

THE APPLICATION OF CRM TO MILITARY OPERATIONS

Capt. Dale E. Cavanagh (ret.)
United Airlines Services Corporation

Dr. Kenneth R. Williams
Seville Training Systems Division
United Airlines Services Corporation

INTRODUCTION

CAPT. CAVANAGH: Cockpit Resource Management (CRM) training, as we think of it today, had its origins in the NASA-sponsored industry conference held in 1979. Many of the concepts advanced during that conference were followed in the development of United Airlines' Command/Leadership/Resource Management training, the first large-scale industry effort. The favorable response to the United Airlines' training and related programs led the Air Force to require that CRM be included in the contractor-operated C-5 Aircrew Training System (ATS), for which United Airlines Services Corporation (formerly Aircrew Training) is the prime contractor.

The detailed content of the CRM training component of the C-5 ATS was left to the discretion of the contractor. As a part of determining what the content should be, United Airlines Services Corporation has made an effort to understand how the needs of MAC crews compare with those of civilian airline crews.

There are distinct similarities between the crew roles in the cockpits of civilian airliners and military air transports. Many of the attitudes and behaviors exhibited by civil and military crew members are comparable, hence much of the training in the field referred to as Cockpit Resource Management is equally appropriate to civil or military aircrews. At the same time, there are significant differences which require assessment to determine if modifications to what might be termed "generic CRM" are necessary.

Our investigation has enabled us to define and specify CRM training which we believe addresses the needs of the C-5 operational community. The study has concentrated largely on military airlift, but we believe the training objectives and course content of our CRM training are readily adaptable to a wider range of military cockpits than are found in strategic airlift. For instance, CRM training focusing on communication, leadership, situational awareness, and crew coordination is just as appropriate, with some modification, to the pilots manning a flight of Tactical Airlift Command A-7's as it is to the pilots, flight engineers, and loadmasters crewing a C-5.

MILITARY AND CIVIL DIFFERENCES

It is not our intent to go into detail concerning the content of the CRM training

being developed by United Airlines Services Corporation for the C-5 ATS; rather, we will focus on a number of general differences between military and civil cockpits which may have implications for the development of military CRM programs. These general differences include: (a) military rank; (b) purpose; (c) crew qualifications; (d) crew lifestyle; (e) labor relations; and (f) other, miscellaneous differences.

Military Rank

Various issues related to military rank may provide the largest difference between military and civilian crews. Let's consider several situations.

Rank Reversal. Occasionally, a crew will be headed by an aircraft commander who is junior in rank to others on the crew (e.g., the aircraft commander may be a Captain and the copilot a Lieutenant Colonel). Regardless of the reversal in rank, there is no question that the Captain is in command during the flight and during any ground activity relating to the flight. There is also no question that the Captain must treat the Lieutenant Colonel copilot with more attention to courtesy than would be the case if the copilot were junior in rank.

Another reverse rank situation is that in which a navigator is senior in rank to the aircraft commander. However, this is less likely to induce undue tension since the navigator is not a pilot.

There is no comparable situation in major airline operations in which the Captain is junior to a subordinate in the cockpit.

Officer-Enlisted. Pilots and navigators are commissioned officers, while the engineers and loadmasters are non-commissioned officers (NCOs). This appears to be less of a problem when crew members are experienced than when either or both are relatively inexperienced. When the enlisted crew member is inexperienced, he is probably new at dealing one-on-one with officers, and this may inhibit voluntary communication which should emanate from the new loadmaster or flight engineer. This is even more acute when one of the pilots has a senior rank, such as Lieutenant Colonel or Colonel.

This aspect of the relationship is peculiar to the military. While there are inexperienced flight engineers on airline flight decks, as pilots they have all had experience in dealing with other pilots. Hence, the major inhibiting factor they share with the new military flight engineer is related to inexperience.

A reversal of the situation above occurs when the flight engineer is a very experienced crew member with a top NCO rank, such as Chief or Senior Master Sergeant. When the aircraft commander is new to the airplane and junior in rank, such as First Lieutenant or Captain, the "old head" flight engineer may attempt to dominate the aircraft commander.

It is also possible for a senior aircraft commander and a senior flight engineer to have difficulty in dealing with each other. The situation can be expanded to a senior NCO loadmaster who may have difficulty with a senior aircraft commander and/or a senior flight engineer.

This is not totally unknown in a civil cockpit, but it is much more rare with the passing of "mechanic" engineers in favor of "pilot" engineers on most of the airlines. There are some situations where a senior flight attendant attempts to dominate the cockpit crew.

A number of airlines have an "experience" situation of their own, which the military does not share. The situation occurs with mandatory retirement of the airline Captain at age 60, who then opts to continue his career as a flight engineer. How does he turn off much of what he has learned about flying during his previous 35+ years to concentrate on being a flight engineer? This seems to have the potential to produce an uneasy situation.

Social barriers exist between the officer and non-commissioned crew members. Fraternization is prohibited and, when it occurs, subjects those so engaged to disciplinary action. There are no airline restrictions against fraternizing/socializing with fellow crew members of any position or sex.

Purpose

The primary purpose of our armed forces is to defend the nation against all threats, foreign and domestic. MAC's role is to provide airlift support for that defense. *The men and women who serve their nation in all of the armed forces do so in response to a number of motivations, such as a desire to travel, an opportunity for education, or simply old-fashioned patriotism.*

MAC crews are expected to fly anywhere, anytime, with cargo or passengers, often to unfamiliar destinations with no local ground support. The crew must handle all the ground arrangements such as service, fueling, loading and unloading, etc. Sometimes the load has political importance such as critical medical equipment or weapons for allied forces. During exercise missions, pressures from Command may be heavy to follow procedures which are contrary to good operating practice.

Airlines flights are generally routine, over familiar routes with standard procedures and navigation aids in the domestic environment. On major airlines, all ground details are handled by specialized company personnel. This varies only during some off-line charter operations, though even there, every attempt is made by the airline to contract for local support. Loads are pretty standard, and extra pressures to deliver a special passenger or cargo are rare.

There is no airline equivalent to the larger role of military aviation, including MAC. In the event of a national emergency, the airlines are ready to supplement MAC operations through the Civil Reserve Air Fleet (CRAF), but in less hazardous environments than those encountered by many MAC crews. During normal times, airline crews serve in response to a different set of motivations which obviously does not include patriotism.

Crew Qualifications

Experience. Within the active force, aircraft commanders probably have an average

of five years as a pilot which translates into 2,000-3,500 hours. Copilots have about two years which equates to 800-1,500 hours. Flight engineers have perhaps seven years, or about 2,500-3,500 hours. Entry level experience may be as little as 260 hours for pilots direct from Undergraduate Pilot Training (UPT), while flight engineers and loadmasters may have zero flight experience.

The average flight crew applicant for major airline employment has over 1,500-2,000 hours, and a majority of the applicants have had previous military flying experience.

Reserve or Guard pilots generally have levels of experience which are significantly higher, and are frequently airline flight crew members. Reserve or Guard flight engineers tend to have longer service but less flight experience than regular Air Force engineers.

Regular Air Force flight experience contrasts with the experience of crew members with a major airline. An airline Captain has at least 10 to 15 years with the company before being promoted to the left seat, or on the order of 7,000-10,000 hours before promotion. A copilot for the same airline spends at least 5-7 years as a flight engineer before being promoted and, excluding time flown as a flight engineer, has 1,500-3,000 hours acquired in the service or in civilian life before employment as an airline crew member. Most airline flight engineers are pilots on the first rung of the cockpit promotion ladder. At the midpoint in the flight engineer assignment (approximately 3 years), they have about 1,800 hours as an engineer plus 1,500-3,000 hours as a pilot before their airline career.

Flight Engineer Qualification: Military flight engineers are obtained from the mechanic ranks, and are not pilots. They are not required to have any formal education beyond high school, except for the appropriate career field training. Their expertise is directed toward aircraft systems rather than toward procedures and techniques appropriate to flying operations. They are not required to have a knowledge of instrument approach procedures, navigation, ATC requirements, etc.

Airline flight engineers are selected for eventual assignment as pilots, and must meet each airline's experience and educational requirements for that position, including piloting experience, licenses, and ratings. Because of their piloting background, they are familiar with instrument approach procedures, navigation, ATC requirements, etc. They also possess the technical knowledge required to perform the functions of flight engineer, as defined by their employer, which generally entails less in-depth knowledge of aircraft systems than is common among military flight engineers. Some airlines, including United, assign flight instrument monitoring or flight procedural duties to their flight engineers.

Turnover. The career path for commissioned flight officers who aspire to higher rank requires an array of academic credentials and a variety of assignments outside the world of flight. Young pilots who are career-oriented begin to look very early for a way out of the cockpit. Earning a Master's degree, and non-flying duties of high visibility are very desirable on an Officer Effectiveness Report, and therefore considered more important to career progression than studying the Flight Manual. Such factors are less important in the Reserve and Guard units; hence, their flight officers are under no career pressure which could cause them to look for non-flying assignments.

The average tour as a pilot within MAC is 2.3 years. This figure varies between seats and fleets, but is true as an average across the Command. "Old heads" remain much longer, perhaps 10 to 15 years, alternating between operational units and training assignments. Younger pilots may be transferred into another command, such as SAC or TAC, frequently into a non-flying job, after three years. Such short tours make it difficult to develop a strong sense of loyalty and devotion to MAC and its larger purpose.

Flight engineers tend to remain longer in MAC. An average is difficult to obtain, but has been estimated as more than 10 years in the C-5 for "old heads," and five years or so for the junior engineers.

Airline "tours" are much longer. Because of the constraints imposed by a seniority system, flight crew members tend to remain with one carrier and develop a sense of togetherness and unity with (or antagonism toward!) their employer. There are changes of seats and equipment, but the policies and objectives of the employer and the relationships with the employees are relatively stable.

Crew Lifestyle

Crew Duties. MAC crews are responsible for a wider variety of ground duties in connection with a flight than are common with most major airlines. For example, the loadmaster is charged with supervising the actual loading and unloading of all cargo, including verification of weight and balance. After landing, the loadmaster is not relieved until the aircraft has been unloaded. The loadmaster or flight engineer prepares the weight and balance forms that are given to the pilots. The flight engineer is charged with overseeing the fueling and verifying that needed maintenance has been performed. As their commander, the aircraft commander is ultimately responsible for the actions of the flight engineers and loadmasters.

Computer flight plans are available for most normal missions, but must be verified in detail by the navigator (if one is carried) or by the pilots. Flight plan filing with ATC is the responsibility of the aircraft commander.

Airliner loading and unloading is the responsibility of airline ground crews. Weight-and-balance forms are prepared by a ground support function and delivered to the cockpit. Flight plans are largely computer-generated, reviewed by a flight dispatcher, and delivered to the pilots for cursory verification and acceptance. Flight plan filing with ATC is handled by the dispatcher.

A MAC aircraft commander is at least partially responsible for his subordinates during ground layovers. For example, if an enlisted person has a run-in with the law, the aircraft commander may be called to provide assistance.

While an airline Captain might be called upon to assist a copilot or flight engineer in similar circumstances, he would be doing so only as a friend. He would not be called for any difficulty involving a flight attendant.

Except for strategic airlift missions, there are no civil equivalents to many of MAC's

missions which frequently require very close coordination and teamwork between all members of the crew, including loadmaster and navigator, to ensure safety.

Crew Scheduling. MAC attempts to lock-in a monthly schedule for aircrew members, but continually changing operational requirements and "add-on" missions create scheduling turbulence which detracts from the crews' quality of life.

Duty days for MAC crews may be as long as 16 hours. With additional crew members assigned to the crew, the day may be extended to as much as 24 hours. There can be several maximum duty days in a row.

Major airline crews have monthly schedules which provide a large measure of stability and predictability in flying assignments. Reserve crew members are available to cover "add-ons" or unavailability of regular crew members. Duty regulations and other work rules make MAC-type work days unlikely, if not impossible, with major airlines.

Labor Relations

There is no formal union among military aircrew members, although there is a strong feeling of fraternity and unity within all ranks. There is an informal flight engineer's "union" which appears to be an "old heads" network which does everything possible to defend its NCOs against the inroads of the officer structure. Peer pressure, attitudes of unit supervisors, and crew position specialists at higher headquarters also contribute to the informal "union."

The relationship with the employer (USAF) is paternalistic and authoritarian. Specific regulations range from those of MAC and the Air Force to the Uniform Code of Military Justice (UCMJ) and govern almost every aspect of life in the military from administrative downgrade to removal from the Air Force. Redress of grievances is difficult and uncertain.

While it is losing members nationally in the face of airline deregulation, the Air Line Pilots Association (ALPA) represents pilots and flight engineers through collective bargaining with their employers. The role of unions is controversial, at best, and in the case of ALPA can cause a dilution of employer authority and diversion of loyalty away from the employer to the union. On the positive side, ALPA provides a strong and influential force for safety in dealing with employers and the government. Airline employers can discipline employees, but are restricted by union intervention. The most severe punishment is dismissal.

Other Differences

Crew Communication. Noise levels and physically-removed work stations mandate the use of the interphone for all intra-crew communications during ground and flying operations. This includes pilots, flight engineers, navigator, and loadmasters. In the C-5, a portion of the system is continually "hot" for communications between the pilot, copilot, flight engineer, navigator station, jump-seat, and avionics bay. Communications to and from other positions requires the use of a push-to-talk switch. Truly "private" conversations are not possible.

Formality in the cockpit (no first names, particularly between officers and enlisted) is mandated by HQ MAC. All interphone communication is, "Engineer, Pilot," or "Co from Pilot," or "Load, Pilot," or "Pilot, Engineer," etc. This MAC procedure is mandated by (a) the officer-enlisted relationship, and (b) the need to communicate via interphone with a crew which may have eight or more members, two or more of whom may share the same first name.

Crew communication in most airline cockpits is more informal, with crew members usually addressed on a first name basis. Cockpit crews are smaller--two or three persons--and there is no need to use interphone. Noise levels in most airline cockpits--and all built by Lockheed, Boeing, or Douglas--are low enough to allow normal cockpit voice communications without resorting to an interphone system. Calls by flight attendants from the passenger compartment employ a separate telephone system.

Training. In MAC, a greater proportion of airplane flight training is carried out in actual flight versus simulation than is customary in the airline world. This includes training on regular, scheduled flights and on dedicated training missions. A much higher proportion of mishaps occurs during training missions than occurs during regular flights. This is explained in part by the inadvertent breakdown in cockpit coordination caused by the diversion of attention from the normal pattern of activities to instruct and supervise the trainee(s). Several gear-up landings and at least one tail strike due to an incorrect speed on approach have occurred on dedicated training missions flown by experienced, well-qualified crews.

Most airlines conduct all training possible, including virtually all non-normal procedures, in simulators because of (a) the operating costs associated with actual airplane operations, and (b) the infinitely greater safety in performing non-normal procedures in simulators versus airplanes. Breakdowns in good cockpit coordination and normal function which can occur during airplane training have no serious or lasting aftermath in a simulator.

IMPLICATIONS FOR CRM TRAINING DEVELOPMENT

DR. WILLIAMS: The differences we have noted between military and civil aircrews have been general considerations for us in our design and development of military CRM training. We find it useful to classify these general differences as either *operational* or *cultural*, even though some of them clearly result from a combination of both operational requirements and cultural imperatives.

Operational Differences

Any differences noted between military and civil operations will have potential implications for designing effective CRM training, but the specific operational differences between and within weapons systems also present even more significant design challenges.

Consider, for example, the operational differences among air frame types just within

the Military Airlift Command. MAC operates a wide variety of fixed- and rotary-wing types. The fixed-wing inventory includes wide-body, narrow-body, propeller-driven, and jet-powered aircraft. Some of these types, especially those classified as strategic airlifters, have principal employments which are roughly similar to their civil counterparts. The C-5 and C-141 are generally thought of as comparable in their principal employments to civil air carrier aircraft. But the C-5 also has a special operations employment (SOE), and the C-141 also has a tactical or airdrop mission.

The C-130, the work horse of MAC, looks to be the same type of aircraft operated by a civil carrier such as Transamerica. In reality, the C-130 performs the widest variety of missions of any fixed-wing aircraft in the Air Force inventory. It is used in greatest numbers as a tactical airlifter to insert and sustain forces wherever and whenever needed. But it is also used for a number of other major missions such as gunship (AC-130), special operations (MC-130), search and rescue (HC-130), and so on.

Each of these major missions, in turn, includes several sub-employments requiring specialized aircrew qualifications. For example, within the tactical airlift mission of the C-130 are various types of airdrops such as HALO, LAPES, sequential heavy, container delivery system, and personnel airdrop. Tactical airlift C-130 crews also qualify for formation lead, special operations low level (SOLL-1), Adverse Weather Aerial Delivery System (AWADS), Primary and Emergency Nuclear Airlift, etc.

The closer one looks at weapons systems even within one Command (and the C-130 is only one example), the more apparent operational differences become. Such differences proliferate across Commands and across service branches. Clearly, operational differences outnumber, and thus perhaps outweigh in significance, operational similarities. In planning military CRM training programs, it may be wise to look upon operational similarities as "differences that don't make a difference."

The significant implication here is that military CRM programs need to be more user-sensitive than civil programs. Civil operations are characterized more by similarities than by differences. Military CRM programs should be more than hasty revisions of generic civil programs. One has to do more than change tail numbers or crew position designators to construct effective military programs. The systematic development of military CRM training programs must involve the end-user heavily and at strategic points in the program development process. At a minimum, the end-user should be involved: (a) in the analysis of training requirements; (b) in a design review of fully-developed course plans; and (c) in systematic acceptance testing of the training package prior to its entering life cycle operation.

The role of the end-user in training requirements analysis is to provide input to what we call "critical requirements analysis." Critical requirements, *from the user's point of view*, are those team tasks which make the difference between performing effectively and ineffectively in the operational environment. A systematic critical requirements analysis should also help identify user plans, resources, and constraints, that could influence course design. How the user might wish to incorporate CRM into existing training plans, the program components that would be selected and configured to fit those plans, resource constraints, and other similar factors should be included in a critical requirements analysis based on end-user input.

After specific learning objectives are determined through a critical requirements analysis, course design proceeds through typical stages such as: (a) assigning objectives to components; (b) assigning candidate activities to objectives; (c) assigning media to activities; and (d) sequencing activities within course components. The output of these design stages is a full-developed course plan. The end-user now makes a second major input to CRM program development through a review of the course plan. The review should validate the training requirements analysis in each aspect of the course plan. That is, the end-user should be able to see that his critical requirements are met by the design and that the design accounts for his existing training plans, resource availability, and constraints. The user's design review should take place before further resources are expended to produce course specifications and materials.

Finally, the end-user should be involved in acceptance testing. A military CRM program should be treated no differently than any other kind of training when it comes to acceptance testing. Acceptance should be based on an initial operational test and evaluation (IOT&E) study which involves trained instructors delivering actual classes of representative students. Continuing acceptance should be based on a systematic program of summative quality control or through a series of follow-on test and evaluation (FOT&E) studies.

Cultural Differences

Civilian organizations interesting in developing CRM training for the military need recognize that they are dealing with a unique institution within society. The military is sanctioned by society as a learned profession in much the same way that medicine, law, and theology are sanctioned as learned professions.

The military is the profession of arms and its social charter is to plan, equip, and train for the possible application of organized force in the service of society. Each component of the military, and ultimately each individual in each component, is entrusted with a mission--"a sending out" to perform a particular service which is ultimately either combat or combat support.

To be entrusted to perform a mission, to be worthy of a mission, requires unconditional commitment. Unconditional commitment is the keystone value in military ethics. It requires that the military professional be willing to forego complete freedom and liberty and live a life based on obedience, discipline, selflessness, and honor.

Like other professions in society, the military retains a sense of corporateness and autonomy through symbolic customs and courtesies. Military customs and courtesies are neither frivolous nor mechanical echoes of tradition. They support, rather, the military value system through material signs of protocol and etiquette and thus bear directly and ultimately upon mission accomplishment.

Charter, mission, and unconditional commitment supported by customs and courtesies cannot be overlooked in planning military CRM programs. Programs that have attempted to do so in the past have not been well-received.

Civilian developers of military CRM programs also need to be aware that the

institutional character of the military is today in direct competition with the concerns of occupationalism. Aircrews today are as concerned with pay and working conditions as their civilian counterparts are. At last year's MAC-wide CRM/CLT conference, attendees were asked, in the context of an exercise, "What is the problem?" Of the forty-three responses to that question, the majority had to do with salary, excessive crew duty, Command pressure, quality of schedule, and similar factors. Essentially the same things surfaced in the course of our critical requirements analysis for the C-5 program. None of our respondents had attended the MAC conference, yet their responses to a similar question during the analysis were virtually identical to those of the conference attendees. These concerns of aircrews today, along with other evidence, suggest economic incentives underlie a fundamental shift in motivation away from professionalism and toward occupationalism.

If there is any point at all in mentioning this motivational shift, it is that CRM program planners should be aware of the key dynamics that are shaping the military today. CRM training itself cannot deal with these dynamics directly, but program planners should be prepared to encounter these crew concerns while, at the same time, honoring traditional military values. The major source of conflict in the military today is between individual needs and organizational goals--the inevitable and omnipresent conflict in any occupation. What CRM programs can do is to help crew members deal effectively with that conflict by helping them redefine and reaffirm those values which are held in balance by an unconditional commitment.

The functional requirements for military CRM program planning must include military as well as individual crew performance objectives. Strong representation of traditional military values must be included at least through a significant Command endorsement. Program components, content areas, and functional relations among components and content are important as in any program design. But, if the instructional strategy does not include a strong integration of military objectives and the concerns of military professionalism with CRM concepts and principles, then the appropriateness, if not the probable success, of CRM training in the military is lessened.

CONCLUSION

As the result of our efforts to date, we believe that military CRM training will contribute to effective team functioning and safe, orderly, and expeditious mission accomplishment to the extent that such training is user-sensitive and explicitly military in character.