Federal Aviation Administration
Aviation Rulemaking Advisory Committee

Training and Qualification Issue Area
Air Carrier Working Group
Task 3 – Crew Resource Management

Task Assignment – Not Available

Recommendation Letter

RAA Regional Airline Association • 1101 Connecticut Avenue, NW • Suite 700 • Washington, DC 20036 • 202/857-1170 • ARINC "WASRAXD"

March 19, 1993

Mr. Anthony J. Broderick
Associate Administrator for
Regulation and Certification, AVR-1
Federal Aviation Administration
800 Independence Ave. SW
Washington, DC 20591

Dear Mr. Broderick:

Enclosed is a copy of the draft Dispatch Resource Management Advisory Circular. This document was accepted at the March 4 meeting of the Aviation Rulemaking Advisory Committee to consider Training and Qualifications Issues. We recommend that the Federal Aviation Administration (FAA) accept and issue this advisory circular.

We look forward to receiving additional and beneficial tasks from the FAA.

Sincerely,

Walter S. Coleman
Assistant Chairman for
Training and Qualifications
Issues, Aviation Rulemaking
Advisory Committee

Enclosure

cc: Mr. Thomas Toula

Acknowledgement Letter

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

800 Independence Ave., S.W.
Washington, D.C. 20591

APR 30 1993

Mr. Walter S. Coleman
President
Regional Airline Association
1101 Connecticut Ave., NW, Suite 700
Washington, DC 20036

Dear Mr. Coleman:

Thank you for your March 19 letter forwarding the Aviation Rulemaking Advisory Committee Training and Qualifications Issues recommendation. The Committee recommends that the Dispatch Resource Management Advisory Circular be accepted and issued. The Federal Aviation Administration (FAA) accepts this recommendation provided there are no legal or other reasons why we cannot adopt it.

However, because the proposed advisory circular requires formatting and an extensive legal review, we cannot give you a definite timeframe for completion of action on the recommendation. After the proposed advisory circular has been formatted and reviewed by the legal office, it will be coordinated within the FAA. Thereafter, the FAA will issue a notice of availability of the document for public comment.

I would like to thank the Committee, and particularly the Air Carrier Training Working Group, for its prompt action on the task assigned by the FAA.

Sincerely,

Anthony J. Broderick
Associate Administrator
for Regulation and Certification

Recommendation

DISPATCH RESOURCE MANAGEMENT ADVISORY CIRCULAR
DRAFT 3.2
REVISED NOV 13, 1992

Prepared By Air Carrier Working Group

1) PURPOSE
To develop a resource management program for dispatchers that compliments the program developed for flight crew members in Crew Resource Management (CRM). Dispatch Resource Management (DRM) is designed to establish Human Factor training for all dispatchers.

2) GOAL
To provide the aircraft dispatcher with the skills required to exercise more effective operational control in an increasingly complicated environment. In exercising operational control, the dispatcher coordinates with the flight crew, ATC, and other members of the operational environment in order to meet the requirements of daily operations. Compliance with this Advisory Circular would maximize the dispatcher's knowledge of the other participants' duties within the National Airspace System and throughout the entire spectrum of the operating environment. This, in turn, would allow dispatchers to improve the administration of information necessary for safe flight operations and would also enhance the interface with the pilot in command in compliance with the joint responsibility concept outlined in Federal Aviation Regulations Part 121.

3) BACKGROUND
The dispatcher, in addition to other roles, is a source of communications continually receiving and disseminating information. He/she interfaces with the flight crew, ATC and other parties in the operational environment.

Recent NTSB findings have shown that the lack of operational control and cooperative decision making has been a contributing factor in the probable cause of several airline accidents.[1] The exchange of resources for operational control needs to be recognized as the best deterrent to incidents and accidents related to miscommunication.

[1] NTSB AAR-91-04; NTSB-AAR-85-03; Royal Canadian Commission Investigation of Air Ontario at Dryden.

Research in Human Factors at NASA and other governmental agencies, private industry, and various universities continues to reinforce the need for resource management training. Therefore, clear and concise communications between the dispatcher and other members of the operational environment are imperative.

CRM is a valuable training program for flight crews, but additional specialized training is required for the aircraft dispatcher. This AC is provided to complement AC 120-51A as a guideline for improved awareness of human factors involved in today's complex airline operations.

4) RELATED FAR SECTIONs and ADVISORY CIRCULARs

A) Part 121, Subpart N (Training). 121.415, 121.418, 121.422.

B) Part 121, Subpart P (Dispatch Qualification). 121.463.

C) Part 121, Subpart T (Flight Operations). 121.533, 121.535, 121.557.

D) Part 121, Subpart U (Dispatching & Flight Release Rules).

E) Part 121, Subpart M (Airman & Crewmember Requirements). 121.395

F) Part 121, Subpart E (Approval of Routes: Domestic & Flag Carriers). 121.107

G) Advisory Circular 120-51A Crew Resource Management Training.

H) SFAR 58, Advanced Qualification Program Advanced Qualification Program Advisory Circular

5) DEFINITIONS

A) Human Factors - Human Factors is a multidisciplinary field that draws on the methods and principles of behavioral and social sciences, engineering, and physiology to optimize human performance and reduce human error. In short, human factors has become an applied science of people working with other people and interfacing with machines. Just as individual errors can degrade a system's performance and safety because of hardware design or inadequate operator training, errors in the design and management of flight dispatch systems can also degrade operational performance.

B) Dispatch Resource Management (DRM) - The focus of communication required for positive operational control is the dispatcher, who coordinates all available resources for the flight crew. DRM encompasses the optimization of the person/machine interface and the interpersonal activities including effective team formation, maintaining information transfer, problem solving, decision making, situational awareness, and utilizing automated systems. Training in DRM/CRM involves initial indoctrination, recurrent training and reinforcement in human factors concepts. DRM refers to the effective use of all available resources: human, hardware, and informational.

C) Operational Control - The exercise of authority over initiating, conducting or terminating a flight.

D) Crew Resource Management (CRM) - Human factors training for crew members covered in crew resource management training AC No. 120-51A.

6) DEVELOPER/FACILITATOR

A) Course developers and facilitators should clearly define DRM and DRM/CRM team concepts as well as related techniques and human factor applications.

B) The effectiveness of any training curriculum can be directly related to the expertise of the personnel involved in the development and facilitation of the program. Therefore, basic criteria for the personnel involved should be established.

Ideally, development and facilitation should be done by current, qualified dispatchers that have also been trained in (but not limited to) the following DRM/CRM areas:

a) Listening and Communication

b) Behavior Identification

c) Role Playing, Simulations and Group Discussions

d) Debrief and Feedback

In the event that the DRM developer/facilitator is not a currently qualified dispatcher, thorough training (in addition to the areas listed above) on the duties and responsibilities of a Flight Dispatcher is imperative.

7) CURRICULUM

A) Basic Indoctrination

The indoctrination and awareness phase of DRM training consists of classroom presentations that focus on the interpersonal relations and coordination involved in a decision making process. This also provides a common terminology and conceptual framework for identifying and describing personal coordination problems. Indoctrination can be accomplished by a combination of methods: lectures, presentations, discussion groups, and role playing exercises. It is advantageous to have interactive participation of flight crew and other members of the operating environment for maximum benefit.

This curriculum development should address DRM skills that have been demonstrated to influence dispatcher performance. For maximum effectiveness, the curriculum should define the concepts involved and relate directly to operational issues which dispatchers face in daily operations.

B) Basic Concepts

1) Operating Environment - The operating environment consists of, but is not limited to, interactions of the Dispatcher with:
   a) Pilots
   b) ATC
   c) Other Dispatchers
   d) Management
   e) Station Personnel
   f) An Approved Meteorology Source
   g) Aircraft Maintenance
   h) Load Planners
   i) Crew Schedulers
   j) Aircraft Routers
   k) Communication Systems & Related Personnel
   l) Approved Flight Planning System & Related Personnel

2) Situational Awareness - The ability to absorb information in a dynamic environment, to evaluate and refine that information, to anticipate contingencies, and to initiate remedial actions as necessary.

3) Communications - The most important aspect of the dispatcher function is the ability to communicate effectively. This communication should be 'n standardized language that is clear and easily understood by individuals of other departments and agencies. Interdepartmental discussions and training also need to be encouraged. Special emphasis should be given to the following:

   a) Inquiry/Advocacy/Assertion.

   b) Conflict Resolution.

   c) Radio Communication (Phraseology and Techniques).

4) Informational Dissemination - One of the aircraft dispatcher's main responsibilities is to keep the flight crew updated on any information that will impact flight safety. Dispatchers are required to process large quantities of real-time information and to decide what data is pertinent to all phases of flights under their operational control. The dispatcher is required to pass on relevant information and obtain missing information. This process provides the flight crew with necessary information and avoids distraction by preventing informational overload to the flight crew.

5) Interpersonal Skills - DRM concentrates on dispatcher attitudes and behaviors and their impact on others.

6) Workload Management - DRM should help dispatchers learn that how they react during normal, routine circumstances can have a powerful influence on how well they function during high workload and stressful situations.

   Strong emphasis should be placed on a prioritization of duties that insure safety through proper operational control.

7) Effective Decision Making - Through inquiry, advocacy and assertion, the dispatcher assumes a leadership role within the operational environment. This leadership role in workload management and situational awareness supports the Captain within his operating environment. Such a role requires the dispatcher together with the pilot in command utilize risk assessment skills which include the following:

a) have a clear understanding of the different concerns to be considered in evaluating decision alternatives (safety, passenger comfort, economy, efficiency).

b) be aware of the different types of data and resources available to the various parties involved in the decision making;

c) be skilled in applying effective problem-solving strategies to help coordinate and participate in decision-making activities;

d) be aware of causes of errors and inefficiencies, so that such behaviors and situations can be recognized and avoided.

C) Periodic Practice and Feedback - DRM reinforcement should extend into other types of training including technical and interdepartmental training on a continuing basis.

1) Technical Training (i.e. Initial and Recurrent training)

a) Simulation
b) Case Studies

2) Interdepartmental Training (i.e. symposiums, seminars, workshops)

a) Problem Solving
b) Stress Awareness
c) Role Reversal
d) Inquiry/Advocacy/Assertion
e) Conflict Resolution

Effective resource management skills are not gained by passively listening to classroom lectures, but by active participation and practice, including the use of simulations such as Line-Operational Simulation (LOS).

Video feedback during debriefing of simulation scenarios and other training should optimally be provided so that dispatchers could assess their skills not only as an individual but as an integral part of the overall operating environment.

The uneasiness created by the presence of videotaping equipment can and should be mitigated by implementing, explaining and then rigidly adhering to a policy of bulk erasure of each tape in the presence of the dispatcher at the end of the debriefing. Such a policy prevents a trainee from keeping a copy of the training session tape, thereby ensuring the credibility of the program.

8) EVALUATION

A) Self - In order to provide a maximum learning environment for all dispatchers, developers/ facilitators should use every available opportunity to emphasize the importance of dispatcher coordination skills and techniques. This is accomplished best by having dispatchers examine their own performance and behavior, with the assistance of a trained developer/facilitator who can point out both positive and negative aspects of DRM performance. Whenever highly effective examples of performance are observed, it is vital that these positive behaviors be discussed and reinforced. Debriefing and critique skills are important tools for developers/facilitators to acquire and utilize.

B) Group/Program - DRM training is a dynamic concept that will continue to be refined and improved. For this reason, it is vitally important that each program be assessed to determine whether it is achieving its stated goal. Each organization should design a systematic assessment program both as a means of tracking the effects of its training program and as a means of making continuous improvements and defining critical topics for periodic training. Assessment of the training program should include observation of the training process and participant's reports using a standard survey method.

C) In order to ensure adequate coverage with such case studies, the FAA, airlines and relevant professional groups (with pilots, ATC and dispatchers as members) should cooperate to develop a national repository of representative cases. Access to such cases should be provided to everyone in the aviation community upon request.

9) GLOSSARY

A) Station Personnel - Employees of an air carrier or contract representatives of an air carrier at a given station/airport.

B) Approved Meteorology Source - Source(s) of meteorological information approved for user in the air carrier's operations specifications.

C) Load Planners - Personnel, in addition to the dispatcher, to whom the responsibilities of preparing the load manifest (FAR 121.665) are delegated.

D) Crew Schedulers - Personnel, in addition to the dispatcher, to whom the responsibilities of monitoring crew qualifications and time legality (FAR 121, Subpart O, Q, R) are delegated.

FAA Action: Dispatch Resource Management Training; Advisory Circular 121-32 -- Regulatory and Guidance Library

#1

U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: DISPATCH RESOURCE MANAGEMENT TRAINING

Date: 2/7/95 **Initiated by:** AFS-210

AC No: 121-32 **Change:**

1. PURPOSE. This advisory circular (AC) complements guidance already developed for flightcrew members and other groups with respect to training in resource management. Focus is on the aircraft dispatcher whose traditional role in air carrier operations is being changed by fundamental changes in aviation, notably advanced technology.

2. RELATED FAR SECTIONS.

a. Part 65, Subpart C - Aircraft Dispatchers.

b. Part 65, Appendix A - Aircraft Dispatcher Courses.

c. Part 121, Subpart E - Approval of Routes: Domestic and Flag Air Carriers, Section 121.107.

d. Part 121, Subpart M - Airman and Crewmember Requirements, Section 121.395.

e. Part 121, Subpart N - Training Program, Sections 121.415, 121.418, and 121.422.

f. Part 121, Subpart P - Aircraft Dispatcher Qualifications and Duty Time Limitations: Domestic and Flag Air Carriers, Section 121.463.

g. Part 121, Subpart T - Flight Operations, Sections 121.533-537.

h. Part 121, Subpart U - Dispatching and Flight Release Rules.

i. Special Federal Aviation Regulation (SFAR) No. 58, Advanced Qualification Program.

3. RELATED READING MATERIAL.

a. AC 120-51B, Crew Resource Management Training.

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

c. AC 120-54, Advanced Qualification Program.

NOTE: These AC's may be obtained from:

Department of Transportation
Property Use and Storage Section, M-45.3
Washington, DC 20590

d. For detailed information on the recommendations made in AC 120-51B, the reader is encouraged to review "Crew Resource Management: An Introductory Handbook," published by the Federal Aviation Administration (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 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, (703) 487-4650.

e. Description of current 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 Wiener, E.L., Kanki, B.G. and Helmreich, R.L., Cockpit Resource Management, 1993, Academic Press, Orlando, Florida.

f. National Transportation Safety Board (NTSB) AAR-91-04; Final report of the Commission of Inquiry into the Air Ontario Accident at Dryden, Ontario, March 10, 1989.

4. BACKGROUND. The NTSB and the Transportation Safety Board of Canada have both found that inadequate operational control and inadequate collaborative decisionmaking have been contributing factors in air carrier accidents. Effective management of available resources by aircraft dispatchers is one essential deterrent to such accidents. In exercising operational control, the dispatcher coordinates with flightcrew members, air traffic controllers (ATC), and other members of a vast team in order to meet the requirements of daily flight operations. This AC encourages the dispatcher's knowledge of the functions of the other participants throughout the operating environment. Two expected benefits to the dispatcher are (1) better handling of information that bears on safe flight operations and (2) a better interface with each pilot in command, consistent with the joint responsibility concept outlined in FAR Part 121.

5. DEFINITIONS.

a. Human Factors. Human factors entails a multidisciplinary effort to generate and compile information about human capabilities and limitations and to apply that information to equipment, systems, facilities, procedures, jobs, environments, training, staffing, and personnel management for safe, comfortable, effective human performance.

> NOTE: 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. Dispatch Resource Management (DRM). The communication center with respect to positive operational control is the dispatcher who coordinates a wide array of resources for the flightcrew. DRM addresses the challenge of optimizing the person/machine interface and related interpersonal issues. These issues include effective teambuilding and maintenance, information transfer, problem solving, decisionmaking, maintaining situational awareness, and dealing with automated systems. DRM training, like CRM training, is comprised of three components: Initial Indoctrination/Awareness, Recurrent Practice and Feedback, and Continuing Reinforcement. DRM differs in the effective use of all resources: human resources, hardware, and information.

c. Operational Control. The authority over initiating, conducting, or terminating a flight.

d. Crew Resource Management Training. Training in aviation human factors for flightcrew members and others.

6. THE MISSION OF DRM TRAINING. DRM training has been conceived to prevent aviation accidents by improving team performance through better team coordination.

7. BASIC CONCEPTS OF DRM.

a. Operating Environment. The operating environment comprises interactions of the aircraft dispatcher with:

(1) Pilots.

(2) Air traffic controllers.

(3) Other dispatchers.

(4) Managers.

(5) Station personnel.

(6) Meteorology resources.

(7) Aircraft maintenance staff.

(8) Load planners.

(9) Crew schedulers.

(10) Aircraft routers.

(11) Communication systems and related personnel.

(12) Flight planning systems and related personnel.

b. Situational Awareness (Dispatcher). The ability to absorb information in a dynamic environment, to evaluate and refine that information, to anticipate contingencies, and to initiate appropriate actions as necessary.

c. Communications. Chief among many functions, the dispatcher is a center for communications, continually receiving and disseminating information. He/she interfaces with the flightcrew, with ATC, and with many others in the operational environment. Communication skills are at the heart of this work. Communication should be in standardized language that is easily understood by individuals in various departments and joint

organizations. Communication among departments and joint training should be encouraged. Special emphasis should be given to:

(1) Inquiry/advocacy/assertion.

(2) Conflict resolution.

(3) Radio communication (phraseology and technique).

d. Handling Information. One of the aircraft dispatcher's main responsibilities is to keep the flightcrew updated on any information that affects flight safety. Dispatchers are required to review large quantities of real-time information and to decide what information is pertinent for each flight under their operational control. Dispatchers pass on information relevant to each flight, sometimes obtaining missing information as part of the process. This linkage provides timely information to the flightcrew members and relieves workload.

e. Interpersonal Skills. DRM concentrates on dispatchers' attitudes and behaviors and the effects that they have on others.

f. Workload Management. DRM should help dispatchers see that how they react during normal routine circumstances can have a powerful influence on how well they function during high workload and stressful situations. Prioritizing tasks is one key element in consistent, effective operational control.

g. Effective Decisionmaking. Through inquiry, advocacy, and assertion, the dispatcher assumes a leadership role within the operational environment. This leadership role in workload management and situational awareness supports the captain. It requires the dispatcher, together with the pilot in command, to apply problem solving skills which include the following:

(1) Weighing the competing needs that must be considered in choosing among alternatives.

(2) Being aware of the resources available to the various parties involved in the decisionmaking;

(3) Applying effective problem solving strategies to help in decisionmaking; and

(4) Avoiding situations and behaviors that contribute to errors.

8. FUNDAMENTALS OF DRM TRAINING IMPLEMENTATION. Research findings 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 DRM concepts are understood and practiced before designing specific training. Surveys of dispatchers, observation of dispatchers at work, and analysis of incident/accident reports can provide essential guidance for program designers.

b. Get Commitment from All Managers, Starting with Senior Managers. Resource management programs are received much more positively by operations personnel when senior managers, flight operations managers, and flight standards officers conspicuously support the basic concepts and provide the necessary resources for training. Training manuals should embrace DRM concepts by providing dispatchers with necessary policy and procedures guidance.

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. This approach increases the relevance of training for dispatchers.

d. Define the Scope of the Program. Institute special DRM training for key personnel including developers/facilitators and supervisors. It is highly beneficial to provide training for these groups before beginning training for dispatchers. DRM training may later be expanded to include pilots, flight attendants, maintenance personnel, and other company resource groups 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 dispatchers 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.

9. COMPONENTS OF DRM TRAINING.

a. Initial Indoctrination/Awareness.

(1) The initial indoctrination/awareness component of DRM training consists of classroom presentations that focus on the interpersonal relations and coordination involved in a decisionmaking process. It also provides a common terminology and conceptual framework for identifying coordination problems. Initial indoctrination may be accomplished by a combination of methods including lectures, discussion groups, and roleplaying exercises. It is advantageous to have interactive participation of flightcrew members and other members of the operating environment.

(2) Indoctrination/awareness training modules for experienced aircraft dispatchers are not the only way that this important DRM training component may be provided. DRM concepts should be addressed in dispatcher initial qualification training for new-hires. Initial qualification training, in turn, may be provided under conventional FAR Part 121 air carrier training programs or under the Advanced Qualification Program (AQP) detailed in SFAR No. 58.

(3) Curriculum development should address DRM skills that have been demonstrated to influence dispatcher performance. For maximum effectiveness, the curriculum should define the concepts involved and relate directly to operational issues which dispatchers face in daily operations.

b. Recurrent Practice and Feedback.

(1) DRM training should be included as a regular part of required recurrent training. Recurrent DRM training should include refresher practice and feedback exercises. An excellent training opportunity is line-oriented flight training (LOFT) with taped feedback, expanded to include the carrier's own aircraft dispatchers. A suitable LOFT substitute specifically for dispatchers might be even more valuable, in which dispatchers interact with several simulated flights at once.

(2) Recurrent training allows participants to practice newly improved skills in communication and interpersonal relationships and to receive feedback on their effectiveness. Feedback has its greatest impact when it comes by way of self-critique and peer review. Guidance from a facilitator with special training in assessment and debriefing techniques completes an effective practice/feedback process.

(3) Effective feedback refers to the coordination concepts identified in indoctrination/awareness training and relates to specific behaviors. Practice and feedback are best accomplished through the use of some form of simulation and audio- or 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. Behaviors are easily seen, and appropriate adjustments are often self-evident.

c. Continuing Reinforcement. DRM concepts should be carried into every other type of training including technical and interdepartmental training so that those concepts are reinforced continuously.

(1) Technical training (e.g., initial and recurrent training).

(i) Simulation.

(ii) Case studies.

(2) Interdepartmental training (e.g., symposiums and seminars).

(i) Problem solving.

(ii) Stress awareness.

(iii) Role reversal.

(iv) Inquiry/advocacy/assertion.

(v) Conflict resolution.

d. Effective resource management skills are not gained by passively listening to classroom lectures, but by active participation and practice, including the use of simulators. Video feedback during debriefing following simulations should be provided so that dispatchers may assess their skills not only as individuals but as integral parts of the operating environment.

e. The uneasiness sometimes created by the presence of videotaping equipment may be relieved by bulk-erasing each videotape in the presence of the dispatcher at the end of the debriefing.

10. ASSESSMENT IN DRM TRAINING PROGRAMS.

a. Self. Developers/facilitators should use every available opportunity to highlight the importance of dispatcher coordination skills and techniques. One of the best learning opportunities occurs when dispatchers examine their own behavior and performance with the assistance of a trained facilitator. The facilitator points out both positive and negative aspects of DRM performance. Whenever highly effective performance is observed, it is vital that the underlying behaviors are discussed and reinforced.

b. Group/Program. DRM training is a dynamic process that works best when it is continually assessed against its goals. Each organization should design a systematic assessment program to track the effects of its training program and to make continuous program adjustments. Experience has shown that resource management training works best if it is continually refreshed by subject matter that is timely, relevant, and usable. Assessment of the training program may include observation of the training process and reports by the participants themselves.

11. THE CRITICAL ROLE OF THE DEVELOPER/FACILITATOR. The effectiveness of any training curriculum is directly related to the expertise of developers and facilitators. Ideally, developers and facilitators should be current, qualified dispatchers who have additional training in one of the following DRM/CRM topics:

a. Listening and communicating.

b. Roleplaying, simulations, and group discussions.

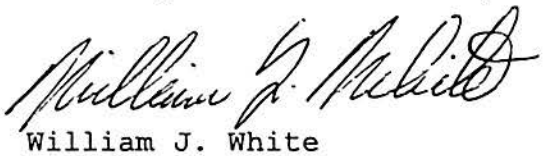
c. Debriefing and feedback.

12. EVOLVING CONCEPTS OF DRM.

a. Concurrent Training. More and more carriers are discovering the value of extending resource management training across organizational lines. Just as the aircraft dispatcher is a resource to the pilot, the pilot is a resource to the dispatcher. Similarly, other groups are resources to the pilot, to the aircraft dispatcher, and to each other. Concurrent training of pilots, flight attendants, aircraft dispatchers, and air traffic controllers has already been tried and found to be valuable. Some carriers include middle and upper-level managers. Their objective is to improve the effectiveness of all the groups within the operations team.

b. National Repository. A frequent recommendation has been that the FAA, airlines, and appropriate professional groups cooperate to develop a national repository of training reference materials relating to communication and other team coordination issues. Access to such materials should be provided to everyone in the aviation community upon request. Initiatives have begun that may provide this capability.

13. SUMMARY STATEMENT. Effective dispatch resource management begins in initial training; it is strengthened by recurrent practice and feedback; and it is sustained by continuing reinforcement that is part of the corporate culture and embedded in every element of a dispatcher's training.



William J. White
Deputy Director, Flight Standards Service

U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: CREW RESOURCE MANAGEMENT TRAINING	Date: 1/22/04	AC No: 120-51E
	Initiated By: AFS-210	Change:

1. PURPOSE. This Advisory Circular (AC) presents guidelines for developing, implementing, reinforcing, and assessing crew resource management (CRM) training for flight crewmembers and other personnel essential to flight safety. CRM training is designed to become an integral part of training and operations. These guidelines were originally intended for Title 14 of the Code of Federal Regulations (14 CFR) part 121 certificate holders who are required by regulation to provide CRM training for pilots and flight attendants, and dispatch resource management (DRM) training for aircraft dispatchers. Fractional ownership program managers, required by 14 CFR part 91, subpart K to provide CRM training to pilots and flight attendants, and those 14 CFR part 135 operators electing to train in accordance with part 121 requirements, should also use these guidelines. Certificate holders and individuals operating under other operating rules, such as parts 91 (apart from subpart K), 125, and part 135 operators not electing to train in accordance with part 121, 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).

2. CANCELLATION. AC 120-51D, Crew Resource Management Training, dated 2/8/01, is cancelled.

3. PRINCIPAL CHANGES. Operators of fractional ownership programs under part 91, subpart K, are now required to provide CRM training to pilots and flight attendants, and are mentioned in the PURPOSE paragraph, above. Under paragraph 12 of this AC, the subparagraph on Briefings has been expanded to address safety and security concerns, including evacuation and hijack. A new subparagraph under paragraph 16, entitled Crew Monitoring and Cross-Checking, emphasizes the critical role of the pilot-not-flying (PNF) as a *monitor*. Monitoring is always essential, and particularly so during approach and landing when controlled flight into terrain (CFIT) accidents are most common. Accordingly, previous references to PNF have been changed to pilot monitoring (PM), in accordance with government and industry preference. In appendix 3, attempted hijack has been included as the most serious level of passenger interference requiring effective crew response, and has been included as an appropriate CRM training topic. Minor editorial changes have also been made in

this revision. Text that has been changed from AC 120-51D is marked with a vertical bar in the left margin.

4. RELATED REGULATIONS (Title 14 of the Code of Federal Regulations). Part 91, section 91.1073; 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. The multidisciplinary field of human factors is devoted to optimizing human performance and reducing human error. It incorporates the methods and principles of the behavioral and social sciences, engineering, and physiology. It is the applied science that studies people working together in concert with machines. It 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. CRM Training. The application of team management concepts in the flight deck environment was initially known as cockpit resource management. As CRM training evolved to include flight attendants, maintenance personnel and others, the phrase "Crew Resource Management" was 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

e. AC 121-32, Dispatch Resource Management Training.

NOTE: Many ACs may be downloaded free of charge from the following FAA public Web site:

www.faa.gov
Click on Regulations & Policies
Click on Advisory Circulars

Free ACs 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 Web site: 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 FAA. This document may be viewed, downloaded, or printed at the following Web site: 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 the Federal Aviation Administration (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: (800) 553-6847 (553-NTIS), 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, Management the Risks of Organizational Accidents, J.T. Reason, Brookfield, VT, Ashgate Publishing, 1997.

(2) Advanced crew resource management (ACRM), 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/dacrmt/dacrmt.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 SOPs as a persistent element in these problems, which sometimes have led to accidents. SOPs define the shared mental model upon which good crew performance depends. Too often, well-established SOPs have been unconsciously ignored by pilots and others; in other cases, they have been consciously ignored. In still other cases, SOPs 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 percent by the year 2007. Initiatives to improve SOPs and adherence to those SOPs are among the top-priority safety initiatives now being implemented by CAST.

b. Industry and government have come to the 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. 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 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 occurs 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 well designed. Trainees need awareness, practice and feedback, and continuing reinforcement: in brief, time to learn attitudes and behaviors that will endure. 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 SOPs.

(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 SOPs, 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 CRM training depends upon check airmen, instructors, and supervisors who are highly qualified in the operator's SOPs 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 SOPs. 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 SOPs, 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 SOPs. 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. A captain's briefings should reaffirm established SOPs and should address the most threatening safety and security situations.

(a) Safety. A captain's briefing should address emergencies that might require an airplane evacuation (e.g., cabin fire or engine fire) and should highlight the functions of flightcrew and flight attendants during an evacuation. A captain's briefing should stress to flight attendants the importance of identifying able-bodied passengers and briefing them, in turn. Passengers in exit rows are particularly important resources, and flight attendants should brief them on what to do during an evacuation.

(b) Security. A captain's briefing should address general security topics, especially hijack, and any known or suspected specific threat pertaining to the flight. Flight attendants should identify able-bodied passengers, including exit row seat occupants, and may enroll them as resources who might be called upon to help contain a disruption caused by a passenger(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 (e.g., 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 SOPs, 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.

c. Training involving communications and the use of automation can be developed for crews operating aircraft with advanced technology cockpits, or for crews transitioning into them.

14. ASSESSMENT OF CRM TRAINING. It is vital that each training program be assessed to determine if CRM training is achieving its goals. Each organization should have a systematic assessment process. Assessment should track the effects of the training program so that critical topics for recurrent training may be identified and continuous improvements may be made in all other respects. Assessment of the training program should include observation and feedback by program administrators and self-reports by participants using standard survey methods.

a. The emphasis in this assessment process should be on crew performance. The essential areas of CRM-related assessment include communications, decisionmaking, team building and maintenance, workload management, and situation awareness, always in balance with traditional technical proficiency. An additional function of such assessment is to determine the impact of CRM training and organization-wide trends in crew performance.

b. For optimal assessment, data on crewmembers' attitudes and behavior should be collected before CRM indoctrination and again at intervals after the last component of CRM training, to determine both initial and enduring effects of the program. The goal should be to obtain an accurate picture of the organization's significant corporate personality traits before formal adoption of CRM training, and to continue to monitor those traits after implementation.

c. Reinforcement and feedback are essential to effective CRM training. Crewmembers must receive continual reinforcement to sustain CRM concepts. Effective reinforcement depends upon usable feedback to crewmembers on their CRM practices and on their technical performance.

d. Usable feedback requires consistent assessment. Crewmembers and those involved in training and evaluation should be able to recognize effective and ineffective CRM behaviors. CRM concepts should be critiqued during briefing/debriefing phases of all training and checking events.

e. To summarize, the assessment process should:

(1) Measure and track the organization's corporate culture as it is reflected in attitudes and norms.

(2) Identify topics needing emphasis within the CRM program.

(3) Ensure that all check airmen, supervisors, and instructors are well prepared and standardized.

15. THE CRITICAL ROLE OF CHECK AIRMEN AND INSTRUCTORS.

a. The success of any CRM training ultimately depends on the skills of the people who administer the training and measure its effects. CRM instructors, check pilots, supervisors, and course designers must be skilled in all areas related to the practice and assessment of CRM. These skills comprise an additional level to those associated with traditional flight instruction and checking.

b. Gaining proficiency and confidence in CRM instruction, observation, and measurement requires special training for instructors, supervisors, and check pilots in many CRM training processes. Among those processes are role-playing simulations, systematic crew-centered observation, administering LOFT, and providing usable feedback to crews.

c. Instructors, supervisors, and check pilots also require special training in order to calibrate and standardize their own skills.

d. Instructors, supervisors, and check airmen should use every available opportunity to emphasize the importance of crew coordination skills. The best results occur when the crews examine their own behavior with the assistance of a trained instructor who can point out positive and negative CRM performance. Whenever highly effective examples of crew coordination are observed, it is vital that these positive behaviors be discussed and reinforced. Debriefing and critiquing skills are important tools for instructors, supervisors, and check pilots. (Behavioral markers of effective LOFT debriefings are shown in appendix 2.)

e. Feedback from instructors, supervisors, and check airmen is most effective when it refers to the concepts that are covered in the initial indoctrination/awareness training. The best feedback refers to instances of specific behavior, rather than behavior in general.

16. EVOLVING CONCEPTS OF CRM.

a. Crew Monitoring and Cross-Checking. Several studies of crew performance, incidents, and accidents have identified inadequate flightcrew monitoring and cross-checking as a problem for aviation safety. Therefore, to ensure the highest levels of safety, each flight crewmember must carefully monitor the aircraft's flight path and systems and actively cross-check the actions of other crewmembers. Effective monitoring and cross-checking can be the last line of defense that prevents an accident because detecting an error or unsafe situation may break the chain of events leading to an accident. This monitoring function is always essential, and particularly so during approach and landing when controlled flight into terrain (CFIT) accidents are most common. (For more information on SOPs that promote effective monitoring, see AC 120-71, as revised, appendix 19.)

b. Joint CRM Training. More carriers are discovering the value of expanding CRM training to reach various employee groups beyond flightcrew and flight attendants. Dissimilar groups are being brought together in CRM training and in other activities. The objective is to improve the effectiveness and safety of the entire operations team as a working system.

(1) The attacks of September 11, 2001, have caused many restrictions on flightdeck access. Among those affected are air traffic controllers, for whom revised access procedures are being studied. Pilots may observe operations in air traffic facilities under certain conditions, and are encouraged to do so. Using real air traffic controllers during LOFT sessions has also proven beneficial to pilots and participating controllers.

(2) Aircraft dispatchers have functioned jointly with flight captains for years. They have been allowed, indeed required to observe cockpit operations from the cockpit jumpseat as part of their initial and recurrent qualification under part 121. Some carriers have included day trips to their aircraft dispatchers' offices to provide the pilot insight into the other side of the joint function scheme. Those trips have commonly been part of the special training offered to first-time captains. Now, real-life aircraft dispatchers are increasingly being used in LOFT sessions. The training experience gained by
the pilot and the dispatcher during LOFT is considered the logical extension of earlier training methods, providing interactivity where CRM (and DRM) principles are applied and discussed.

(3) Under certain conditions, maintenance personnel have had access to the cockpit jumpseat in air carrier operations under part 121; but that access has come under scrutiny because of security concerns following the attacks of 9/11. Training of first-time captains has often included day trips to a carrier's operations control center where a pilot and a maintenance supervisor can meet face to face and discuss issues of mutual interest in a thrumming, real-life setting. Some carriers have included maintenance personnel in LOFT sessions. Dedicated CRM training courses for maintenance personnel have been operating since 1991.

(4) Even broader cross-pollination of CRM concepts has been considered, using other groups such as passenger service agents, mid- and upper-level managers, and special crisis teams like hijack and bomb-threat teams.

(5) Flight attendants are probably the most obvious of the groups other than pilots who may profit from CRM training. Joint CRM training for pilots and flight attendants is not required by FAA regulations, but it is encouraged and has been practiced effectively at some air carriers for years. One fruitful activity in joint training has been that each group learns of the other group's training in shared issues. The joint training has revealed inconsistencies between training for one group and training on the same topic for another group. Examples of shared issues include delays, the use of personal electronic devices in the cabin, evacuation and ditching, and hijack response. When inconsistencies are identified between the contents of pilots' manuals and flight attendants' manuals, for instance, or between widely-held ideas or attitudes in those two populations, those inconsistencies are brought out into the open and often resolved. Other specific topics for joint training include:

(a) Pre-flight briefings;

(b) Post incident/accident procedures;

(c) Sterile cockpit procedures;

(d) Notification procedures (pre-takeoff and pre-landing);

(e) Procedures for turbulence and other weather;

(f) Security procedures;

(g) Passenger-handling procedures;

(h) In-flight medical problems;

(i) Smoke/fire procedures;

(j) Passenger-related regulations such as those relating to smoking (section 121.571), exit row seating (section 121.585), and carry-on baggage (section 121.589); and

(k) Authority of the pilot in command.

(6) CRM principles are made more relevant for pilots, flight attendants, and other groups by treating those principles in a familiar job-related context. Furthermore, each group should benefit from concurrent training in CRM that is complemented by usable knowledge of the other's job.

(7) Communication and coordination problems between cockpit crewmembers and flight attendants continue to challenge air carriers and the FAA. Other measures with positive CRM training value for flightcrews are being considered, such as:

(a) Including flight attendants as participants during LOFT;

(b) Scheduling month-long pairings of pilots and flight attendants; and

(c) Providing experienced flight crewmembers to teach new-hire flight attendant orientation classes.

c. Error Management. It is now understood that pilot errors cannot be entirely eliminated. It is important, therefore, that pilots develop appropriate error management skills and procedures. It is certainly desirable to prevent as many errors as possible, but since they cannot all be prevented, detection and recovery from errors should be addressed in training. Evaluation of pilots should also consider error management (error prevention, detection, and recovery). Evaluation should recognize that since not all errors can be prevented, it is important that errors be managed properly.

d. Advanced CRM. CRM performance requirements or procedures are being integrated into the SOPs of certain air carriers. Specific callouts, checks, and guidance have been included in normal checklists, the quick-reference handbook (QRH), abnormal/emergency procedures, manuals, and job aids. This integration captures CRM principles into explicit procedures used by flightcrews.

e. Culture issues. While individuals and even teams of individuals may perform well under many conditions, they are subject to the influence of at least three cultures – the professional cultures of the individuals themselves, the cultures of their organizations, and the national cultures surrounding the individuals and their organizations. If not recognized and addressed, factors related to culture may degrade crew performance. Hence, effective CRM training must address culture issues, as appropriate in each training population.

17. SUMMARY. Effective CRM begins in initial training; it is strengthened by recurrent practice and feedback; and it is sustained by continuing reinforcement that is part of the corporate culture and embedded in every stage of training.

/s/ James J. Ballough
Director, Flight Standards Service

APPENDIX 1. CREW PERFORMANCE MARKER CLUSTERS

Italicized Markers apply to Advanced Technology Flight Decks. These behavioral markers are provided to assist organizations in program and curriculum development and to serve as guidelines for feedback. They are not presented as a checklist for evaluating individual crewmembers.

1. COMMUNICATIONS PROCESSES AND DECISION BEHAVIOR CLUSTER.

a. Briefings. An effective briefing is interesting and thorough. It addresses coordination, planning, and problems. Although briefings are primarily a captain's responsibility, other crewmembers may add significantly to planning and should be encouraged to do so.

Behavioral Markers.

(1) The captain's briefing establishes an environment for open/interactive communications (e.g., the captain calls for questions or comments, answers questions directly, listens with patience, does not interrupt or "talk over," does not rush through the briefing, and makes eye contact as appropriate).

(2) The briefing is interactive and emphasizes the importance of questions, critique, and the offering of information.

(3) The briefing establishes a "team concept" (e.g., the captain uses "we" language, encourages all to participate and to help with the flight).

(4) The captain's briefing covers pertinent safety and security issues.

(5) The briefing identifies potential problems such as weather, delays, and abnormal system operations.

(6) The briefing provides guidelines for crew actions centered on standard operating procedures (SOP); division of labor and crew workload is addressed.

(7) The briefing includes the cabin crew as part of the team.

(8) The briefing sets expectations for handling deviations from SOPs.

(9) The briefing establishes guidelines for the operation of automated systems (e.g., when systems will be disabled; which programming actions must be verbalized and acknowledged).

(10) The briefing specifies duties and responsibilities with regard to automated systems, for the pilot flying (PF) and the pilot monitoring (PM).

b. Inquiry/Advocacy/Assertion. These behaviors relate to crewmembers promoting the course of action that they feel is best, even when it involves conflict with others.

Behavioral Markers.

(1) Crewmembers speak up and state their information with appropriate persistence until there is some clear resolution.

(2) "Challenge and response" environment is developed.

(3) Questions are encouraged and are answered openly and nondefensively.

(4) Crewmembers are encouraged to question the actions and decisions of others.

(5) Crewmembers seek help from others when necessary.

(6) Crewmembers question status and programming of automated systems to confirm situation awareness.

c. Crew Self-Critique Regarding Decisions and Actions. These behaviors relate to the effectiveness of a group and/or an individual crewmember in critique and debriefing. Areas covered should include the product, the process, and the people involved. Critique may occur during an activity, and/or after completing it.

Behavioral Markers.

(1) Critique occurs at appropriate times, which may be times of low or high workload.

(2) Critique deals with positive as well as negative aspects of crew performance.

(3) Critique involves the whole crew interactively.

(4) Critique makes a positive learning experience. Feedback is specific, objective, usable, and constructively given.

(5) Critique is accepted objectively and nondefensively.

d. Communications/Decisions. These behaviors relate to free and open communication. They reflect the extent to which crewmembers provide necessary information at the appropriate time (e.g., initiating checklists and alerting others to developing problems). Active participation in the decisionmaking process is encouraged. Decisions are clearly communicated and acknowledged. Questioning of actions and decisions is considered routine.

Behavioral Markers.

(1) Operational decisions are clearly stated to other crewmembers.

(2) Crewmembers acknowledge their understanding of decisions.

(3) "Bottom lines" for safety are established and communicated.

(4) The "big picture" and the game plan are shared within the team, including flight attendants and others as appropriate.

(5) Crewmembers are encouraged to state their own ideas, opinions, and recommendations.

(6) Efforts are made to provide an atmosphere that invites open and free communications.

(7) Initial entries and changed entries to automated systems are verbalized and acknowledged.

2. TEAM BUILDING AND MAINTENANCE CLUSTER.

a. Leadership Followership/Concern for Tasks. These behaviors relate to appropriate leadership and followership. They reflect the extent to which the crew is concerned with the effective accomplishment of tasks.

Behavioral Markers.

(1) All available resources are used to accomplish the job at hand.

(2) Flight deck activities are coordinated to establish an acceptable balance between respect for authority and the appropriate practice of assertiveness.

(3) Actions are decisive when the situation requires.

(4) A desire to achieve the most effective operation possible is clearly demonstrated.

(5) The need to adhere to SOPs is recognized.

(6) Group climate appropriate to the operational situation is continually monitored and adjusted (e.g., social conversation may occur during low workload, but not high).

(7) Effects of stress and fatigue on performance are recognized.

(8) Time available for the task is well managed.

(9) Demands on resources posed by operation of automated systems are recognized and managed.

(10) When programming demands could reduce situation awareness or create work overloads, levels of automation are reduced appropriately.

b. Interpersonal Relationships/Group Climate. These behaviors relate to the quality of interpersonal relationships and the pervasive climate of the flight deck.

Behavioral Markers.

(1) Crewmembers remain calm under stressful conditions.

(2) Crewmembers show sensitivity and ability to adapt to the personalities of others.

(3) Crewmembers recognize symptoms of psychological stress and fatigue in self and in others (e.g., recognizes when he/she is experiencing "tunnel vision" and seeks help from the team; or notes when a crewmember is not communicating and draws him/her back into the team).

(4) "Tone" in the cockpit is friendly, relaxed, and supportive.

(5) During times of low communication, crewmembers check in with others to see how they are doing.

3. WORKLOAD MANAGEMENT AND SITUATION AWARENESS CLUSTER.

a. Preparation/Planning/Vigilance. These behaviors relate to crews anticipating contingencies and the various actions that may be required. Excellent crews are always "ahead of the curve" and generally seem relaxed. They devote appropriate attention to required tasks and respond without undue delay to new developments. (They may engage in casual social conversation during periods of low workload and not necessarily diminish their vigilance.)

Behavioral Markers.

(1) Demonstrating and expressing situation awareness (e.g., the "model" of what is happening is shared within the crew).

(2) Active monitoring of all instruments and communications and sharing relevant information with the rest of the crew.

(3) Monitoring weather and traffic and sharing relevant information with the rest of the crew.

(4) Avoiding "tunnel vision" caused by stress (e.g., stating or asking for the "big picture").

(5) Being aware of factors such as stress that can degrade vigilance, and watching for performance degradation in other crewmembers.

(6) Staying "ahead of the curve" in preparing for planned situations or contingencies, so that situation awareness and adherence to SOPs is assured.

(7) Ensuring that cockpit and cabin crewmembers are aware of plans.

(8) Including all appropriate crewmembers in the planning process.

(9) Allowing enough time before maneuvers for programming of the flight management computer.

(10) Ensuring that all crewmembers are aware of initial entries and changed entries in the flight management system.

b. Workload Distributed/Distractions Avoided. These behaviors relate to time and workload management. They reflect how well the crew manages to prioritize tasks, share the workload, and avoid being distracted from essential activities.

Behavioral Markers.

(1) Crewmembers speak up when they recognize work overloads in themselves or in others.

(2) Tasks are distributed in ways that maximize efficiency.

(3) Workload distribution is clearly communicated and acknowledged.

(4) Nonoperational factors such as social interaction are not allowed to interfere with duties.

(5) Task priorities are clearly communicated.

(6) Secondary operational tasks (e.g., dealing with passenger needs and communications with the company) are prioritized so as to allow sufficient resources for primary flight duties.

(7) Potential distractions posed by automated systems are anticipated, and appropriate preventive action is taken, including reducing or disengaging automated features as appropriate.

APPENDIX 2. LOFT DEBRIEFING PERFORMANCE INDICATORS

The effective line-oriented flight training (LOFT) facilitator leads the flightcrew through a self-critique of their own behavior and of their crew performance during the simulation. The debriefing and crew analysis include both technical and crew resource management (CRM) discussion topics. Positive points of crew performance are discussed as well as those needing improvement. At the conclusion of the session, key learning points are summarized covering all participants, including the instructor. A strong sense of training accomplishment and learning is taken away from the session.

The following performance markers may be used to evaluate the LOFT facilitator's performance in the debrief/critique phase of LOFT.

a. Actively states the debriefing and critique agenda and solicits topics from the crew on items that they would like to cover; sets time limits.

b. Asks the crew for their appraisal of the mission overall.

c. States his/her own perceptions of the LOFT while guarding against making the crew defensive. Comments are as objective as possible and focus on performance.

d. Shows appropriate incidents using videotape of the LOFT session, including examples of technical and CRM performance, and selects tape segments for discussion illustrating behaviors that feature the crew performance markers.

e. Effectively blends technical and CRM feedback in the debriefing; does not preach to the crew, but does not omit items worthy of crew discussion.

f. Is patient, and is constructive in probing into key areas where improvement is needed.

g. Ensures that all crewmembers participate in the discussion, and effectively draws out quiet or hostile crewmembers.

h. Provides a clear summary of key learning points.

i. Asks the crew for specific feedback on his/her performance.

j. Is effective in both technical and CRM debriefing.

APPENDIX 3. APPROPRIATE CRM TRAINING TOPICS

1. BACKGROUND INFORMATION.

a. Findings coming from accident investigations have consistently pointed to the fact that human errors contribute to most aviation accidents.

b. Research findings suggest that crew resource management (CRM) training can result in significant improvements in flightcrew performance. CRM training is seen as an effective approach to reducing human errors and increasing aviation safety.

c. Aviation safety information is readily available on the Internet. Many Web sites contain valuable source materials and reference materials that may be helpful in developing CRM training. Web sites commonly link to other Web sites containing related material. Aviation-related Web sites maintained by U.S. Government agencies include the following:

(1) National Aeronautics and Space Administration (NASA), http://www.nasa.gov.

(2) National Transportation Safety Board (NTSB), http://www.ntsb.gov.

(3) Federal Aviation Administration (FAA), http://www.faa.gov.

2. TRAINING TOPICS, PRINCIPLES, AND TECHNIQUES. It is recommended that CRM training include the curriculum topics described in paragraph 12 of the Advisory Circular (AC) and the following topics, principles, and techniques:

a. Theory and practice in using communication, decisionmaking, and team building techniques and skills.

b. Theory and practice in using proper supervision techniques (i.e., captains working with first officers).

c. Theory and practice in selecting and using interventions needed to correct flying errors made by either pilot, especially during critical phases of flight. These interventions may include, but not be limited to, communication, assertion, decisionmaking, risk assessment, and situation awareness skills.

d. During Line Operational Simulation training, information, and practice of nonflying pilot functions (i.e., monitoring and challenging pilot functions, and monitoring and challenging errors made by other crewmembers for flight engineers, first officers, and captains). Training will alert flightcrews of hazards caused by tactical decision errors, which are actually errors of omission. Practice in monitoring, challenging, and mitigating errors, especially during taxi operations, should be included. These skills are important to minimize procedural errors that may occur as a result of inadequately performed checklists.

e. Training for check airmen in methods that can be used to enhance the monitoring and challenging functions of both captains and first officers. The check airmen training should include the

message that appropriate questioning among pilots is a desirable CRM behavior and part of the corporate safety culture; further, that such questioning is encouraged, and that there will be no negative repercussions for appropriate questioning of one pilot's decision or action by another pilot.

f. Training for new first officers in performing the role of the pilot monitoring (PM) to establish a positive attitude toward monitoring and challenging errors made by the pilot flying (PF). Training should stress that appropriate questioning is encouraged as a desirable CRM behavior, and that there will be no negative repercussions for appropriate questioning of one pilot's decision or action by another pilot.

g. Training for captains in giving and receiving challenges of errors. Training should stress that appropriate questioning is encouraged as a desirable CRM behavior, and that there will be no negative repercussions for appropriate questioning of one pilot's decision or action by another pilot.

h. Factual information about the detrimental effects of fatigue and strategies for avoiding and countering its effects.

i. Training for crewmembers that identifies conditions in which additional vigilance is required, such as holding in icing or near convective activity. Training should emphasize the need for maximum situation awareness and the appropriateness of sterile cockpit discipline, regardless of altitude. Scenario-based flight simulator training in ground taxi operations should emphasize flightcrew vigilance in avoiding runway incursions.

j. Training that identifies appropriate levels of automation to promote situation awareness and effective management of workload.

k. Use of autopilot in inflight icing. All flightcrew members should clearly understand their aircraft's susceptibility to inflight icing and should monitor inflight ice accretion by all means available. One effective means of monitoring ice accretion might be to disconnect the autopilot at intervals, if doing so is consistent with the approved procedures contained in the airplane flight manual.

l. Training for crewmembers in appropriate responses when passengers intimidate, abuse, or interfere with crewmember performance of safety duties. Training should address crew coordination and actions, which might defuse the situation. See AC 120-65, Interference with Crewmembers in the Performance of their Duties, dated October 18, 1996. Training should include specific communication topics, such as conflict resolution, with particular attention to the most serious passenger interference, attempted hijack.

m. Line-oriented flight training (LOFT) or special purpose operational training (SPOT) for cockpit crewmembers, which addresses appropriate responses to the effects of pitot-static system anomalies, such as a blocked pitot tube. Emphasis should be on situation awareness, inquiry/advocacy/ assertion, and crew coordination, when flight instruments act abnormally.

n. LOFT or SPOT for cockpit crewmembers that contain a controlled flight into terrain scenario. Emphasis should be on prevention through effective communication and decision behavior. The importance of immediate, decisive, and correct response to a ground proximity warning should also be addressed.

o. Training for pilots in recognizing cues that indicate lack or loss of situation awareness in themselves and in others, and training in countermeasures to restore that awareness. Training should emphasize the importance of recognizing each pilot's relative experience level, experience in specific duty positions, preparation level, planning level, normal communication style and level, overload state, and fatigue state. Pilots should assess these characteristics actively and continuously, in their fellow crewmembers and in themselves. Training should also emphasize the importance that improper procedures, adverse weather, and abnormal or malfunctioning equipment may have in reducing situation awareness. "Guidelines for Situation Awareness Training" contains expanded guidance on cues and countermeasures, and may by viewed or downloaded from the FAA Web site at: http://faa.gov/avr/afs/train.htm.

p. Training in communication of time management information among flightcrew and cabin crewmembers during an emergency. Training should stress that the senior or lead flight attendant can effectively brief other flight attendants and passengers and prepare the cabin only if the time available in the emergency is clearly communicated by the flightcrew. Other information elements that are vital in effective time management are the nature of the emergency and any special instructions relating to the planned course of action.

3. APPROPRIATE TRAINING INTERVENTIONS.

a. The most effective CRM training involves active participation of all crewmembers. LOFT sessions give each crewmember opportunities to practice CRM skills through interactions with other crewmembers. If the training is videotaped, feedback based on crewmembers' actual behavior, during the LOFT, provides valuable documentation for the LOFT debrief.

b. CRM training can be presented using a combination of the following training interventions:

(1) Operator in-house courses.

(2) Training center courses.

(3) SPOT.

(4) LOFT sessions.

(5) Computer-based training courses.

[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 121

[Docket No. 28471; Amendment No. 121-]

RIN 2120-AF08

Training and Qualification Requirements for Check Airmen and Flight Instructors: Correction and Editorial Changes

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule; correction

SUMMARY: This amendment makes corrections and minor editorial changes to regulations published on June 17, 1996 (61 FR 30734). This amendment will not impose any additional restrictions on persons affected by these regulations. The final rule published on June 17, 1996, established separate requirements for check airmen who check only in flight simulators and flight instructors who instruct only in flight simulators. In addition this rule allows check airmen and flight instructors to obtain all of their flight training in simulators, as opposed to the current scheme in which initial and transition flight training must include an in-flight element.

EFFECTIVE DATE: [Insert date of publication in the Federal Register.]

FOR FURTHER INFORMATION CONTACT: Tom Toula, Telephone (202) 267-3766.

SUPPLEMENTARY INFORMATION:

Background

On June 17, 1996, the FAA published a regulation that established separate requirements for check airmen who check only in flight simulators and flight instructors who instruct only in flight simulators. A reference to § 121.411 in current § 121.409(b)(4) is no longer appropriate. Flight instructor qualification requirements have been moved to new § 121.412. This correction will change the reference in § 121.409(b)(4) to § 121.412.

It was the intent of this rule to have the requirements of § 121.412(e) virtually identical to those in § 121.411(e). Upon further review there appears to be a difference between § 121.411(e) and § 121.412(e) in that § 121.412(e) prohibits a flight instructor who has reached his or her 60th birthday from serving as an instructor. By this correction, the requirements will be identical. Under § 121.413 (d), the last word of the paragraph was rendered as "transaction" instead of 'transition" as the FAA had specified.

List of Subjects in 14 CFR Part 121

Air carriers, Aircraft, Airmen, Aviation safety, Safety, Reporting and recordkeeping requirements, Transportation.

Accordingly, Title 14 of the Code of Federal Regulations (CFR) Part 121 is amended as follows:

PART 121 - OPERATING REQUIREMENTS: DOMESTIC, FLAG, AND SUPPLEMENTAL OPERATIONS

1. The authority citation for part 121 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 40119, 44101, 44701-44702, and 44705, 44709-44711, 44713, 44716-44717, 44722, 44901, 44901-44904, 44912, 46105.

2. Section 121.409 is amended by revising paragraph (b)(4) (the undesignated paragraph following paragraph (b)(4) remains unchanged) to read as follows:

§121.409 Training courses using airplane simulators and other training devices.

(b) * * *

(4) Is given by an instructor who meets the applicable requirements of § 121.412.

* * * * *

3. Section 121.412 is amended by revising paragraph (e) to read as follows:

§ 121.412 Qualifications: Flight Instructors (airplane) and flight instructors (simulator).

* * * * *

(e) Flight instructors who have reached their 60th birthday, or who do not hold an appropriate medical certificate, may function as flight instructors, but may not serve as pilot flight crewmembers in operations under this part.

4. Section 121.413 is amended by revising paragraph (d) to read as follows:

§ 121.413 Initial and transition training and checking requirements: Check airmen (airplane), check airmen (simulator).

* * * * *

(d) The transition ground training for check airmen must include approved methods, procedures, and limitations for performing the required normal, abnormal, and emergency procedures applicable to the airplane to which the check airman is in transition.

* * * * *

Issued in Washington, D.C. on

Donald P. Byrne
Assistant Chief Counsel
Regulations Division

#1

U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: DISPATCH RESOURCE MANAGEMENT TRAINING

Date: 2/7/95 **Initiated by:** AFS-210

AC No: 121-32 **Change:**

1. PURPOSE. This advisory circular (AC) complements guidance already developed for flightcrew members and other groups with respect to training in resource management. Focus is on the aircraft dispatcher whose traditional role in air carrier operations is being changed by fundamental changes in aviation, notably advanced technology.

2. RELATED FAR SECTIONS.

a. Part 65, Subpart C - Aircraft Dispatchers.

b. Part 65, Appendix A - Aircraft Dispatcher Courses.

c. Part 121, Subpart E - Approval of Routes: Domestic and Flag Air Carriers, Section 121.107.

d. Part 121, Subpart M - Airman and Crewmember Requirements, Section 121.395.

e. Part 121, Subpart N - Training Program, Sections 121.415, 121.418, and 121.422.

f. Part 121, Subpart P - Aircraft Dispatcher Qualifications and Duty Time Limitations: Domestic and Flag Air Carriers, Section 121.463.

g. Part 121, Subpart T - Flight Operations, Sections 121.533-537.

h. Part 121, Subpart U - Dispatching and Flight Release Rules.

i. Special Federal Aviation Regulation (SFAR) No. 58, Advanced Qualification Program.

3. RELATED READING MATERIAL.

a. AC 120-51B, Crew Resource Management Training.

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

c. AC 120-54, Advanced Qualification Program.

NOTE: These AC's may be obtained from:

Department of Transportation
Property Use and Storage Section, M-45.3
Washington, DC 20590

d. For detailed information on the recommendations made in AC 120-51B, the reader is encouraged to review "Crew Resource Management: An Introductory Handbook," published by the Federal Aviation Administration (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 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, (703) 487-4650.

e. Description of current 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 Wiener, E.L., Kanki, B.G. and Helmreich, R.L., Cockpit Resource Management, 1993, Academic Press, Orlando, Florida.

f. National Transportation Safety Board (NTSB) AAR-91-04; Final report of the Commission of Inquiry into the Air Ontario Accident at Dryden, Ontario, March 10, 1989.

4. BACKGROUND. The NTSB and the Transportation Safety Board of Canada have both found that inadequate operational control and inadequate collaborative decisionmaking have been contributing factors in air carrier accidents. Effective management of available resources by aircraft dispatchers is one essential deterrent to such accidents. In exercising operational control, the dispatcher coordinates with flightcrew members, air traffic controllers (ATC), and other members of a vast team in order to meet the requirements of daily flight operations. This AC encourages the dispatcher's knowledge of the functions of the other participants throughout the operating environment. Two expected benefits to the dispatcher are (1) better handling of information that bears on safe flight operations and (2) a better interface with each pilot in command, consistent with the joint responsibility concept outlined in FAR Part 121.

5. DEFINITIONS.

a. Human Factors. Human factors entails a multidisciplinary effort to generate and compile information about human capabilities and limitations and to apply that information to equipment, systems, facilities, procedures, jobs, environments, training, staffing, and personnel management for safe, comfortable, effective human performance.

> NOTE: 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. Dispatch Resource Management (DRM). The communication center with respect to positive operational control is the dispatcher who coordinates a wide array of resources for the flightcrew. DRM addresses the challenge of optimizing the person/machine interface and related interpersonal issues. These issues include effective teambuilding and maintenance, information transfer, problem solving, decisionmaking, maintaining situational awareness, and dealing with automated systems. DRM training, like CRM training, is comprised of three components: Initial Indoctrination/Awareness, Recurrent Practice and Feedback, and Continuing Reinforcement. DRM differs in the effective use of all resources: human resources, hardware, and information.

c. Operational Control. The authority over initiating, conducting, or terminating a flight.

d. Crew Resource Management Training. Training in aviation human factors for flightcrew members and others.

6. THE MISSION OF DRM TRAINING. DRM training has been conceived to prevent aviation accidents by improving team performance through better team coordination.

7. BASIC CONCEPTS OF DRM.

a. Operating Environment. The operating environment comprises interactions of the aircraft dispatcher with:

(1) Pilots.

(2) Air traffic controllers.

(3) Other dispatchers.

(4) Managers.

(5) Station personnel.

(6) Meteorology resources.

(7) Aircraft maintenance staff.

(8) Load planners.

(9) Crew schedulers.

(10) Aircraft routers.

(11) Communication systems and related personnel.

(12) Flight planning systems and related personnel.

b. Situational Awareness (Dispatcher). The ability to absorb information in a dynamic environment, to evaluate and refine that information, to anticipate contingencies, and to initiate appropriate actions as necessary.

c. Communications. Chief among many functions, the dispatcher is a center for communications, continually receiving and disseminating information. He/she interfaces with the flightcrew, with ATC, and with many others in the operational environment. Communication skills are at the heart of this work. Communication should be in standardized language that is easily understood by individuals in various departments and joint

organizations. Communication among departments and joint training should be encouraged. Special emphasis should be given to:

(1) Inquiry/advocacy/assertion.

(2) Conflict resolution.

(3) Radio communication (phraseology and technique).

d. Handling Information. One of the aircraft dispatcher's main responsibilities is to keep the flightcrew updated on any information that affects flight safety. Dispatchers are required to review large quantities of real-time information and to decide what information is pertinent for each flight under their operational control. Dispatchers pass on information relevant to each flight, sometimes obtaining missing information as part of the process. This linkage provides timely information to the flightcrew members and relieves workload.

e. Interpersonal Skills. DRM concentrates on dispatchers' attitudes and behaviors and the effects that they have on others.

f. Workload Management. DRM should help dispatchers see that how they react during normal routine circumstances can have a powerful influence on how well they function during high workload and stressful situations. Prioritizing tasks is one key element in consistent, effective operational control.

g. Effective Decisionmaking. Through inquiry, advocacy, and assertion, the dispatcher assumes a leadership role within the operational environment. This leadership role in workload management and situational awareness supports the captain. It requires the dispatcher, together with the pilot in command, to apply problem solving skills which include the following:

(1) Weighing the competing needs that must be considered in choosing among alternatives.

(2) Being aware of the resources available to the various parties involved in the decisionmaking;

(3) Applying effective problem solving strategies to help in decisionmaking; and

(4) Avoiding situations and behaviors that contribute to errors.

8. FUNDAMENTALS OF DRM TRAINING IMPLEMENTATION. Research findings 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 DRM concepts are understood and practiced before designing specific training. Surveys of dispatchers, observation of dispatchers at work, and analysis of incident/accident reports can provide essential guidance for program designers.

b. Get Commitment from All Managers, Starting with Senior Managers. Resource management programs are received much more positively by operations personnel when senior managers, flight operations managers, and flight standards officers conspicuously support the basic concepts and provide the necessary resources for training. Training manuals should embrace DRM concepts by providing dispatchers with necessary policy and procedures guidance.

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. This approach increases the relevance of training for dispatchers.

d. Define the Scope of the Program. Institute special DRM training for key personnel including developers/facilitators and supervisors. It is highly beneficial to provide training for these groups before beginning training for dispatchers. DRM training may later be expanded to include pilots, flight attendants, maintenance personnel, and other company resource groups 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 dispatchers 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.

9. COMPONENTS OF DRM TRAINING.

a. Initial Indoctrination/Awareness.

(1) The initial indoctrination/awareness component of DRM training consists of classroom presentations that focus on the interpersonal relations and coordination involved in a decisionmaking process. It also provides a common terminology and conceptual framework for identifying coordination problems. Initial indoctrination may be accomplished by a combination of methods including lectures, discussion groups, and roleplaying exercises. It is advantageous to have interactive participation of flightcrew members and other members of the operating environment.

(2) Indoctrination/awareness training modules for experienced aircraft dispatchers are not the only way that this important DRM training component may be provided. DRM concepts should be addressed in dispatcher initial qualification training for new-hires. Initial qualification training, in turn, may be provided under conventional FAR Part 121 air carrier training programs or under the Advanced Qualification Program (AQP) detailed in SFAR No. 58.

(3) Curriculum development should address DRM skills that have been demonstrated to influence dispatcher performance. For maximum effectiveness, the curriculum should define the concepts involved and relate directly to operational issues which dispatchers face in daily operations.

b. Recurrent Practice and Feedback.

(1) DRM training should be included as a regular part of required recurrent training. Recurrent DRM training should include refresher practice and feedback exercises. An excellent training opportunity is line-oriented flight training (LOFT) with taped feedback, expanded to include the carrier's own aircraft dispatchers. A suitable LOFT substitute specifically for dispatchers might be even more valuable, in which dispatchers interact with several simulated flights at once.

(2) Recurrent training allows participants to practice newly improved skills in communication and interpersonal relationships and to receive feedback on their effectiveness. Feedback has its greatest impact when it comes by way of self-critique and peer review. Guidance from a facilitator with special training in assessment and debriefing techniques completes an effective practice/feedback process.

(3) Effective feedback refers to the coordination concepts identified in indoctrination/awareness training and relates to specific behaviors. Practice and feedback are best accomplished through the use of some form of simulation and audio- or 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. Behaviors are easily seen, and appropriate adjustments are often self-evident.

c. Continuing Reinforcement. DRM concepts should be carried into every other type of training including technical and interdepartmental training so that those concepts are reinforced continuously.

(1) Technical training (e.g., initial and recurrent training).

(i) Simulation.

(ii) Case studies.

(2) Interdepartmental training (e.g., symposiums and seminars).

(i) Problem solving.

(ii) Stress awareness.

(iii) Role reversal.

(iv) Inquiry/advocacy/assertion.

(v) Conflict resolution.

d. Effective resource management skills are not gained by passively listening to classroom lectures, but by active participation and practice, including the use of simulators. Video feedback during debriefing following simulations should be provided so that dispatchers may assess their skills not only as individuals but as integral parts of the operating environment.

e. The uneasiness sometimes created by the presence of videotaping equipment may be relieved by bulk-erasing each videotape in the presence of the dispatcher at the end of the debriefing.

10. ASSESSMENT IN DRM TRAINING PROGRAMS.

a. Self. Developers/facilitators should use every available opportunity to highlight the importance of dispatcher coordination skills and techniques. One of the best learning opportunities occurs when dispatchers examine their own behavior and performance with the assistance of a trained facilitator. The facilitator points out both positive and negative aspects of DRM performance. Whenever highly effective performance is observed, it is vital that the underlying behaviors are discussed and reinforced.

b. Group/Program. DRM training is a dynamic process that works best when it is continually assessed against its goals. Each organization should design a systematic assessment program to track the effects of its training program and to make continuous program adjustments. Experience has shown that resource management training works best if it is continually refreshed by subject matter that is timely, relevant, and usable. Assessment of the training program may include observation of the training process and reports by the participants themselves.

11. THE CRITICAL ROLE OF THE DEVELOPER/FACILITATOR. The effectiveness of any training curriculum is directly related to the expertise of developers and facilitators. Ideally, developers and facilitators should be current, qualified dispatchers who have additional training in one of the following DRM/CRM topics:

a. Listening and communicating.

b. Roleplaying, simulations, and group discussions.

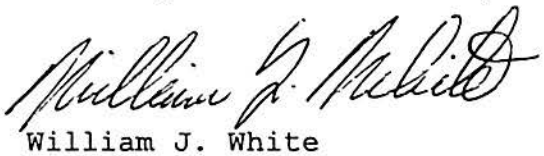
c. Debriefing and feedback.

12. EVOLVING CONCEPTS OF DRM.

a. Concurrent Training. More and more carriers are discovering the value of extending resource management training across organizational lines. Just as the aircraft dispatcher is a resource to the pilot, the pilot is a resource to the dispatcher. Similarly, other groups are resources to the pilot, to the aircraft dispatcher, and to each other. Concurrent training of pilots, flight attendants, aircraft dispatchers, and air traffic controllers has already been tried and found to be valuable. Some carriers include middle and upper-level managers. Their objective is to improve the effectiveness of all the groups within the operations team.

b. National Repository. A frequent recommendation has been that the FAA, airlines, and appropriate professional groups cooperate to develop a national repository of training reference materials relating to communication and other team coordination issues. Access to such materials should be provided to everyone in the aviation community upon request. Initiatives have begun that may provide this capability.

13. SUMMARY STATEMENT. Effective dispatch resource management begins in initial training; it is strengthened by recurrent practice and feedback; and it is sustained by continuing reinforcement that is part of the corporate culture and embedded in every element of a dispatcher's training.



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