of the flight crew to make use of readily available resources. Research programmes have demonstrated that these types of occurrences have many common characteristics. One of the most compelling observations of these programmes is that often the problems encountered by flight crews are associated with poor group decision-making, ineffective communication, inadequate leadership, and poor management. In addition, many traditional training programmes emphasize the technical aspects of flying almost exclusively and do not deal effectively with various types of crew management strategies and techniques that are also essential to flight safety.

2.1.2 These observations have led to a consensus in both industry and government that more emphasis needs to be placed upon the factors which influence crew co-ordination and the management of crew resources. Briefly defined, crew resource management (CRM) is the effective use of all available resources, i.e. equipment, procedures and people, to achieve safe and efficient flight operations. CRM training programmes have been or are being developed by several major operators. Although the concept is receiving widespread acceptance, limited progress has been made in the industry as a whole. Moreover, there is some confusion with respect to the key elements of CRM training and how to go about developing a CRM training programme.

2.1.3 With these concerns in mind, the ICAO Air Navigation Commission reviewed, during March—May 1991, Annex 6 (*Operation of Aircraft*), Parts I, II and III, with the purpose of updating, aligning and harmonizing the three parts. The Commission adopted, among others, a proposal to include in Annex 6 a Standard regarding initial and recurrent training on Human Factors knowledge

and skills for flight crews. Amendment 21 to Annex 6 became applicable in November 1995. Annex 6 thus joined Annex 1 (see Chapter 1 of this manual) and Annex 13 (see Chapter 4 of this manual) in including Human Factors Standards and Recommended Practices (SRPs). The Eighth Edition of Annex 1 (*Personnel Licensing*) includes Human Factors training requirements for applicants for a pilot licence since 1989, and for a controller licence since 1994. The Eighth Edition of Annex 13 (*Aircraft Accident*), applicable since November 1994, requires that the format of the final report includes organizational and management information, i.e. pertinent information concerning the organizations and their management involved in influencing the operation of the aircraft.

The Human Factors requirement in Annex 6

2.1.4 The new Human Factors Standard in Annex 6 must be viewed under the light of the preceding discussion. The text of the amendment, included in Part I, Chapter 9, under the heading *Flight crew member training programmes* (9.3.1), indicates that

The training programme shall also include training in knowledge and skills related to human performance.

It further requires that

The training programme shall be given on a recurrent basis as determined by the State of the Operator and shall include an examination to determine competence.

2.1.5 Experience within the aviation community clearly shows that development and implementation of Human Factors training within an airline or a training organization is a long-term effort. The development and implementation of Crew Resource Management (CRM) and Time-Oriented Flight Training (TOFT) takes about one year, since it involves collection and interpretation of data. Furthermore, training an entire airline pilot population in CRM may take several years, depending on the size of the population. It is essential for operators to resist the temptation of acquiring off-the-shelf programmes, which

highly recommended that they develop CRM training programmes which are tailored for their specific organizational needs and which include full consideration of their corporate culture as well as of cross-cultural issues. This chapter is therefore intended as an aid for civil aviation administrations and, in particular for operators who must now include Human Factors training in their pilots' training curricula.

The implications of the amendment

2 1 6 Amendment 21 to Annex 6 carries important consequences for the international aviation community, including trainers and training developers, regulators and Human Factors researchers. The requirement to develop Human Factors knowledge and skills among flight crew members has the same weight as that related to systems, normal abnormal and emergency procedures. Non-compliance with the requirement to provide Human Factors training would mean non-compliance with an international Standard. Many operators already provide Human Factors training, mainly through CRM and LOFT. But there are also a considerable number of operators who have yet to implement such training, and the responsibility of training development and implementation will fall upon trainers and training developers. The onus is on them to see that initial Human Factors training is optimized and that recurrent Human Factors training is operationally relevant and observes the philosophy guiding Amendment 21 and explained in this chapter. Otherwise, Human Factors training could lend itself to unintentional abuse which would do more bad than good.

2 1 7 The real onus in this endeavour however, will fall upon the regulatory and research communities. It remains a matter of concern that important sectors of the international community still confuse the evaluation of Human Factors skills in operational settings with increased medical assessment or psychological evaluation of operational personnel. There is obviously still ample room for education, since if such misconceptions were to be translated into practice, they would defeat — possibly beyond hope of recovery — the safety purpose and ensuing benefits of the new Human Factors training requirement.

2 1 8 The regulatory community will have the responsibility of developing appropriate regulations in a field in which, notwithstanding a major educational campaign and a significant effort by ICAO and other international organizations, there are still misconceptions about the aim and objective behind Human Factors regulations. Some States have already implemented Human Factors training requirements for flight crews. It is hoped

that for both civil aviation administrations and operators in need of advice, the mechanisms of international co-operation, which have been a trademark in aviation, will once again be set in motion. As part of its Flight Safety and Human Factors programme, ICAO will support States in implementing the new Human Factors training requirement within the logical limitations imposed by resource considerations.

2 1 9 The Human Factors research community has a fundamental contribution to the implementation of Human Factors training for flight crews. The effectiveness of CRM/LOFT as a vehicle for Human Factors training is beyond question. The evaluation of CRM has been the focus of numerous efforts by researchers in different States. The fact remains, however, that a universally-accepted tool for CRM/LOFT student evaluation does not exist. While some progress has been made, the amendment to Annex 6 dictates the need to further research endeavours. Admittedly a major undertaking the development of an examination tool for CRM/LOFT training is an effort with tremendous payoffs in terms of enhanced safety and efficiency of the aviation system. It therefore deserves unreserved attention, since until such an instrument is available and acceptable, the wisdom of testing Human Factors skills is open to challenge. Until prevailing misconceptions and misunderstandings are clarified, and until an objective evaluation tool is designed and accepted by consensus of opinion until and unless these obstacles are overcome, we can evaluate Human Factors knowledge but we must be very cautious when it comes to the evaluation of Human Factors skills.

General

2 1 10 CRM training is but one practical application of Human Factors. Although CRM can be approached in many different ways, there are some essential features. The training should focus on the functioning of the flight crew as an intact team, not simply as a collection of technically competent individuals and should provide opportunities for crew members to practise their skills together in the roles they normally perform in flight. The programme should teach crew members how to use their own personal and leadership styles in ways that foster crew effectiveness. The programme should also teach crew members that their behaviour during normal, routine circumstances can have a powerful impact on how well the crew as a whole functions during high-workload stressful situations. During critical emergency situations rather basic skills and knowledge come into play, and it is unlikely that any crew member will be able to take the time to reflect upon his or her CRM training to determine how to act. Similar situations experienced in training

increase the probability that a crew will handle actual stressful situations more competently

2.1.11 Research strongly suggests that behaviour change in any environment cannot be accomplished in a short period of time even if the training is very well designed. Trainees need time, awareness, practice and feedback, and continual reinforcement to learn lessons that will long endure. To be effective, CRM training must be accomplished in several phases.

2.1.12 Accordingly, CRM training should include at least three distinct phases:

- a) an awareness phase where CRM issues are defined and discussed
- b) a practice and feedback phase where trainees gain experience with CRM techniques, and
- c) a continual reinforcement phase where CRM principles are addressed on a long-term basis.

Each of these phases is discussed in more detail below.

CRM training phases

Awareness

2.1.13 Awareness is the essential first phase and usually comprises instructional presentations focusing on the roles of interpersonal and group factors in the maintenance of crew co-ordination. It is important because it provides a common terminology and a conceptual framework for crew members to begin thinking about crew co-ordination problems and how such factors have contributed to accidents and incidents in the past. A useful way of beginning the awareness phase might be to introduce CRM skills as they pertain to communication, situation awareness, problem solving, etc.

2.1.14 Other useful techniques might include computerized instruction, preparatory work for classroom instruction, detailed case studies of accidents and incidents looking for crew performance issues, and videotaped examples of good and poor team behaviour in the cockpit. The exposure of line and training staff to the awareness phase is a critical part of CRM training and such exposure is also beneficial in heightening awareness in an organization.

2.1.15 Awareness promotes credibility and helps in changing attitudes; however, it is important to recognize that it is only a first step. Some programmes rely almost

exclusively on this aspect of training, but classroom instruction alone will probably not significantly alter crew member attitudes and behaviour in the long term.

Practice and feedback

2.1.16 The second phase of CRM training is practice and feedback. Some programmes use role-playing techniques to provide group skills practice, as well as personality and attitude-measuring questionnaires as a means of providing feedback to individuals on their own interpersonal styles, some aspects of which they probably have not previously evaluated. Personality and attitude insights allow individuals to recognize some of their strengths and weaknesses. Role-playing or group exercises can provide useful practice in areas of crew decision-making and other skills discussed in the awareness phase of the CRM curriculum. The review of videotaped examples of good and poor team performance in both low- and high-workload flight regimes is another good practice technique.

2.1.17 Line-oriented flight training (LOFT) is a well-proven method of providing practice and feedback in crew co-ordination and CRM. LOFT is a group performance training exercise. Well-designed LOFT scenarios require the co-ordinated efforts of all crew members for successful crew performance. LOFT appears to be particularly effective when it is coupled with videotape feedback and self-critique. For further discussion of LOFT see 2.4.

2.1.18 If available, simulators should be utilized for LOFT exercises coupled with video feedback in a CRM training programme. If flight simulators are not available, role-playing exercises which require group problem solving can be used with video feedback.

2.1.19 Videotape feedback is particularly effective because the third-person perspective creates a level of awareness not possible with other techniques. This perspective provides insight and provokes 'self-critique' which appears to be a strong stimulant for attitude and behaviour change. It is virtually impossible to deny the presence of an ineffective managerial or interpersonal style if one sees it for oneself. Moreover, these video feedback exercises provide opportunities for peer critique. There is ample evidence for the effectiveness of the video feedback technique, which should be used whenever possible.

2.1.20 In the past many CRM programmes have finished with the practice and feedback stage and while crew members usually leave such programmes feeling that they have learned valuable lessons, these insights more often than not tend to fade very rapidly. Today we know

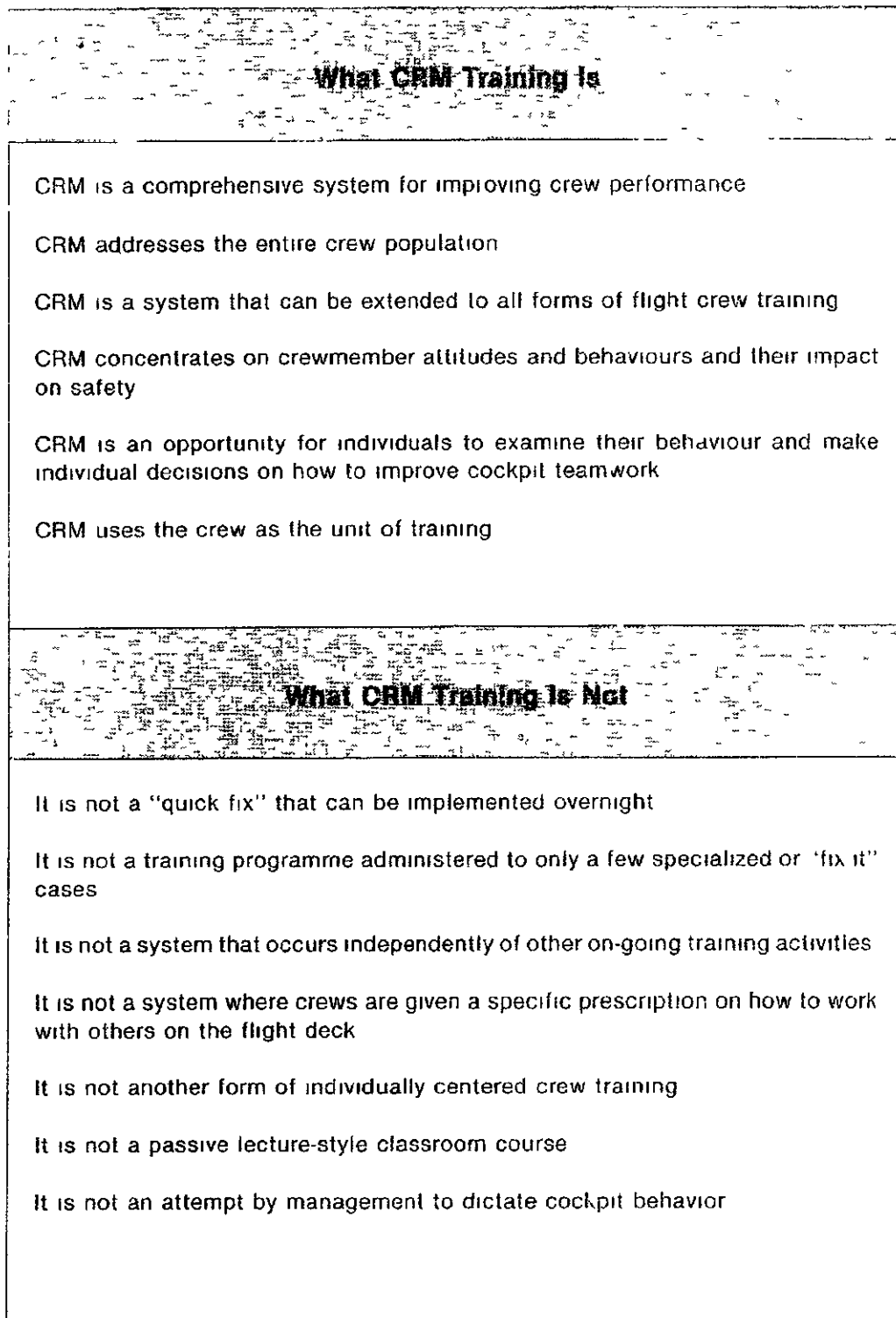


Figure 2-1

that for a CRM programme to produce more than short term insight, it must be reinforced and integrated into a recurrent training programme

Reinforcement

2.1.21 The third phase is reinforcement. No matter how effective the CRM classroom curriculum, interpersonal drills, LOFT exercises and feedback techniques are, a single exposure will be insufficient. Undesirable attitudes and norms which contribute to ineffective crew co-ordination are ubiquitous and have developed over a crew member's lifetime. It is unrealistic to expect a short training programme to counteract a lifetime of development. For maximum effect CRM must be embedded in the total training programme, it must be continually reinforced and it must become an inseparable part of the organization's culture. The last factor is often overlooked however, it is clear that effective CRM training requires the support of the highest levels of management.

2.1.22 CRM training should therefore be instituted as a regular part of the recurrent training requirement, and should include refresher curriculum and practice and feedback exercises such as LOFT, or a suitable substitute, employing video feedback. It is particularly important that some of these recurrent CRM exercises take place with a full crew, with crew members operating in their usual positions. For example, recurrent training LOFT exercises designed for CRM should only be conducted with complete crews. This is stressed because there is a natural tendency to think of CRM as training only for the managers' or captains. This belief misses the essence of the primary CRM training objective which is the prevention of crew-related incidents and accidents. The training will be most effective in the entire crew context and this requires training exercises that include all crew members working and learning together. In the past much of flight crew training has been separated by crew position, and while this may be effective for certain types of training such as technical skills and systems knowledge, it is not appropriate for CRM training.

Curriculum development

Assumptions and preconditions

2.1.23 Before attempting to develop a programme of CRM training, three major areas must be dealt with on the part of both operator management and course developers:

- a) global goals

- b) awareness of "good versus poor" cockpit performance, and
- c) critical planning elements including gathering data about the user population.

There are two global goals which override all other aspects of any flying operation. First, all flying is conducted to satisfy the production demands of the airline and these demands are mainly based on economic considerations. Second, safety must be maximized through joint management and crew responsibility as well as crew co-ordination. These two goals are sometimes mutually supportive and sometimes in conflict. A correct balance is not always easy to maintain, nor is it always clear when one goal or the other is paramount. It is essential that global goals be defined and consciously identified, for they, and the conflicts they can present, are frequently at the root of operational problems.

2.1.24 Awareness of good versus "poor" performance is also vital. "Poor" performances can be more easily identified than good but "good" performance can be stressed through development of individual role-models. The concept of "good" performance is also vital to preservation of self-image. While one cannot desire improvement until the need for improvement is felt, positive aspects must be stressed in the course development. The need for supportive and co-operative interrelationships among crew members must be accepted by students before a desire to alter individual behaviour can be evoked. Finally, flight crews must be trained to cope with difficult individuals.

2.1.25 The following list presents critical planning elements in any course of CRM training:

- a) careful selection of instructors (or co-ordinators as they are often called in CRM programmes). They must be credible and selected on the basis of motivation, instructional skills and sensitivity to student needs.
- b) motivation of students.
- c) justification of CRM concepts and the training programme itself.
- d) management support. No course will be effective without the clear support of both upper and middle management, and
- e) professional organizations. The support of the people to be trained is essential.

- l) collection of data about the user population, including demographics, attitudes towards leadership and followership, communication styles, work values, team concept and the use and flexibility of regulations

2.1.26 Finally, it should be stressed that although negative behaviour patterns must be identified, the atmosphere of the training itself must be positive. For example, one may point out the potential danger that a passive crew member poses and identify the kinds of behaviour that are 'passive', so that individuals can assess themselves and others. However, the CRM coordinators should not project a negative or evaluative tone toward the participants themselves, instead they should take a positive stance by focusing on the skills and concepts conducive to individual improvement.

Essential curriculum elements

Introduction

2.1.27 Curriculum elements are divided into two major areas: concepts to be understood and skills to be acquired. There is a great value in enhancing "understanding" of certain topics which pertain to the interrelationships between crew members. It is of equal importance, however, to develop "skills."

Concepts to be understood

2.1.28 The following list of topics is not complete nor is it intended to substitute for the conceptual learning which is an integral part of learning skills. However, the topics constitute the "language" and awareness that enable skills to be understood and ultimately used in an operational environment. These are the topics to understand:

- a) a common language or glossary of terms,
- b) the concept of synergy (a combined effect that exceeds the sum of individual effects),
- c) the need for individual commitment to CRM principles,
- d) guidelines for continued self-improvement (continuation training)
- e) individual attitudes and behaviour and how they affect the team effort
- f) complacency and its effect on team efforts
- g) fitness to fly: the concept that each individual is responsible to arrive at work 'fit to fly' and the ramifications and refinements of this concept
- h) the impact of the context or environment such as company policy and culture, air traffic control, aircraft type, etc.,
- i) resources available: identification and use,
- j) identification and assignment of priorities,
- k) human components and behavioural characteristics: awareness of the human being as a composite of many complex characteristics, often not controllable. Each crew member must be aware of these characteristics in order to adjust his or her own actions and behaviour
- l) interpersonal relationships and their effect on team work: the way in which crew members approach, or respond to each other has a critical effect on team-building and team results
- m) 'team required' versus 'individual' tasks: some problems require a team solution while others may be solved through individual effort,
- n) identification of norms (i.e. tacitly accepted actions, procedures and expectations). Whether consistent or deviant with written policy, norms exert strong pressures upon individuals to conform,
- o) pilot judgement: once all information is available to the pilot-in-command the situation may be clear-cut or may require judgement. These judgement calls are the ones which are most likely to spark dissent, produce initial resistance and have a negative effect on the team,
- p) the statutory and regulatory position of the pilot-in-command as team leader and commander. All decision-making must be done by or funnelled through the pilot-in-command, and
- q) ground rules, policies and procedures to be followed during the course of instruction as well as subsequent operations. For example, management support for the programme and concepts taught; management support for those who attempt to act in accordance with learned principles, and absence of punitive action during the course and afterwards in actual flight operations
- r) attitudes towards automation (see Chapter 3)

Skills targets

2.1.29 There are six major areas to be taught

- a) Communication/interpersonal skills
 - 1) cultural influence
 - 2) barriers e.g. rank, age, crew position
 - 3) polite assertiveness
 - 4) participation
 - 5) listening
 - 6) feedback
 - 7) legitimate avenues of dissent
- b) Situation awareness
 - 1) total awareness of surrounding environment
 - 2) reality versus perception of reality
 - 3) fixation/distraction
 - 4) monitoring (constant, regular)
 - 5) incapacitation (partial/total physical/mental, overt and subtle)
- c) Problem-solving/decision-making/judgement
 - 1) conflict management
 - 2) review (immediate, ongoing)
- d) Leadership/ 'followership'
 - 1) team-building
 - 2) managerial and supervisory skills (plan, organize, direct, control)
 - 3) authority
 - 4) assertiveness
 - 5) barriers
 - 6) cultural influence
 - 7) roles
 - 8) professionalism
 - 9) credibility
 - 10) responsibility of all crew members
 - 11) time/workload management,
- e) Stress management
 - 1) fitness to fly (mental and physical)
 - 2) fatigue
 - 3) incapacitation in varying degrees and
- f) Critique (three basic types)
 - 1) pre-mission analysis and planning
 - 2) on-going review
 - 3) post-mission

2.1.30 Communication/interpersonal skills Specific skills associated with good communication practices include such items as polite assertiveness and participation, active listening and feedback. In order to improve the communication channel, cultural influences must be taken into account as well as factors such as rank, age and crew position, all of which can create barriers to communication in the cockpit situation. Polite assertiveness is a skill frequently ignored in communications training but vital to a healthy cockpit. A pilot-in-command may be open to communication but temporarily unable to receive and comprehend. Other crew members must be aware of the importance of the information they hold and have a strong feeling of self-value, a single hesitant attempt to communicate important data constitutes a failure to discharge individual responsibility. Pilots-in-command must constantly strive to emphasize this responsibility in their team-building efforts. The concept of 'legitimate avenue of dissent' is an important vehicle for 'clearing the air', maintaining lines of communication and maintaining self-image.

2.1.31 Situation awareness Situation awareness refers to one's ability to accurately perceive what is going on in the cockpit and outside the aircraft. It further extends to the planning of several solutions for any emergency situation which could occur in the immediate future. Maintaining a state of awareness of one's situation is a complex process, greatly motivated by the understanding that one's perception of reality sometimes differs from reality itself. This awareness promotes on-going questioning, cross-checking and refinement of one's perception. Constant conscious monitoring of the situation is required. Note that the situation referred to here includes the human environment. The evaluation of oneself and others for partial or total incapacitation is vital but often overlooked.

2.1.32 Problem-solving/decision-making/judgement These three topics are very broad and interrelate to a great extent with each other as well as with the other areas. One may consider problem-solving as an over-all cycle of events beginning with information input and ending with pilot judgement in making a final decision. During the phase in which information is requested and offered, some conflicting points of view may be represented. Skills in resolving conflict are therefore especially appropriate at this time. All decisions must come from the pilot-in-command because the team will fail if command authority is not maintained. This requires the support of all crew members. The in-flight, immediate post-decision review is likewise a vital concept for promoting good decision-making.

Domains for CRM Training

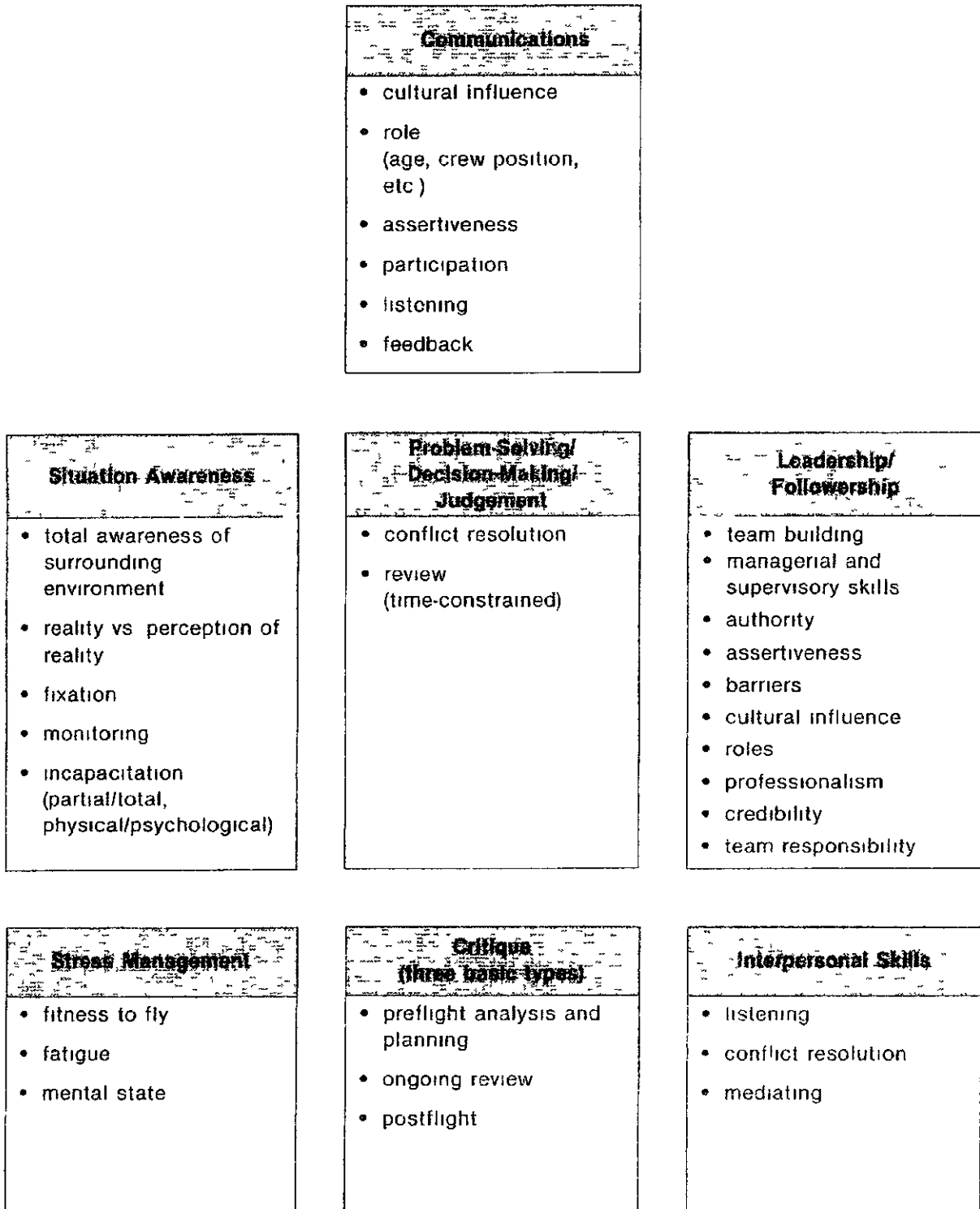


Figure 2-2

Note -- in paragraph 2.1.29 "communications" and "interpersonal skills" have been grouped together

2.1.33 Leadership/followership In this area there is clear recognition that the command role carries a special responsibility. For instance, although individual crew members should be actively planning and managing their own workloads with respect to time, the pilot-in-command is responsible for supervising the over-all management of the flight. This command authority must be acknowledged at all times. The effectiveness of command authority cannot be assumed by position alone. The credibility of a leader is built over time and must be accomplished through conscious effort. Similarly every non-command crew member is responsible for actively contributing to the team effort, for monitoring changes in the situation and for being assertive when necessary.

2.1.34 Stress management Stress creates a special kind of problem for a crew since its effects are often subtle and difficult to assess. Although any kind of emergency situation generates stress, there is also the stress, both physical and mental, that a crew member may bring to the situation and which others may not be able to detect. A crew member's over-all fitness to fly may nevertheless decline because of fatigue, mental and emotional problems, etc., to the extent that other crew members should consider that individual as incapacitated. Skills related to stress management refer not only to one's ability to perceive and accommodate to stress in others but primarily to anticipate, recognize and cope with one's own stress as well. This would include psychological stresses such as those related to scheduling and rostering, anxiety over training courses and checks, career and achievement stresses, interpersonal problems with both cabin crew and other flight crew, as well as the home and work interface including related domestic problems (family health, children's education, etc.). It would also include so-called life event stresses, such as those related to the death of a spouse, divorce, or marriage, all of which represent major life changes.

2.1.35 Several operators are attempting to alleviate stress problems by encouraging open and frank communications between operational management and flight crew members and by viewing stress as part of the fitness to fly concept. The prerequisite for this is management understanding of the stress problem. In at least one case the understanding required by management personnel was fostered by having managers and other non-crew personnel attend the CRM training.

2.1.36 Critique Skills of critique generally refer to the ability to analyse a plan of action whether future, current or past. Since techniques for accomplishing critique vary according to the availability of time, resources and information, three basic types of critique are distinguished:

- a) pre-mission analysis and planning
- b) on-going review as part of the in-flight problem-solving process and
- c) post-mission debriefing

All three are of vital importance but are often overlooked both in operations and during instruction. Each type has two fundamental elements, i.e. remembering to perform the critique and structuring of the critique itself.

Training techniques

Introduction

2.1.37 The effectiveness of specific techniques varies with the training phase:

- a) Awareness This phase is weighted toward individual instruction. The principal objective is to motivate the trainees and get them off to a good start, and to provide a conceptual framework for CRM.
- b) Practice and feedback Here the objective is to achieve an understanding of the principles as defined in the syllabus. It is best accomplished in a group.
- c) Reinforcement This is primarily a small group function. The final goal is to achieve lasting acquisition and enhancement of the required skills in all cockpit crew members.

Basic principles

2.1.38 The following basic principles are applicable to all training regardless of the characteristics and resources of the training organization:

- a) Pilot-group participation is essential
- b) Instructors/co-ordinators must be credible
- c) It is important to establish and use terms and principles that are familiar to the pilots and common in the organization
- d) Techniques that work well in one culture may not work at all in another. The availability of the personal skills and other resources required by some of the techniques is an obvious consideration. (Note — The term *culture* is used

here in its broadest sense and includes both national and corporate culture the norms of organizations and their management, ethnic origin religion, etc)

- e) Instructor training is critical. Instructors require special training to develop understanding and skills above and beyond the basic syllabus
- f) In virtually all instances more than one technique can be used effectively
- g) There is considerable confusion regarding the requirement for the optimum use of simulators. As a general guideline high-fidelity simulators are not required in awareness training. They are however required for handling/skill training
- h) More than one type of medium (such as lectures film strips audio or video recordings, etc) can be effectively used in several of the techniques and equally important, several techniques can effectively utilize the same media

Categories of training techniques

2.1.39 The CRM techniques fall into two categories basic techniques that are important in all aspects of CRM training and techniques that are particularly effective in specific phases of training

Basic techniques for all training phases

- Pacing (or timing) of the presentation of training material. This involves both the amount of material that is presented and the time frame in which it is given. Variables are the phase of training, the knowledge and experience of the trainees, and the specific techniques being used
- Credible co-ordination. This does not mean that the co-ordinator (instructor, lecturer etc) must be a line-qualified pilot, although considerable success has been achieved by maximizing the use of line pilots in this role. It is essential that trainee pilots recognize the co-ordinator as a subject expert, and perceive the subject as relevant and important to flight operations

Techniques for specific training phases

- Seminars or workshops. Seminars or workshops are more effective if they can be held at a location that is isolated from the normal home or work environment particularly for the awareness phase

However, this is not always possible and there are several examples of successful seminars held in the regular training setting

One airline uses up to eighteen trainees for its seminars or workshops which are held in a private setting off the company premises. The group is then split into smaller teams of five or six for the interactive training phases. Prior to the seminar, trainees are also given a small amount of introductory material. The aims are to establish a conceptual framework for resource management and to motivate the trainees. Another airline runs workshops with twenty-five to thirty participants. The objectives are to provide individuals with insight into their own behaviour and reactions, and to provide ideas on how to deal with individual shortcomings and problems in normal, abnormal and emergency situations. The three-day workshop (eighteen hours) is then followed by a one and a half hour LOFT simulator exercise

- Panels. Panels are effective. This includes expert panels, participants panels or a combination of the two. They can be presented live or through such media as audio or video cassettes
- Group exercises. A wide variety of group exercises have been used and found to be particularly useful
- CRM knowledge can be taught in a group or on a one-to-one basis. CRM skill acquisition and retention needs an interactive medium and a group
- Videotaping of group exercises is important for maximum effectiveness. While at least one airline gives the video cassette to the trainee because of its continued training potential, in another airline this is forbidden under an agreement with its pilots for fear of potential misuse. In such cases erasure after use is mandatory
- Role playing. Role playing leads to considerable discussion and some controversy. Knowledge of CRM principles and a skilful, credible co-ordinator (instructor) are important
 - a) This technique can be very effective where roles are exchanged because it gives participants a different perspective
 - b) It is very good training for new pilots
 - c) It can be used to personal evaluation on the first day and then on the last day to observe behavioural changes

Advocacy and Inquiry

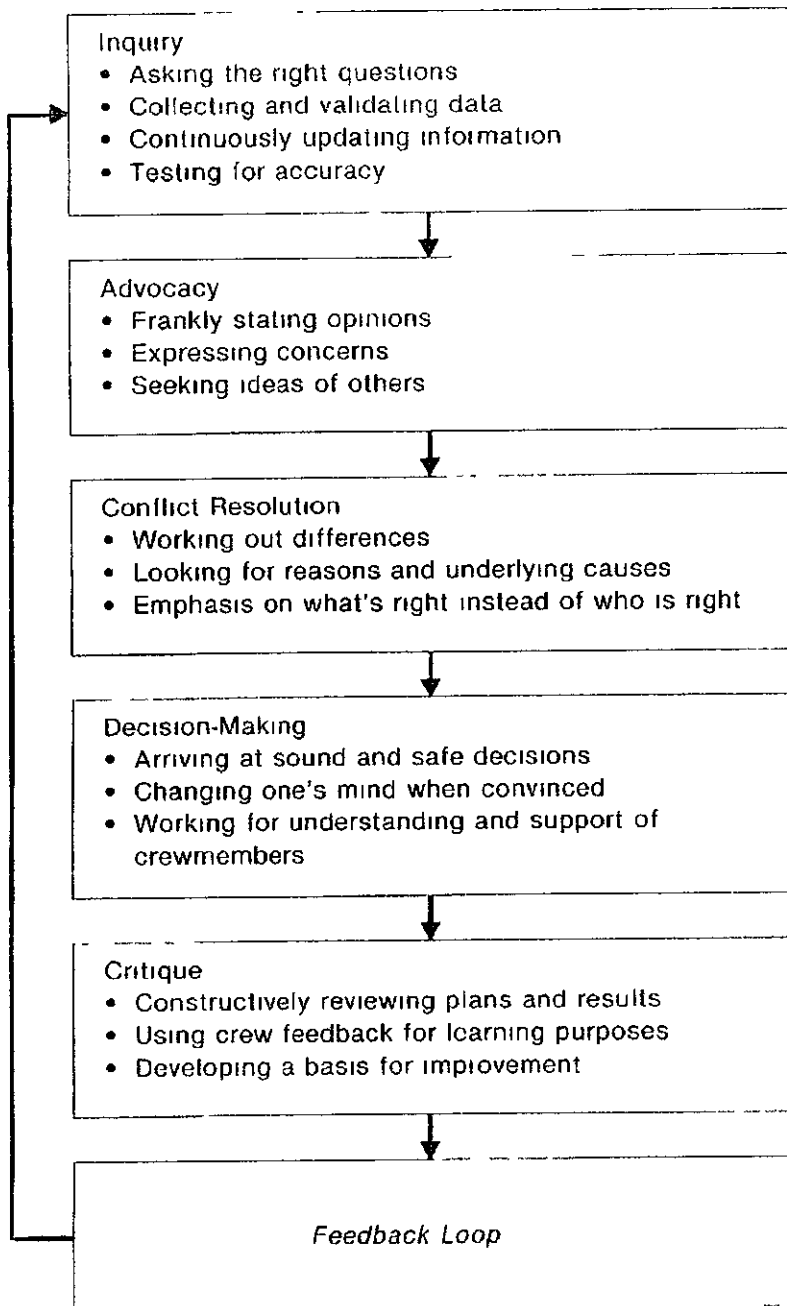


Figure 2-3

Note — This model concerns several of the six areas taught

- Feedback of interpersonal traits. This technique involves evaluation by the co-ordinator and feedback in numerical form to the trainee during normal debriefing. The feedback can be used to improve monitoring effectiveness, to identify individual interpersonal styles and in critique of the performance of both self and others.

The rationale for using this technique is that different resource management skills, such as communication can be measured and quantified. The profile generated in this way can be accompanied by discussion of alternative approaches to improve performance and achieve objectives. It enables communicators to develop a means for choosing the "right tool for the job". The analytic technique is called behavioural analysis. It requires a skilled leader or instructor, and has been found to be very effective in a wide range of airlines and aeronautical organizations.

- Situational leadership. This technique uses a special inventory to stimulate thought on alternative styles of leadership. It stresses the importance of recognizing the characteristics and 'readiness' (both job readiness and psychological readiness) of the followers (other team members) in order to develop the full potential of the team. A leadership style that is effective in one group may not be effective in another. Situational leadership recognizes the need for leaders to adapt to the needs, attributes and readiness of the other individuals with whom the leader has to work effectively.
- Evaluation/critique. This technique should be performed by the crew involved after a group session. Voice and video playbacks of crew members' performance can be very effective.
- Case studies. Video scenarios of accidents and incidents are very effective. Replays of actual cockpit voice recordings are particularly dramatic and effective if available.
- LOFT. LOFT should be used if at all possible. In LOFT exercises, videotaping is important for maximum effectiveness. Note that there may be a requirement to erase the tape after use in the debriefing.
- Structural observations. This technique involves the use of examples (through videotape, lectures etc.) that encourage the trainee to look for real life hints in the real world. For example, in the

teaching of listening skills, trainees can be asked to look for misunderstandings caused by the failure of participants to listen actively.

- Classroom instruction. This technique is mainly used in the early stages of training and usually decreases as more group activities are introduced. Lectures are a good vehicle for establishing common semantics, organizational culture etc.
- Computer-assisted training. Two advantages of computer-assisted instruction are that it can be performed at the individual's own pace and that it is interactive with the trainee.

CRM effectiveness

Introduction

2140 There is sufficient evidence supporting the effectiveness of CRM to warrant its use in the training environment. This conclusion is based upon several types of evidence. First, the programmes have a high degree of validity. That is, they reflect sound operating principles and are focused on areas of known weaknesses as supported by accident/incident data. Second, the skills which are targeted for improvement in these programmes and the means to achieve that improvement have been incorporated into effective programmes already in use in other areas, such as business management. Third, feedback from pilots, training management, check pilots and others in the training community supports the need for and the effectiveness of CRM programmes. Fourth, objective data, although very limited in scope, is encouraging. United Airlines, which has one of the more established and fully integrated programmes, has reported improvements in a number of areas, including training and checking.

Scientific evaluation of individuals

2141 As yet, no large-scale scientific evaluation has been carried out on individuals. The reason is that the performances of individual crew members have to be not only assessed but also recorded, a practice contrary to the requisite confidentiality in effective CRM training. In other words, a checking-type environment would be created or perceived.

Operator formal assessments

2142 A formal evaluation of CRM effectiveness should be provided as part of the programme. It must be stressed that such evaluations are minimum criteria

confidentiality of crew member data and that the objective is to evaluate the programme and not the individual

2.1.43 Formal evaluations should be used to modify the programme to the specific needs of the organization

Formal assessment of the CRM concept

2.1.44 Many experts consider that the CRM training concept in the future should be assessed by a neutral organization such as a national research institution. This would include measurements at both the macro level (accident and incident records, etc.) and the micro level (observation of crew members' procedures, etc.). It is expected that a comprehensive data base, to which operators would report, could be created to serve both the research programme and the operators.

2.2 CRM TRAINING FOR SMALL OPERATORS (REGIONAL, CORPORATE, ETC.)

Introduction

2.2.1 Small operators must now include resource management principles within their training syllabi. Standard operational procedures are frequently merged with CRM policies and CRM philosophy in order to attain optimum behavioural patterns in the cockpit.

2.2.2 Small operators differ from large ones in various operational areas. The major differences appear to be

- a) more short-haul, multi-sector flights with frequent take-off/landing cycles,
- b) minimum financial support for add-on training costs
- c) reduced availability of crew members for scheduling into CRM programmes, and
- d) lack of simulators for some small operators

2.2.3 Corporate flying also differs from major airline operations. The industry encompasses first-class "red carpet" operations and small, spartan, one- or two-pilot work force complements. Rank, seniority and status at times are unclear, junior crew members may be in command or two captains may crew the aircraft with the role of the pilot-in-command being determined by the flip of a coin.

2.2.4 Often corporate flight departments are isolated from higher-level management, particularly in organizations where the primary business activities are unrelated to aviation. Similarly, company management in these organizations may have little knowledge of pilot concerns or flight crew training needs. There may be direct high-level management pressures on the cockpit (i.e. in corporate flight, the "boss" may be the passenger riding in the cabin). The cost of proper flight crew training may be difficult for the financial managers of the corporation to accept.

2.2.5 With such variable sets of economic and operational circumstances it is considered that industry adoption of full-scale CRM training is currently unfeasible and beyond the financial capabilities of many small corporations.

CRM training steps for small operators

2.2.6 These steps can be progressively adopted by any transport operator according to financial constraints:

- a) development of pilot awareness of CRM policies through distribution of booklets, pamphlets, republished articles and studies and videotapes stressing 'this could happen to you' types of incidents or accidents,
- b) conduct of in-house seminars for crew members using role-playing for demonstrations of CRM techniques,
- c) phase-in of CRM principles into initial first officer training programmes. Open cockpit atmosphere and assertiveness training would be key elements in such training,
- d) integration of CRM policies into recurrent ground school curricula into captain upgrade training and into flight operations manuals,
- e) recruitment of a core-nucleus of training-staff personnel for development of in-house CRM training programmes,
- f) employment of an outside consultant for preparation of in-house CRM programmes and
- g) outright purchase of a complete CRM programme from a third-party vendor.

2.2.7 In summary CRM training is an important element in small airline operations. At a recent workshop

a recurring theme sounded throughout all panel discussions regarding small operators

'Go home go back to your airlines and start doing something about it. No matter how small the training budget take that first step toward a comprehensive, integrated CRM training programme.'

2.3 CRM — THE OPERATOR EXPERIENCE

Introduction

2.3.1 Several operators' programmes are discussed in this section. It will be seen that while the fundamentals of CRM remain the same for these operators, the training has in each case been tailored to meet the operator's requirements and culture. The terminology used by individual operators is sometimes different from the terminology used elsewhere in this document. It should also be noted that these operators are at various stages of CRM development.

Alaska Airlines

2.3.2 The following is a summary of Alaska Airlines' 'Integrated Crew Experience' training programme.

Alaska Airlines has designed its own version of 'Cockpit Resource Management Training', we call it "Integrated Crew Experience (ICE)". This programme has been developed by conducting a "needs analysis" designed by R. Helmreich Ph.D. of the University of Texas at Austin, who is operating under a NASA grant to evaluate Cockpit Resource Management programmes. A review of the Needs Analysis for Alaska Airlines flight crew members has shown emphasis is needed in four primary training requirements:

- a) Group co-ordination. These are items that relate to smooth group operational problems, verbalizing and acknowledging procedures, reporting of overloads and the process of critique.
- b) Personal invulnerability. These items relate to invulnerability to fatigue, working with inexperienced crew members, personal problems and nicks/pilot myths.
- c) Pilot-in-command dominance. These items relate to undesirable crew dominance and authority

issues such as captains dictating procedures and flying the aircraft, with everybody else being silent and inactive.

- d) Social consideration. These items relate to social niceties and consideration of others in the crew.

The Alaska Airlines ICE programme addresses these training needs through a three-part, long-term programme. First we conduct a three-day, intensive workshop designed to give each crew member training in each of the following subjects:

Part one: Awareness

- a) Introduce crew members to the concept of human factors as a cause of aircraft accidents.
- b) The process of voluntary and involuntary change.
 - 1) barriers to change
 - 2) synergy concept
- c) Best/worst crew member characteristics.
- d) Leadership/followership.
 - 1) administer leadership styles instrument
 - 2) leadership/management theories
 - 3) situational leadership
- e) Conflict resolution.
 - 1) response to conflict
 - 2) coping with conflict
- f) Assertiveness.
 - 1) aggression
 - 2) non-assertion
 - 3) assertion
- g) Crew dynamics.
 - 1) styles of crew evolution
 - 2) functional crews
 - 3) dysfunctional crews
- h) Stress management.
 - 1) positive stressors
 - 2) negative stressors
 - 3) mental and physical reactions to stress
- i) Communication training.