

d The FAA considers interruption of LOFT scenarios a deterrent to the learning qualities inherent in LOFT. Arbitrary interruption of LOFT is not acceptable. LOFT scenarios should be allowed to continue to their logical completion. In Qualification LOFT, if the instructor is certain that negative training is occurring, the scenario may be interrupted. The FAA believes that well-thought-out and properly developed scenarios will not lead often to situations which require interruption.

e Proper planning and development of LOFT scenarios are essential to ensure that training objectives are met. This is a critical characteristic of any FAA approved LOFT program. Training value is diminished when students become familiar with scenarios. Therefore, a variety and a sufficient number of LOFT scenarios are required to guard against crewmembers experiencing repetitious situations. In addition, the FAA expects operators to regularly update LOFT scenarios, thereby ensuring that crewmembers are exposed to new technology, procedures, and current operational problems.

26 -30 RESERVED

CHAPTER 4 TYPES OF LOFT

31. GENERAL As discussed throughout this AC, there are two types of LOFT, Recurrent LOFT and Qualification LOFT. Guidelines for designing and conducting these types of LOFT are presented below

32. RECURRENT LOFT. Recurrent LOFT is designed to ensure that each crewmember maintains proficiency in the type of aircraft and crewmember duty position involved (See §§ 121 409, 121 427, 121 433, and 121 441) Recurrent LOFT is intended for flight crewmembers who are presently qualified in a particular make model and series aircraft. Recurrent LOFT is best conducted with a complete line qualified crew. Interruption of Recurrent LOFT is not permitted. Recurrent LOFT may be substituted on an alternate basis for the proficiency check requirements of FAR § 121 441

33. GUIDELINES FOR RECURRENT LOFT Recurrent LOFT should meet the following guidelines

a. No Direct Instruction or Scenario Interruption Recurrent LOFT does not permit direct instruction and normally does not permit interruption of the scenario by the instructor

b. Crew Composition Recurrent LOFT requires scheduling of a complete crew which is line qualified

c. Crew Substitutes The use of substitutes is discouraged and substitution should be rare. When the composition of the scheduled line qualified crew cannot be maintained, the operator may use substitutions based on the guidelines in Table 4-1. However, the operator will attempt first to substitute with another line qualified crewmember. This table should be used only as a last resort to prevent interruption of scheduled training

Table 4-1. Recurrent LOFT Substitution Table

| Pilot-in-Command Position | Second-in-Command Position | Flight Engineer (FE) Position |
|---------------------------|-----------------------------------------------------|---------------------------------------------|
| 1 | Another person of the same status for that position | |
| 2 | PIC ¹ | SIC ¹ FE ¹ |
| 3 | Pilot Instructor ² | PIC ¹ FE Instructor ² |
| 4 | Pilot Instructor ² | |

¹ - Includes those who are either line qualified or in training for the position

² - May act as a substitute when a line qualified crewmember is not available. The instructor should not have previous knowledge of the scenario, however, when this is unavoidable, the instructor should not use that knowledge to influence or direct the scenario

NOTE: The instructor conducting the LOFT session may not act as a substitute crewmember

d. Number and Type of Segments A Recurrent LOFT scenario may include one or more flight segments, depending upon the training objectives

e. Training Media The highest fidelity flight simulator available should be scheduled for Recurrent LOFT (See AC 120-40, Airplane Simulator Qualification, as amended) Recurrent LOFT may be conducted in a Level A, B, C, or D flight simulator, however, the use of the highest level simulator (Level D) is encouraged and the use of Level A simulators is discouraged

34 QUALIFICATION LOFT Qualification LOFT is designed to prepare crewmembers, who are not yet fully qualified for line operations and whose training has been provided in accordance with an Advanced Simulation Plan, for actual flight operations. Qualification LOFT provides training that facilitates the transition from flight simulator training to operational flying. Scenarios are designed to represent typical flight segments. Qualification LOFT is instructional in nature, therefore, when it is essential to do so, instructors may momentarily interrupt a scenario for instructional purposes. Qualification LOFT is best conducted when the student crewmember, who is not yet fully qualified, is scheduled with a crew complement whose other members are line qualified. For example, a PIC candidate would be scheduled with a line qualified SIC and FE

35 GUIDELINES FOR QUALIFICATION LOFT Qualification LOFT should meet the following guidelines

a. Direct Instruction and Scenario Interruption Qualification LOFT permits minimal interruption of the scenario for the purpose of instruction. Interruption is allowed only when the instructor is certain that negative learning is taking place.

b. Crew Composition Qualification LOFT requires the scheduling of a complete crew complement. Ideally, the crewmember who is qualifying would be scheduled with other crewmembers who are fully line qualified. In any case, the crewmembers will be Task Familiar with their assigned duty position but need not be Line Familiar.

c. Crew Substitutes The use of substitutes is highly discouraged and substitution should be implemented rarely. When the composition of the scheduled crew cannot be maintained, the operator may substitute crewmembers using Table 4-2. Operators should attempt first to substitute another person in the same status.

Table 4-2 Qualification LOFT Substitution Table

| Pilot-in-Command Position | Second-in-Command Position | Flight Engineer Position |
|------------------------------|-----------------------------------------------------|-----------------------------|
| 1 | Another person of the same status for that position | |
| 2 | PIC ¹ | SIC ¹ |
| 3 | SIC ¹ | FE Instructor |
| 4. | Pilot Instructor | Pilot Instructor |

¹ - Includes those who are either qualified or in training for the position and will be Task Familiar for the position in which they are substituting.

d. Number and Type of Segments Qualification LOFT should consist of at least two flight segments, one containing normal line operations and one containing abnormal and emergency occurrences.

e. Training Media Qualification LOFT will be conducted in flight simulators qualified at Levels C or D. (See AC 120-40, Airplane Simulator Qualification, as amended.)

36 -40 RESERVED

CHAPTER 5 SPECIAL PURPOSE OPERATIONAL TRAINING

41 GENERAL Special Purpose Operational Training is designed for training crewmembers in a flight simulator or flight training device. Special Purpose Operational Training is useful whenever coordinated crew performance is required. It may not be substituted for Recurrent LOFT or Qualification LOFT. Examples of Special Purpose Operational Training may include training which

- a Focuses on CRM skills
- b Provides differences training on variant aircraft
- c Provides windshear training
- d Trains in special aircraft equipment, e.g., navigational equipment and flight management systems

42 ELEMENTS RESEMBLING LOFT Special Purpose Operational Training contains some elements which are similar to those found in LOFT, including line environment, scenarios which are real world and real time, no-jeopardy training, and the use of feedback and critique. Elements of Special Purpose Operational Training which may vary from LOFT are described below.

43 GUIDELINES FOR SPECIAL PURPOSE OPERATIONAL TRAINING The components of Special Purpose Operational Training vary, depending on the purpose or objective of the training. Therefore, the following provides only general guidelines for Special Purpose Operational Training.

a Direct Instruction and Scenario Interruption Special Purpose Operational Training permits direct instruction and allows for interruption of the scenario by the instructor.

b Crew Composition Special Purpose Operational Training may include use of a complete or partial crew, depending upon the training objectives.

c Crew Substitutes The use of crew substitutes in Special Purpose Operational Training depends upon the type of training being provided.

d Number and Type of Segments Special Purpose Operational Training may contain any number of full or partial flight segments, depending upon the training objectives.

e Training Media Special Purpose Operational Training may use a wide range of flight simulators and flight training devices, depending upon the training objectives. (See AC 120-40, as amended, Airplane Simulator Qualification and AC 120-45, as amended, Airplane Flight Training Device Qualification.)

44 -50 RESERVED

CHAPTER 6. LINE OPERATIONAL EVALUATION

51 GENERAL. Line Operational Evaluation is primarily designed for crewmember evaluation under an Advanced Qualification Program (AQP). Line Operational Evaluation is conducted in a flight simulator or flight training device and is designed to check for both individual and crew competence. Line Operational Evaluation may also be used to evaluate a specific training objective. Line Operational Evaluation includes the concepts listed below

52. ELEMENTS RESEMBLING LOFT Line Operational Evaluation contains elements similar to those in LOFT; i e , line environment; complete crew, scenarios which are real world, real time, and may run uninterrupted. An inventory of operational problems and environmental conditions should be developed which allows scenarios to be selected on a random basis. This will ensure that flight crewmembers are not familiar with repetitive scenarios. An important factor is that every attempt be made to have a complete crew complement scheduled and maintained. Flight crewmember substitution is highly discouraged. If crew substitutions are necessary, the substitute crewmember will be either another qualified crewmember or a Task Familiar crewmember in a training status comparable to the person being evaluated. Instructors and evaluators may not serve as a substitute crewmember

53 EVALUATION. Unlike LOFT, Line Operational Evaluation requires evaluation of both crewmember and crew competence and performance. Therefore, Line Operational Evaluation contains an element of "jeopardy," as opposed to the "no-jeopardy" environment in LOFT

54 EVALUATORS. The role of an evaluator (including check airmen) in Line Operational Evaluation is to observe and evaluate crewmember performance during the simulation. The evaluator must be qualified in accordance with the operator's approved training program. The evaluator is responsible for informing crewmembers, prior to the start of the exercise, that they will be evaluated

55 FLIGHT SIMULATORS/FLIGHT TRAINING DEVICES Operators conducting Line Operational Evaluation may be approved to use any level of flight simulator or flight training device, depending on the objective of the evaluation and the capability of the device. The level of the flight simulator or flight training device required to support evaluation in Line Operational Evaluation will depend upon the evaluation objectives and the device's capability to support the objectives

56 -60 RESERVED

CHAPTER 7 THE ROLE OF INSTRUCTORS

61 MINIMUM QUALIFICATIONS Instructors should be trained in the philosophy, skills, and conduct of Line Operational Simulations and CRM. They should be able to effectively observe and critique both individual and crew performance during the scenario. To do this, they should meet the minimum requirements discussed in the following paragraphs:

a Line Familiar Instructors should be Line Familiar, i.e., familiar with the operations for which they are providing training. This will ensure that instructors accurately perceive and evaluate situations as they arise. In cases where instructors currently are not line qualified, an approved line observation program (see paragraph 9a, Line Qualified) should ensure that they are familiar with line operational procedures and problems. In this way, instructors will maintain an understanding of the operational demands confronting line crewmembers.

b Qualified as Instructors Instructors should be qualified as defined in FAR § 121.411(b) or § 135.337(b), or as otherwise approved. They are not required to hold current medical certificates to qualify and serve as instructors.

c Trained in CRM Skills Instructors will receive training in CRM skills in order to observe and critique these areas in Line Operational Simulations. (See AC 120-51, Cockpit Resource Management Training, for further information on the skills of CRM.)

d Trained in Methods for Briefing, Debriefing, and Critique Instructors should be trained to conduct the briefing and debriefing/critique phases of Line Operational Simulations, including how to provide feedback in a non-threatening and sensitive manner.

62 INSTRUCTOR RESPONSIBILITIES AT EACH STAGE OF LINE OPERATIONAL SIMULATIONS The following is a description of the roles and responsibilities expected of instructors:

a Briefing and Preparation Instructors should be able to effectively convey the purpose of the Line Operational Simulation and how it is representative of line operations. Instructors should also explain the instructor's role during the training, i.e., as an observer and not considered present unless playing a role in the scenario.

b Flight Segment Instructors should be able to both observe and perform ancillary roles. They should be trained in observing both technical and CRM skills. The instructor should also be trained in proper pacing, proper introduction of abnormal/emergency procedures, and methods of handling unforeseen crew actions.

c Debriefing and Critique Instructors should provide both positive and negative feedback during critiques of individual and crew performance. Prior to the instructor's critiques, crewmembers should be encouraged to

critique themselves Instructors will provide feedback to the crew to encourage the changes needed for improved performance Instructors should also provide specific recommendations to improve individual crewmembers' performance

63 -70 RESERVED



<資料4>

AC120-51D (2001)
Crew Resource Management Training



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

**Subject: CREW RESOURCE MANAGEMENT
TRAINING**

Date: 2/8/01

AC No: 120-51D

Initiated By: AFS-210

Change:

1. PURPOSE. This advisory circular (AC) presents guidelines for developing, implementing, reinforcing, and assessing Crew Resource Management (CRM) training programs for flight crewmembers and other personnel essential to flight safety. These programs are designed to become an integral part of training and operations. Guidelines are primarily for those operators subject to Title 14 of the Code of Federal Regulations (14 CFR) part 121. All part 121 operators are required by regulations to provide CRM training for pilots and flight attendants, and dispatch resource management (DRM) training for aircraft dispatchers. These guidelines are also for use by those 14 CFR part 135 operators electing to train in accordance with part 121 requirements. Certificate holders and individuals operating apart from air carrier operations, under other operating rules, such as 14 CFR parts 91, 125, and others, should find these guidelines useful in addressing human performance issues. This AC presents one way, but not necessarily the only way, that CRM training may be addressed. CRM training focuses on situation awareness, communication skills, teamwork, task allocation, and decisionmaking within a comprehensive framework of standard operating procedures (SOP's).

2. CANCELLATION. AC 120-51C, Crew Resource Management Training, dated 10/30/98, is canceled.

3. PRINCIPAL CHANGES. The text that has been changed from AC 120-51C is marked with a vertical bar in the left margin.

4. RELATED REGULATIONS (Title 14 of the Code of Federal Regulations). Part 121, subpart N and O, part 135, subparts E and H, sections 121.400-405, 121.409-422, 121.424, 121.427, 121.432-433, 121.434, 121.440-443, 135.243-245, 135.293-295, 135.299-301, 135.321-331, and 135.335-351, Special Federal Aviation Regulation (SFAR) No. 58.

5. DEFINITIONS. The human factors safety challenge and the CRM training response may be defined as follows:

a. Human Factors. Human factors is a multidisciplinary field devoted to optimizing human performance and reducing human error. It incorporates the methods and principles of the behavioral

and social sciences, engineering, and physiology. Human factors is the applied science that studies people working together in concert with machines. Human factors embraces variables that influence individual performance and variables that influence team or crew performance. It is recognized that inadequate system design or inadequate operator training can contribute to individual human error that leads to system performance degradation. Further, it is recognized that inadequate design and management of crew tasks can contribute to group errors that lead to system performance degradation.

b. Crew Resource Management (CRM) Training. The application of team management concepts in the flight deck environment was initially known as Cockpit Resource Management. As CRM training programs evolved to include flight attendants, maintenance personnel and others, the phrase Crew Resource Management has been adopted.

(1) As used in this AC, CRM refers to the effective use of all available resources: human resources, hardware, and information. Other groups routinely working with the cockpit crew, who are involved in decisions required to operate a flight safely, are also essential participants in an effective CRM process. These groups include but are not limited to:

- (a) Aircraft dispatchers
- (b) Flight attendants
- (c) Maintenance personnel
- (d) Air traffic controllers

(2) CRM training is one way of addressing the challenge of optimizing the human/machine interface and accompanying interpersonal activities. These activities include team building and maintenance, information transfer, problem solving, decisionmaking, maintaining situation awareness, and dealing with automated systems. CRM training is comprised of three components: initial indoctrination/awareness, recurrent practice and feedback, and continual reinforcement.

6. RELATED READING MATERIAL.

a. AC 120-35B, Line Operational Simulations: Line-Oriented Flight Training, Special Purpose Operational Training, Line Operational Evaluation

b. AC 120-48, Communication and Coordination Between Flight Crewmembers and Flight Attendants

c. AC 120-54, Advanced Qualification Program

d. AC 120-71, Standard Operating Procedures for Flightdeck Crewmembers
<<http://www.faa.gov/avr/afs/acs/ac-idx.htm>>

e. AC 121-32, Dispatch Resource Management Training

NOTE: All AC's may be obtained by mail from:

U S Department of Transportation
Subsequent Distribution Office, SVC-121 23
Ardmore East Business Center
3341 Q 75th Ave
Landover, MD 20785

f. Guidelines for Situation Awareness Training, NAWCTSD/FAA/UCF Partnership for Aviation Team Training This document may be viewed, downloaded, or printed at the following website
<<http://www.faa.gov/avr/afs/train.htm>>

g. Controlled Flight into Terrain Education and Training Aid, Flight Safety Foundation, International Civil Aviation Organization (ICAO), and the Federal Aviation Administration (FAA) This document may be viewed, downloaded, or printed at the following website
<<http://www.faa.gov/avr/afs/train.htm>>

h. International Civil Aviation Organization (ICAO) Annex 13 on Human Factors This document may be obtained from ICAO Document Sales Unit, Montreal, Quebec, Canada, 514-954-8022

i. For detailed information on the recommendations made in this AC, the reader is encouraged to review Crew Resource Management An Introductory Handbook published by FAA (Document No DOT/FAA/RD-92/26) Additional background material can be found in Cockpit Resource Management Training Proceedings of a NASA/MAC Workshop, 1987 The National Aeronautics and Space Administration (NASA) Conference Proceedings (CP) number is 2455 The National Plan for Aviation Human Factors defines research issues related to crew coordination and training Copies of the preceding publications may be purchased from the National Technical Information Service, U S Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161 The telephone numbers for National Technical Information Service are voice - (800) 553-NTIS[6847], and (703) 605-6000, fax (703) 605-6900

j. Descriptions of relevant research findings, methodological issues, and organizational experience can be found in Helmreich, R.L , and Wilhelm, J A , (1991) "Outcomes of CRM Training," International Journal of Aviation Psychology, 1, 287-300, in Helmreich, R L , and Foushee, H C , "Why Crew Resource Management Empirical and Theoretical Bases of Human Factors Training in Aviation", in Orasanu, J , "Decisionmaking in the Cockpit", and in Gregorich, S E , and Wilhelm, J A , "Crew Resource Management Training Assessment " Each of the preceding appears as a chapter in E L Wiener, B G Kanki, and R L Helmreich (Eds), (1993), "Cockpit Resource Management," Academic Press, Orlando, FL For more detail on certain evolving concepts of CRM

(1) Error management, see "Human Error," J T Reason New York Cambridge University Press, 1990 Also, "Managing the Risks of Organizational Accidents," J T Reason, Brookfield, VT, Ashgate Publishing, 1997

(2) Advanced crew resource management, see “Developing Advanced Crew Resource Management (ACRM) Training A Training Manual,” Seamster, Boehm-Davis, Holt, Schultz, 8-1-98 <<http://www.hf.faa.gov/products/dacrm/dacrm.html>>

(3) Culture issues, see “Culture, Error, and Crew Resource Management,” book chapter from “Applying Resource Management in Organizations A Guide for Professionals,” in press (Helmreich, Wilhelm, Klinect, and Merritt) <<http://www.psy.utexas.edu/psy/helmreich/nasaut.htm>>

(4) Situation awareness, see “Cockpit Distractions and Interruptions,” Dismukes, Young, Sumwalt, December, 1998 <http://asrs.arc.nasa.gov/directline_issues/dl10_distract.htm>

7. BACKGROUND. Investigations into the causes of air carrier accidents have shown that human error is a contributing factor in 60 to 80 percent of all air carrier incidents and accidents. Long term NASA research has demonstrated that these events share common characteristics. Many problems encountered by flightcrews have very little to do with the technical aspects of operating in a multi-person cockpit. Instead, problems are associated with poor group decisionmaking, ineffective communication, inadequate leadership, and poor task or resource management. Pilot training programs historically focused almost exclusively on the technical aspects of flying and on an individual pilot's performance, they did not effectively address crew management issues that are also fundamental to safe flight.

a. The National Transportation Safety Board (NTSB), the FAA, and many other parties have identified SOP's as a persistent element in these problems, which sometimes have led to accidents. SOP's define the shared mental model upon which good crew performance depends. Too often well-established SOP's have been unconsciously ignored by pilots and others, in other cases they have been consciously ignored. In still other cases SOP's have been inadequately developed by the operator for use by its pilots, flight attendants, or aircraft dispatchers, or a significant SOP has been omitted altogether from an operator's training program. The Commercial Aviation Safety Team (CAST), a coalition of industry and government organizations, including the FAA, chartered by the White House in 1997, has undertaken to reduce the air carrier accident rate by 80% by the year 2007. Initiatives to improve SOP's and adherence to those SOP's are among the top-priority safety initiatives now being implemented by CAST.

b. Industry and government have come to consensus that training programs should place emphasis on the factors that influence crew coordination and the management of crew resources. The need for additional training in communication between cockpit crewmembers and flight attendants has been specifically identified.

c. Coordinated efforts by representatives from the aviation community have produced valuable recommendations for CRM training programs. This collaborative process has occurred under the auspices of the Aviation Rulemaking Advisory Committee (ARAC). ARAC comprises representatives from a broad array of aviation organizations, including pilots' and flight attendants' associations, aircraft manufacturers, government offices, and others. ARAC is chaired by the Director of the FAA's Office of Rulemaking and is subdivided into working groups. One of those working groups is the

Training and Qualifications Working Group This AC is one product that has come from that working group and represents the sum of many parts While compliance with this AC is not mandatory, the recommendations which it contains provide a useful reference for understanding and applying the critical elements of CRM training

d. Continuing NASA and FAA measurements of the impact of CRM training show that after initial indoctrination, significant improvement in attitudes occur regarding crew coordination and flight deck management In programs that also provide recurrent training and practice in CRM concepts, significant changes have been recorded in flightcrew performance during Line Oriented Flight Training (LOFT) and during actual flight CRM-trained crews operate more effectively as teams and cope more effectively with nonroutine situations

e. Research also shows that when there is no effective reinforcement of CRM concepts by way of recurrent training, improvements in attitudes observed after initial indoctrination tend to disappear, and individuals' attitudes tend to revert to former levels

8. THE MISSION OF CRM TRAINING. CRM training has been conceived to prevent aviation accidents by improving crew performance through better crew coordination

9. BASIC CONCEPTS OF CRM. CRM training is based on an awareness that a high degree of technical proficiency is essential for safe and efficient operations Demonstrated mastery of CRM concepts cannot overcome a lack of proficiency Similarly, high technical proficiency cannot guarantee safe operations in the absence of effective crew coordination

a. Experience has shown that lasting behavior changes in any environment cannot be achieved in a short time, even if the training is very well designed Trainees need awareness, practice and feedback, and continuing reinforcement in brief, time to learn attitudes and behaviors that will endure In order to be effective, CRM concepts must be permanently integrated into all aspects of training and operations

b. While there are various useful methods in use in CRM training today, certain essentials are universal

(1) CRM training is most effective within a training program centered on clear, comprehensive standard operating procedures

(2) CRM training should focus on the functioning of crewmembers as teams, not as a collection of technically competent individuals

(3) CRM training should instruct crewmembers how to behave in ways that foster crew effectiveness

(4) CRM training should provide opportunities for crewmembers to practice the skills necessary to be effective team leaders and team members

(5) CRM training exercises should include all crewmembers functioning in the same roles (e.g., captain, first officer, and/or flight engineer, flight attendants) that they normally perform in flight

(6) CRM training should include effective team behaviors during normal, routine operations

c. Good training for routine operations can have a strong positive effect on how well individuals function during times of high workload or high stress. During emergency situations, it is highly unlikely (and probably undesirable) that any crewmember would take the time to reflect upon his or her CRM training in order to choose the appropriate behavior. But practice of desirable behaviors during times of low stress increases the likelihood that emergencies will be handled effectively.

d. Effective CRM has the following characteristics:

(1) CRM is a comprehensive system of applying human factors concepts to improve crew performance.

(2) CRM embraces all operational personnel.

(3) CRM can be blended into all forms of aircrew training.

(4) CRM concentrates on crewmembers' attitudes and behaviors and their impact on safety.

(5) CRM uses the crew as the unit of training.

(6) CRM is training that requires the active participation of all crewmembers. It provides an opportunity for individuals and crews to examine their own behavior, and to make decisions on how to improve cockpit teamwork.

(a) LOFT sessions provide an extremely effective means of practicing CRM skills and receiving reinforcement (see section 121.409 and part 121 Appendix H).

(b) Audiovisual (taped) feedback during debriefing of LOFT and other training is an excellent way for flight crewmembers to assess their skills as individuals and as team members. Bulk erasure of taped sessions is suggested to encourage candor among participants while assuring their privacy.

(c) In cases where simulators are not available, crewmembers can participate in group problem-solving activities designed to exercise CRM skills. Through taped feedback during debriefing, they can then assess the positive and negative behaviors of all crewmembers.

(d) Crewmembers may also participate in role-playing exercises. Such exercises permit practice in developing strategies for dealing with events or event sets, and enable analysis of behaviors shown while dealing with them. Again, taping the role-playing exercises is useful for assessment and feedback during debriefing. Crewmembers' abilities can be clearly observed in such areas as adherence to SOP's, decisionmaking, teamwork, and leadership.

(e) Attitude and/or personality measures can also be used to provide feedback to participants, allowing them to assess their own strengths and weaknesses

(7) Success of a CRM training program depends upon check airmen, instructors, and supervisors who are highly qualified in the operator's SOP's and specially trained in CRM

10. FUNDAMENTALS OF CRM TRAINING IMPLEMENTATION. Research programs and airline operational experience suggest that the greatest benefits are achieved by adhering to the following practices

a. Assess the Status of the Organization Before Implementation. It is important to know how widely CRM concepts are understood and practiced before designing specific training. Surveys of crewmembers, management, training, and standards personnel, observation of crews in line observations, and analysis of incident/accident reports can provide essential data for program designers

b. Get Commitment from All Managers, Starting with Senior Managers. CRM programs are received much more positively by operations personnel when senior managers, flight operations managers, and flight standards officers conspicuously support CRM concepts and provide the necessary resources for training. Flight operations manuals and training manuals should embrace CRM concepts by providing crews with necessary policy and procedures guidance centered on clear, comprehensive SOP's. A central CRM concept is communication. It is essential that every level of management support a safety culture in which communication is promoted by encouraging appropriate questioning. It should be made perfectly clear in pilots' manuals, and in every phase of pilot training, that appropriate questioning is encouraged and that there will be no negative repercussions for appropriate questioning of one pilot's decision or action by another pilot.

c. Customize the Training to Reflect the Nature and Needs of the Organization. Using knowledge of the state of the organization, priorities should be established for topics to be covered including special issues, such as the effects of mergers or the introduction of advanced technology aircraft. Other special issues might include topics specific to the particular type of operation, such as the specific characteristics that exist in commuter operations, in long-haul international operations or night operations. This approach increases the relevance of training for crewmembers.

d. Define the Scope of the Program and an Implementation Plan. Institute special CRM training for key personnel including check airmen, supervisors, and instructors. It is highly beneficial to provide training for these groups before beginning training for crewmembers. CRM training may be expanded to combine pilots, flight attendants, and aircraft dispatchers. It may also be expanded to include maintenance personnel and other company team members as appropriate. It is also helpful to develop a long term strategy for program implementation.

e. Communicate the Nature and Scope of the Program Before Startup. Training departments should provide crews, managers, training, and standards personnel with a preview of what the training

will involve together with plans for initial and continuing training. These steps can prevent misunderstandings about the focus of the training or any aspect of its implementation.

f. Institute Quality Control Procedures. It has proved helpful to monitor the delivery of training and to determine areas where training can be strengthened. Monitoring can be initiated by providing special training to program instructors (often called facilitators) in using surveys to collect systematic feedback from participants in the training.

11. COMPONENTS OF CRM TRAINING. The topics outlined below have been identified as critical components of effective CRM training. They do not represent a fixed sequence of phases, each with a beginning and an end. Ideally, each component is continually renewed at every stage of training.

a. Initial Indoctrination/Awareness.

(1) Indoctrination/awareness typically consists of classroom presentations and focuses on communications and decisionmaking, interpersonal relations, crew coordination, leadership, and adherence to SOP's, among others. In this component of CRM training, the concepts are developed, defined, and related to the safety of line operations. This component also provides a common conceptual framework and a common vocabulary for identifying crew coordination problems.

(2) Indoctrination/awareness can be accomplished by a combination of training methods. Lectures, audiovisual presentations, discussion groups, role-playing exercises, computer-based instruction, and videotaped examples of good and poor team behavior are commonly used methods.

(3) Initiating indoctrination/awareness training requires the development of a curriculum that addresses CRM skills that have been demonstrated to influence crew performance. To be most effective, the curriculum should define the concepts involved and relate them directly to operational issues that crews encounter. Many organizations have found it useful to survey crewmembers. Survey data have helped identify embedded attitudes regarding crew coordination and cockpit management. The data have also helped to identify operational problems and to prioritize training issues.

(4) Effective indoctrination/awareness training increases understanding of CRM concepts. That understanding, in turn, often influences individual attitudes favorably regarding human factors issues. Often the training also suggests more effective communication practices.

(5) It is important to recognize that classroom instruction alone does not fundamentally alter crewmember attitudes over the long term. The indoctrination/awareness training should be regarded as a necessary first step towards effective crew performance training.

b. Recurrent Practice and Feedback.

(1) CRM training must be included as a regular part of the recurrent training requirement. Recurrent CRM training should include classroom or briefing room refresher training to review and amplify CRM components, followed by practice and feedback exercises such as LOFT, preferably with

taped feedback, or a suitable substitute such as role-playing in a flight training device and taped feedback. It is recommended that these recurrent CRM exercises take place with a full crew, each member operating in his or her normal crew position. A complete crew should always be scheduled, and every attempt should be made to maintain crew integrity. Recurrent training LOFT which includes CRM should be conducted with current line crews, and preferably not with instructors or check airmen as stand-ins.

(2) Recurrent training with performance feedback allows participants to practice newly improved CRM skills and to receive feedback on their effectiveness. Feedback has its greatest impact when it comes from self-critique and from peers, together with guidance from a facilitator with special training in assessment and debriefing techniques.

(3) The most effective feedback refers to the coordination concepts identified in Indoctrination/Awareness training or in recurrent training. Effective feedback relates to specific behaviors. Practice and feedback are best accomplished through the use of simulators or training devices and videotape. Taped feedback, with the guidance of a facilitator, is particularly effective because it allows participants to view themselves from a third person perspective. This view is especially compelling in that strengths and weaknesses are captured on tape and vividly displayed. Stop action, replay, and slow motion are some of the playback features available during debriefing. Behavioral patterns and individual work styles are easily seen, and appropriate adjustments are often self-evident.

c. Continuing Reinforcement.

(1) No matter how effective each curriculum segment is (the classroom, the role-playing exercises, the LOFT, or the feedback), one-time exposures are simply not sufficient. The attitudes and norms that contribute to ineffective crew coordination may have developed over a crewmember's lifetime. It is unrealistic to expect a short training program to reverse years of habits. To be maximally effective, CRM should be embedded in every stage of training, and CRM concepts should be stressed in line operations as well.

(2) CRM should become an inseparable part of the organization's culture.

(3) There is a common tendency to think of CRM as training only for captains. This notion misses the essence of the CRM training mission: the prevention of crew-related accidents. CRM training works best in the context of the entire crew. Training exercises are most effective if all crewmembers work together and learn together. In the past, much of the flightcrew training has been segmented by crew position. This segmentation has been effective for meeting certain training needs such as seat dependent technical training and upgrade training, but segmentation is not appropriate for most CRM training.

(4) Reinforcement can be accomplished in many areas. Training such as joint cabin and cockpit crew training in security can deal with many human factors issues. Joint training with aircraft dispatchers, maintenance personnel, and gate agents can also reinforce CRM concepts and is recommended.

12. SUGGESTED CURRICULUM TOPICS. The topics outlined below have been included in many current CRM programs. Specific content of training and organization of topics should reflect an organization's unique culture and specific needs. Appendix 1 offers a set of behavioral markers fitting subtopics within each topic cluster. Sometimes overlapping, these markers may be helpful in curriculum development and in LOFT design. Appendix 3 gives additional CRM training topics.

a. Communications Processes and Decision Behavior. This topic includes internal and external influences on interpersonal communications. External factors include communication barriers such as rank, age, gender, and organizational culture, including the identification of inadequate SOP's. Internal factors include speaking skills, listening skills and decisionmaking skills, conflict resolution techniques, and the use of appropriate assertiveness and advocacy. The importance of clear and unambiguous communication must be stressed in all training activities involving pilots, flight attendants, and aircraft dispatchers. The greater one's concern in flight-related matters, the greater is the need for clear communication. More specific subtopics include the following:

- (1) Briefings Training in addressing both operational and interpersonal issues, and training in establishing and maintaining open communications. Briefings should reaffirm established SOP's.
- (2) Inquiry/Advocacy/Assertion Training in the potential benefits of crewmembers advocating the course of action that they feel is best, even though it may involve conflict with others.
- (3) Crew Self-Critique (Decisions and Actions) Illustrating the value of review, feedback, and critique focusing on the process and the people involved. One of the best techniques for reinforcing effective human factors practices is careful debriefing of activities, highlighting the processes that were followed. Additionally, it is essential that each crewmember be able to recognize good and bad communications, and effective and ineffective team behavior.
- (4) Conflict Resolution Demonstrating effective techniques of resolving disagreements among crewmembers in interpreting information or in proposing courses of action. Demonstrating effective techniques for maintaining open communication while dealing with conflict.
- (5) Communications and Decisionmaking Demonstrating effective techniques of seeking and evaluating information. Showing the influence of biases and other cognitive factors on decision quality. There are benefits in providing crews with operational models of this group decision process. Crews may refer to these models to make good choices in situations when information is incomplete or contradictory.

b. Team Building and Maintenance. This topic includes interpersonal relationships and practices. Effective leadership/followership and interpersonal relationships are key concepts to be stressed. Curricula can also include recognizing and dealing with diverse personalities and operating styles. Subtopics include:

- (1) Leadership/Followership/Concern for Task Showing the benefits of the practice of effective leadership through coordinating activities and maintaining proper balance between respecting authority and practicing assertiveness. Staying centered on the goals of safe and efficient operations.

(2) Interpersonal Relationships/Group Climate Demonstrating the usefulness of showing sensitivity to other crewmembers' personalities and styles. Emphasizing the value of maintaining a friendly, relaxed, and supportive yet task oriented tone in the cockpit and aircraft cabin. The importance of recognizing symptoms of fatigue and stress, and taking appropriate action.

(3) Workload Management and Situation Awareness Stressing the importance of maintaining awareness of the operational environment and anticipating contingencies. Instruction may address practices (for example, vigilance, planning and time management, prioritizing tasks, and avoiding distractions) that result in higher levels of situation awareness. The following operational practices may be included:

(a) Preparation/Planning/Vigilance Issues include methods to improve monitoring and accomplishing required tasks, asking for and responding to new information, and preparing in advance for required activities.

(b) Workload Distribution/Distraction Avoidance Issues involve proper allocation of tasks to individuals, avoidance of work overloads in self and in others, prioritization of tasks during periods of high workload, and preventing nonessential factors from distracting attention from adherence to SOP's, particularly those relating to critical tasks.

(4) Individual Factors/Stress Reduction Training in this area may include describing and demonstrating individual characteristics that can influence crew effectiveness. Research has shown that many crewmembers are unfamiliar with the negative effects of stress and fatigue on individual cognitive functions and team performance. Training may include a review of scientific evidence on fatigue and stress and their effects on performance. The content may include specific effects of fatigue and stress in potential emergency situations. The effects of personal and interpersonal problems and the increased importance of effective interpersonal communications under stressful conditions may also be addressed. Training may also include familiarization with various countermeasures for coping with stressors. Additional curriculum topics may include examination of personality and motivation characteristics, self-assessment of personal style, and identifying cognitive factors that influence perception and decisionmaking.

13. SPECIALIZED TRAINING IN CRM CONCEPTS. As CRM programs have matured, some organizations have found it beneficial to develop and implement additional courses dealing with issues specific to their operations:

a. After all current crewmembers have completed the Initial Indoctrination/Awareness component of CRM training, arrangements are needed to provide newly hired crewmembers with the same material. A number of organizations have modified their CRM initial courses for inclusion as part of the initial training and qualification for new hire crewmembers.

b. Training for upgrading to captain provides an opportunity for specialized training that deals with the human factors aspects of command. Such training can be incorporated in the upgrade process.