

COCKPIT RESOURCE MANAGEMENT AT USAIR

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This paper deals with the current USAir CRM program and combines the lessons learned and the program issues.

CURRICULUM

The training material was developed after an extensive literature search and pilot interview survey to determine the problem. The USAir program began in 1979. The *problem* was identified as a large number of accidents involving the "human factor" and "human performance/interaction" as key variables. This problem was not unique to any one airline but to the whole industry, including the military. There is much research to identify the issue and I will not cover that data at this time--suffice it to say that extensive research was done to ensure there was a problem with a pilot's behavior and the interaction with the environment, or another person, in a negative manner, and the result was a loss of life.

The investigation led to the *design, implementation, and evaluation* of a behavioral science awareness training program. The need was found, and the *target population* was identified as the pilot group.

Problems in the human factor interface with accidents were identified which impacted on curriculum selection. Some of these were fatigue, boredom, disorientation, preoccupation with personal problems, attitudes, misreading instruments, interpersonal communication with crew members, misunderstanding communication at all levels, language barriers, judgement, decision-making, personal pathology, lack of assertiveness, incorrect assumptions, authority problems, trust of crew members, discipline, leadership, role dilemmas, inadequate planning, workload, equipment interaction, physical and psychological stress, and many more. The resultant research came up with a two and a three day program (depending on training days available).

The program has been evaluated and reevaluated over time. A *research survey* instrument is used at the beginning of each session to evaluate the amount of knowledge a pilot has about each subject presented. The instrument also calls for each pilot to give input on problems encountered, expected, whether the pilot feels a need for training, and what that training should include. Another instrument has been utilized at the end of each session (all surveys are anonymous) to evaluate the pilots perception of the training and its effectiveness. This material is used to constantly add or subtract subjects as feedback dictates.

In 1985 a survey was sent to graduates who received training in the 1980-1982 time-frame to obtain feedback on *applicability, effectiveness, and retainability* of subject matter. This research is ongoing and will be mentioned later. This feedback has also

dictated curriculum changes.

The intent of the program has been guided by the fact that the pilot who has the accident/incident (pilot error) is someone who has either:

- o Personality problems and/or pathology,
- o Interpersonal skill/communication problems,
- o Inability to control environmental variables for whatever reason, or
- o Physical problems.

This is keeping in mind the fact that the technical malfunction of the aircraft may or may not be separate from these identified problem areas. The long laundry-list of problems will fall under these categories in some way.

All of the above mentioned issues and research guided the curriculum to include the following subjects:

1. Incident/accident case studies.
2. Personality theories.
3. Leadership theories.
4. Stress self-assessment tests.
5. Leadership assessment tests.
6. Human development theories.
7. Personality profile inventory tests.
8. Substance abuse.
9. ASRS, NASA, NTSB, and FAA data discussions.
10. Captain, FO, Engr. and other crew roles.
11. Diet, sleep, circadian factors, and physiology assessment.

Some other very important components of the curriculum are discussions on the following subjects:

1. Internally-/externally-driven individuals.
2. Personality/attitude discussions.
3. Technical/non-technical pilot training.
4. "Left/right brain" personality studies.
5. Subtle incapacitation.
6. Cognitive dissonance.
7. Psychosomatic studies.
8. Circadian studies.
9. Sleep research.
10. Behavior modification.
11. Personality types (how to deal with various types).
12. Family/marital and child-raising problems and techniques.

The research over the past 6 years supports the curriculum. This is, of course, a

very brief overview, but does give the flavor of the program.

TECHNIQUES FOR CRM

The education/training should start in the classroom as it does for all professionals. Research is very clear that one must grasp the principles of the subject matter for it to be effective in the long range. The application of the education to the job will occur in a number of ways. There must of course be a "leap" made from education and theory to the real world of flying. One must make this type of leap every day in all sorts of ways. Pilot education has been overloaded in the technical flying area and largely lacking in the behavioral science field. CRM must use techniques other than rote memory or "left brain"-oriented tests and exercises. There is no cookbook answer or manual to cover every possible accident scenario. Hence, the pilot must possess skills (and be taught them) to identify human factors as they pertain to accidents. The pilot must be able to determine the "warning lights" of problem behavior as they occur with a fellow crew member or himself. This is one of the ways we can avoid the human factor accident. A crewmember who doesn't know how to assert himself/herself, for example, may die and kill others in an accident due to never knowing how to send a strong "I message." It has happened. The crewmember who cannot recognize problem behavioral clues given by a fellow pilot will also die due to a lack of education and sadly kills others too. These human factor variables can be taught and must be taught in the classroom where discussion is allowed in a non-threatening manner. This is the way the professional psychiatrist, psychologist, social worker, or counselor is taught. There is no other proper way to start the process correctly. Documented educational research is very clear in this matter. The pilot then must take this classroom knowledge to the cockpit or home situation and apply it there.

Statistically-valid and reliable tests should be used. Pilots are individuals who like facts, data, and numbers in a logical sequence. They need proof. The tests give them that type of feedback and open the door for personality/attitude change as needed.

LOFT [-type exercises] do not have to occur in the simulator. LOFT [-type exercises] and simulator do not need to be synonymous. This is too narrow a definition*. The simulator may be a natural follow-up to the classroom education but may not be necessary in all cases if on-going classroom education were utilized and reinforced. If a pilot cannot make the educational leap from behavioral science education in the classroom to the cockpit, then I would submit we have a potentially dangerous pilot in regard to the human factor issue and accidents.

There may even be a danger to use of simulator situations and human behavior because it reinforces the need for structure when in reality there is no cookbook structured situation that applies in all scenarios. If too much "spoon feeding" of the material is done we may not be conditioning pilots to expect and be prepared for the unexpected. Ideally though, the simulator is an excellent classroom if needed and the

*EDITORS' NOTE: The acronym LOFT (Line-Oriented Flight Training), as commonly used in the industry and described in Federal Aviation Administration Advisory Circular 120-35, refers to the use of a high-fidelity training simulator to conduct simulated line operations for training purposes.

"right exercises" are introduced.

This constant mentality of having to have structured training may be adding to the problem at times. Dependence upon structure and the idea that if you do not have written rules or structure you can't control or govern something may be fallacious. It may also be why we have no mandated training even though the problem of "pilot error" and research in this area has been with us for the past 20 years. The research supports *recurrent classroom instruction* to reinforce theories and principles and then utilize personal experience discussions to heighten cognitive awareness of accident factors.

The *group situation* is most helpful in identifying and experiencing group interaction variables. The pilot is in the group (15 to 20 members) and is educated on group principles/theories. Being a member also allows experimenting with new behavior as well as identification with the many individual issues discussed. The *group feedback* is most helpful as it helps motivate and modify behavior much better than one-on-one situations. Research on groups and their benefit in changing behaviors is extensive.

I would add that the training does not have to be expensive and involve simulators at the onset. One well-chosen, educated, experienced teacher could deal with a student group of 15-20. This would include didactic material and extensive discussion. The second step would be the simulator or a reinforcement in the classroom within a year or so, with follow-up material by mail. Material could also be mailed prior to a classroom structure.

INTEGRATION INTO THE TOTAL TRAINING CURRICULUM

For maximum effectiveness the training should be reinforced at least yearly. Research into the USAir program does show 5-year retainability of some portions of the training, but much data asks for more follow-up--even for 6-month recurrent. The research documents that some *tangible and lasting behavior change* did occur in the *two- or three-day* period training time. We also have at least two documented experiences where pilots have stated that the training saved two accidents and potentially 300 lives.

The National Training Laboratories (NTL) and others have been offering courses of two- or three-day duration in a variety of formats for the past 30 years. They have extensive research to document *lasting change occurring* during and after these sessions.

Remedial training should be utilized and has been in this program. It has not been identified as such, but has been done. Ideally, the feeling is that "accident-prone" (or pilots exhibiting pathology) should be taken off the line, given training, and a series of neurological/psychological tests. If no progress is made then the individual should not be allowed to fly again and kill him/herself and others.

EFFECTIVENESS OF CRM TRAINING

To begin with, the initial reaction from the pilot after training should be positive. The target pilot group is an intelligent, aware population. The rationale for the training should be acceptable to the individual who is also rational. A number of research issues on follow-up have surfaced which pilots have identified as being key to long-term effective programs.

The research extends back to 1980 for this program. Overall, our initial pre-class survey indicates 2 percent of the pilots felt the training unnecessary. Post-class survey instruments show a 4.75 rating (on a 1 to 5 scale with 5 being maximum) overall on all subjects. The five-year follow-up survey data is still being processed. Some of the information has been presented previously, and more will be presented when the data is "crunched." Initially the data does show a definite need for reinforcement through recurrent training. It also shows an identified need for some type of training to be done with family members, spouses, and other employees, as well as accident/incident/hijack victims. It does show more retainability of the subject matter than expected.

What follows is a list of clinical issues that needs to be considered in any CRM program. I have been involved in the instructional aspect, as well as practical application on the clinical side while a US Army Medical Department Officer in Vietnam flying "dustoff." My research dates back to 1970.

CLINICAL ISSUES IN PILOT HUMAN FACTOR TRAINING

The following issues are presented in a smorgasbord-type format to identify them as keys to an effective CRM program. I am making an educated judgment based on research that the pilot who is most likely to have an accident can be identified with a degree of certainty. That pilot may never have an accident due to never being placed in a situation where all the variables lead to an accident situation. However at some time the regression to the mean statistical theory may apply. My research indicates the problem pilot can and should be identified through standardized psychological and physiological tests, peer review, and past incidents.

You change behavior through: 1) behavior therapies; 2) cognitive insight; and 3) psychoanalytic techniques.

Pilots who exhibit excessive insistent demands on others are exhibiting neurotic/distorted behavior initiated by extreme insecurity and are exhibiting "warning lights" that should be heeded. Many pilots prefer to remain where they are and are not interested in altering behavior except in times of crisis or stress.

The pilot can be obsessional where anxiety/distress comes from unrealizable demands that a person be perfect and beyond human limitations. The recognition of weakness and fallibility produces anxiety, which may lead that person to seek help. This may be brought about by cognitive awareness. It is tough for a pilot (problem pilot) to change because some aspects of their life are beyond their conscious control and influence. The group classroom experience provides intellectual/emotional insight. There is a need to interrupt impulsive, destructive behavior and correct some confusion. The

program must give the potential problem pilot some insight which may cause change to occur.

Pilots need to talk it out rather than act it out. They need to understand that there are impediments (perhaps neurotic obstacles) in their living. They need to interrupt impulsive destructive behavior. They must alter responses that are derived from conditioning process.

I have seen many problem pilots who are very defensive on intellectual and emotional issues and this makes them very confused. The confusion leads them to be very rigid and overly stable in their behavior patterns. The captain-upgrade process from right to left seat and the new computers in the cockpit are two examples. Another prime example is the introducing of behavioral science information into pilot training. There is a need to understand and grasp factors such as:

- o How and why a person came to be that way.
- o How the present way is maladaptive and unsatisfactory.
- o How to alter without giving up valid goals/ideals.

The training program must identify many of these issues as there is no certainty they will be brought out in any other way. Most pilots will not seek psychiatric help. We cannot wait for ideal circumstances because they may never occur. We do have a certain number of pilots flying who in many cases have been identified by peers and others who are just "accidents waiting to happen." A program should help identify those individuals.

If a person's capacity for decisive action is interfered with by compulsive need to behave otherwise, then it may take much persuasion and/or encouragement to change. Many potential problem pilots employ intellectualizing, philosophizing, and conceptual thinking (not specific) to defeat understanding. It is tough to focus on concrete issues when a person's defense insists on generalizations, or when they are concrete to such a degree as to destroy the value of the observation. We must overcome compulsion that is of such rigid resolve and teach some type of abandon of resolve so that a person can behave in some random, unplanned fashion to avoid the accident which will also come in some random unplanned manner. The training must present a view of a person's behavior and its consequences. The person has more freedom to explore different or more useful patterns of reacting only when he/she recognizes rigid patterns are not necessary and may cause accidents.

At times, the pilot world is one of excesses of a compulsive power-oriented, activity-dominated culture/system. The person in this system feels he can do anything, succeed at anything if only one wishes, and the possibility of achievement and fulfillment is limited only by one's desires and capacity for work. Insufficient account is taken of physiological and existential barriers and limits to man's capabilities and man's mortality. This might be especially true when applied to aging and its physiological accompaniments--especially for an older pilot who has no other options than flying. At times, the pilot must be able to remove himself from doing and producing. This will divest him from the compulsive need to perform all the time especially and importantly

if this is dysfunctional behavior in the cockpit.

Pilot morale affects all aspects of his/her functioning. Feeling down for whatever reason (bad check-ride) may lead to apathy and other dysphoric emotions and then on to low self-confidence. A program should try to create and maintain a helping relationship characterized by respect, interest, understanding, tact, maturity, and firm belief and ability to help that troubled pilot and teach other pilots to be aware of the danger signals (warning lights of dysfunctional behavior). The program should offer:

- o Suggestions (persuasion)
- o Encouragement of open communication, self-scrutiny and honesty
- o Interpretations of "unconscious material" such as self-defeating behavior
- o Examples of maturity such as the ability, capacity and willingness to profit from experience

There is no one way specific behavior change takes place but rather a number of ways and contexts in which it is facilitated. The CRM program must teach this fact and include some examples of various programs. It should also be stressed that there are formal and informal treatment methods.

There are seasons for everything in life and pilots need to understand this, via perhaps, a lesson in Erikson's eight stages of life. We want to encourage different outlooks on themselves, others, and the surrounding world. This tends to help one cope better with a variety of personal and social problems that arise at home and in the cockpit. This allows one to be more "un-upsettable" when confronted with a new set of troublesome conditions in either setting. Then when the "catastrophes" occur, they do not "awfulize," whine, or grandiosely command in a negative way.

It must be recognized that philosophic or cognitive change remains a prerequisite to basic personality change. This too must be kept in mind in CRM program design. Behavioral change, then, partly and significantly depends on realization that one can learn new ways. Without this cognitive awareness an enormous degree of resistance and inertia tends to occur and may lead to the accident. Self-assessment tests help through cognitive review of a number of different areas that fit in with stress and/or personality disorder. Conceptions and misconceptions are learned and hence, can be unlearned.

The above thoughts are gathered from clinical experience with pilots over the past 10 years. I feel they should have some bearing on curriculum design in an effort to prevent unnecessary human behavior which leads to accidents and loss of life. These thoughts and ideas are by no means completely discussed. They have been a factor in USAir CRM program design.

MILITARY APPLICATIONS OF CRM*

Working Group VI

Col. Timothy H. Hatch, Chair
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INTRODUCTION

The objective of the working group on Military Applications of Cockpit Resource Management (CRM) Training was to examine current CRM training concepts and their applicability to the military environment. It is well known that the military environment presents unique challenges that must be addressed. Among the challenges are the interaction of the military rank structure and the flight deck command structure (which are often independent), officer-enlisted relationships, operational differences (e.g. tactical operations), crew experience levels, high crew-turnover rates, differing crew lifestyles and duties, scheduling irregularities, long crew-duty days, customs and courtesies, mission purpose and endemic problems to include command pressures, inadequate support, job satisfaction and salary. The task of the working group was to develop recommendations addressing specific military needs. Areas considered were curriculum development, CRM training techniques, effectiveness of CRM training and integration of CRM training into the total training curriculum. As these areas were considered, the group made an on-going assessment of the strengths and weaknesses of the current CRM training when applied to the special needs and characteristics of military operations. The group was well qualified to fulfill its intended purpose. It consisted of a good blend of military and civilian, different branches of service (Army and Air Force), major air commands (MAC, SAC, and ATC) and levels of responsibility (ranging from headquarters USAF level to unit level). This report will discuss the what and how of military CRM training and conclude with recommendations on CRM training for military operations.

DISCUSSION

Opening discussion centered on MAC's position and philosophy concerning CRM training. This discussion served as an education and reinforcement about one military application of CRM principles. Before proceeding to the chore at hand to determine the what and how of military CRM training, the group discussed the difference between military and civilian environments. All differences listed in the introduction of this report were discussed and agreement was reached that the differences must be dealt with in the military's CRM training.

* This is an expanded version of the oral report which appeared on p. 241.

Essential Elements of Military CRM Training

The key term in generating the essential elements of an optimum military CRM training syllabus is resource management. The term resource management is defined as using *all* resources to bring about safe airplane operations with resources used in the broadest sense to mean that both external and internal to the cockpit. An additional key factor is that the training must be crew-oriented dealing with all members of the crew, not just the pilots. The global goals of the training should satisfy command demands and maximize safety. Goals are a joint responsibility requiring a coordinated effort. Objectives to satisfy these goals must focus on the often-cited management skills. These skills deal with leadership, followership, communication, problem solving and stress management. The crew's abilities to function as a team and maintain situational awareness are also critical elements of the program.

The overall training objective is to make **all** crewmembers aware of proper behavior. This awareness is developed in two ways. First, a model for proper behavior is created and presented. Second, improper behavior must be demonstrated. Next, the program must teach small group dynamics to include leadership, followship, communication skills and the synergy of good team play. **All** crewmembers must become aware that they do not operate in a vacuum and that they must use their individual talents to form a functioning crew unit. Crew coordination to include problem solving, decision making, task assignment and conflict resolution plays a significant role in developing proper situational awareness.

The military CRM training must be critiqued but not graded. It is important for the crew to share feedback (both good and bad) at the end of training. The goal of this critique is to reinforce the good and correct the bad.

Techniques for Military CRM Training

The group objective concerning the "how to" of military CRM training was to reach the needed balance between techniques that supply information and those techniques that provide experience regarding the trainees own behavior when working with others in the cockpit. The driving principles are: make the training military-specific tailored to the trainee's unit mission; ensure that instructors are properly selected, well-trained and motivated to purpose; and that the training program content is consistent with command philosophy. The training must accomplish three things. First, the trainee must be motivated, provided a conceptual framework and involved in the training. Second, the trainee's knowledge base must be built. This base must include an understanding of the CRM process and the establishment of a common language. Third, CRM skills must be acquired and retained. The objective here is the optimum use of all cockpit resources. This process must enhance existing skills, build new skills and retain and reinforce skills. Techniques should include classroom instruction, role playing, interpersonal relationships, group problem solving, video tape feedback and LOFT type scenarios. The user must be involved in military CRM training to ensure that the training is tailored to needs. Three steps must be performed early in training program. The steps are: first, conduct a user critical requirements analysis. Second, conduct a user review. Third, conduct user acceptance testing. When these steps are properly conducted, user involvement is ensured.

Implementation of Military CRM Training

Planning for CRM training implementation is critical. The plan must be well thought out and existing training forums should be used to the maximum extent possible. Because this training is not a "one time shot", close attention must be given to reinforcement training. Equally important is the integration of CRM training into the total training curriculum. Military CRM training should begin very early in the crewmember's training. The recommended beginning point is at the end of UPT, UNT, basic flight engineer school, etc. An introductory seminar would probably fill the bill of an introduction to CRM training. Next, each major air command should teach the initial CRM course at their formal schools (CCTS). The CRM course should be taught at or near the conclusion of the formal transition course. To provide reinforcement, formal CRM training should be integrated as a part of annual simulator training. Additionally, for those who conduct semi-annual simulator training (such as MAC), CRM training should be included. When possible, reinforcement should be conducted using video tape and reading materials on at least a monthly basis. In summary, CRM training should be conducted as part of initial training and then reinforced at every opportunity using available forums. Simulators and cockpit procedures and trainers (if available) are a must. CRM training sessions should be recorded on video tape to be used in self-critique.

Effectiveness of Military CRM Training

While not within the specific group charter, the group felt that some statements on effectiveness would be appropriate. Just as with civilian CRM training, there is little to go on to determine the effectiveness of military CRM training. MAC has the only Air Force program in existence, and the program results look good. However, the data are limited and certainly inconclusive. A real need exists for a data base benchmark so that effectiveness can be measured. A neutral agency such as NASA is a prime contender to develop such a data base. Until better means are devised, each using organization should evaluate their own program to determine if the desired results are achieved. All should be aware that barriers to effective CRM do exist. Among these barriers are: the "not invented here syndrome," resistance to change, a belief that such training already exists, and inadequate command support. Our conclusion is that military CRM training will contribute to effective team performance thereby enhancing safe, orderly, and expeditious mission accomplishment to the extent that such training is user sensitive and decidedly military.

RECOMMENDATIONS

The group voiced unanimous support for a strong and credible military CRM training program that trains all aircrew members. The following recommendations are offered concerning such a program.

- o The entire military aviation community must be educated on the benefits of CRM.

- o The CRM training must start in Air Training Command, continue in each command formal school training and be reinforced at least annually as part of simulator training.
- o The program must be decidedly military and sensitive to all military requirements.
- o The users must be involved in the training program development to ensure all unique requirements are met.
- o Continual command support for the training is a must.
- o Trainees must be provided feedback from video tapes and self-critique. Formal checkrides should be avoided.

No formal recommendations are offered on the "what and how" of the training program. Because each program must be tailored to user requirements, those areas discussed earlier in this report should be used as guidelines for program development.

In conclusion, each member of the working group expressed the value of this forum and voiced hope and strong support for a tailored military CRM training program.



Report Documentation Page

1. Report No. NASA CP-2455		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Cockpit Resource Management Training				5. Report Date May 1987	
				6. Performing Organization Code	
7. Author(s) Harry W. Orlady and H. Clayton Foushee, Editors				8. Performing Organization Report No. A-87038	
9. Performing Organization Name and Address Ames Research Center Moffett Field, CA 94035				10. Work Unit No.	
				11. Contract or Grant No.	
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, DC 20546				13. Type of Report and Period Covered Conference Publication	
				14. Sponsoring Agency Code 505-67-41	
15. Supplementary Notes Point of Contact: H. Clayton Foushee, M/S 239-21, Ames Research Center, Moffett Field, CA 94035 (415)694-6114 or FTS 464-6114 Harry W. Orlady: Orlady Associates, Inc., Los Gatos, California. H. Clayton Foushee: Ames Research Center, Moffett Field, California.					
16. Abstract Cockpit Resource Management Training is a relatively new concept in the aviation industry. Although it is still in the process of maturing, it has received widespread acceptance in all facets of the community, worldwide. NASA sponsored the first workshop on this subject in 1979. That workshop was a direct outgrowth of research begun in the mid-seventies at the NASA-Ames Research Center's Man-Vehicle Systems Research Division (now the Aerospace Human Factors Research Division). This work, under the leadership of Drs. Charles E. Billings and John K. Lauber along with George E. Cooper, Ames' former Chief Test Pilot, was aimed at addressing some of the more perplexing problems underlying so-called "pilot error" accidents that seemed to account for an unusually large percentage of the total. One of the early observations of this research was that many of these problems had nothing to do with "stick-and-rudder" skills, but seemed to be related to other areas, such as decision-making, crew coordination, command, leadership, and communications skills. Another observation was that pilot training programs scarcely touched upon these concepts. The 1979 workshop included presentations from a broad spectrum of the industry and stimulated the development of a number of training programs. The proceedings document of that workshop (Cooper, White, & Lauber, 1979; NASA Conference Publication 2120) has sometimes been referred to as "the bible" of Cockpit Resource Management Training. Much has happened in this area since 1979, and NASA-Ames' Aerospace Human Factors Research Division has received many requests over the years to sponsor a new workshop to review the progress that has been made. The U.S. Air Force Military Air-lift Command, having undertaken resource management training on a large scale, also urged a comprehensive review and agreed to co-sponsor this workshop. This volume is an up-to-date reference for use by those interested in the subject of Cockpit Resource Management Training. It is a complete proceedings of the new workshop and intended to be the "new testament" for this important training concept.					
17. Key Words (Suggested by Author(s)) Cockpit resource management Crew coordination Leadership Communication skills			18. Distribution Statement Unclassified - Unlimited Subject Category 03		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of pages 308	22. Price A14