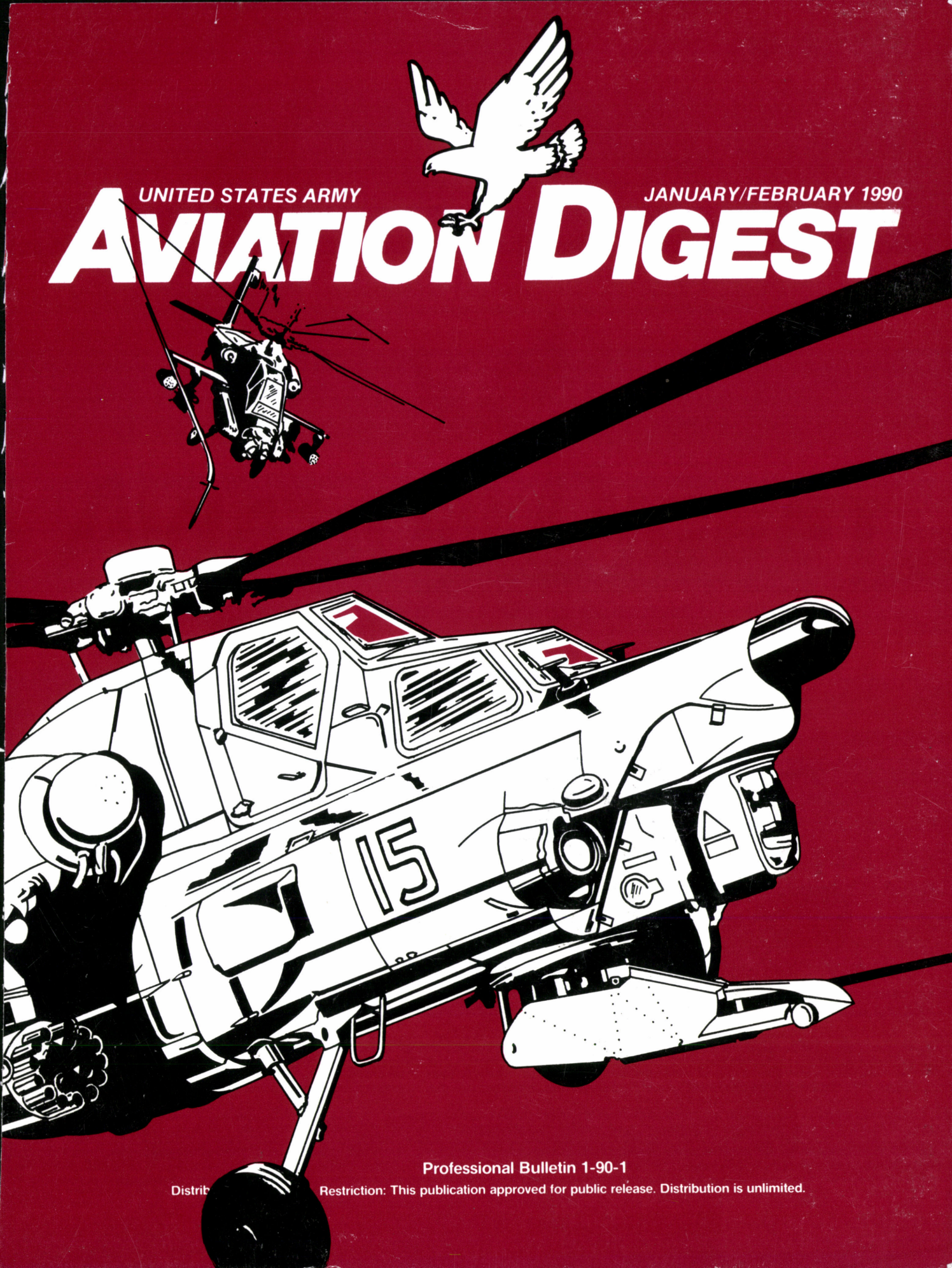
UNITED STATES ARMY

JANUARY/FEBRUARY 1990

AVIATION DIGEST



Professional Bulletin 1-90-1

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AVIATION DIGEST

PROFESSIONAL BULLETIN

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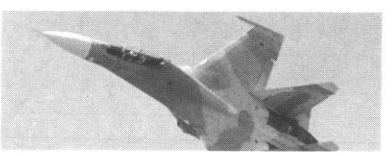

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Major General Rudolph Ostovich III
Chief, Army Aviation Branch

Defining the Army Aviation Total Combat System in the 1990s

THERE IS AN old Chinese curse that says, "May you live in interesting times." I don't know what we've done to deserve it, but surely we DO live in interesting times. Past threats seem less ominous, political alliances are being adjusted and, in many instances, the size of national military forces is being reduced. Never before has there been a greater need for the U.S. Army to achieve the full potential of its soldiers and their weapons systems. Said another way, the decade of the nineties will give us all the opportunity to BE ALL THAT YOU CAN BE!

This issue of the *Aviation Digest* gives some insight into the research being performed in the area of man-machine interface. The lead article focuses on potential aeromedical hazards of helicopter air combat. You'll read how air combat maneuvering can affect human cardiovascular and sensory systems and about behavioral hazards to aviators, such as target fixation, fatigue, competitiveness and breakdown in cockpit communications—any of which can become disastrous pitfalls in helicopter combat.

The second article in this issue discusses the military side of weapon system design. It sets the stage for a series of articles on human factors considerations that will appear in the *Aviation Digest* in 1990. In this article, you'll take a look at the extended-operations battlefield where fighting will be intense, and our soldiers will be expected to perform even when they are tired. The author asserts that human factors engineering is a vital part of major systems acquisition.

As aviation combat systems become more complex, commanders will be challenged to train operators to understand and adjust for potential operating hazards. To keep aviators safe and effective, flight surgeons, standardization personnel and instructor pilots will help us better understand our human limitations. As leaders of well trained soldiers equipped with high technology weapons systems, we need to be able to assess the stressful conditions under which we are likely to operate. Two courses on this subject are currently being offered to U.S. Army Training and Doctrine Command (TRADOC) military and civilian personnel, the Manpower Personnel Integration (MANPRINT) Senior Training Course and the MANPRINT Staff Officers Course.

This decade presents the Army Aviation professional with many challenges. We face more diversified scenarios in which we could be employed while working with smaller budgets and less manpower. More than ever before, a premium exists for weapons systems that respond to Army requirements that are relevant to our national security interests. We will continue to focus on leader development to provide confident, competent leaders who can effectively deal with the highly complex future battlefield. And, finally, as in this edition of *Aviation Digest,* we continue to address the need for effective man-machine interface. This will ensure that our investments in both money and manpower will produce a deployable, flexible and lethal force for the nineties. Remember, Army Aviation remains a relevant force for the future!

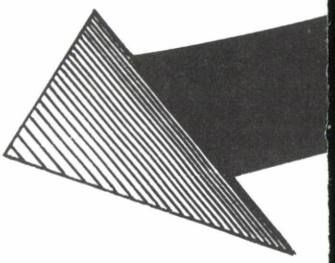
Traditionally in aviation, high-performance, fixed-wing aircraft and pilots have been the attention-getters. Consider, for example, the popularity of movies such as *Top Gun* and *Iron Eagle,* and aerobatic teams like the "Blue Angels" and "Thunderbirds." In many ways, it is true that this type of flying demands the most of a pilot. Excellent vision and superior reflexes are essential in acquiring a lightning-fast airborne target and maneuvering around it. Also, when "yanking and banking," the modern fixed-wing fighter pilot must strain constantly with his chest and abdominal muscles to keep the blood from draining out of his head, thereby rendering him unconscious. (See figure 1 on workload and Gs.)

New Army Aviation tactics may require the conduct of helicopter air combat maneuvering (ACM). While there are obvious differences between modern rotary-wing and fixed-wing aircraft, the hazards are more similar than one might think. Helicopter ACM is conducted much closer to the ground than fixed-wing ACM; reaction speed is critical in both types of flying. No longer are helicopters confined to the 1- to 2-G (gravity) environment. The AH-64 Apache helicopter easily can subject the pilot to gravitational forces three and one-half times greater than those normally experienced on the ground.

This article informs both pilots and flight surgeons about some of the aeromedical hazards of this relatively new flight envelope. These hazards will be discussed in three general categories—*physiological, perceptual* and *behavioral.*

Major John S. Crowley, M.D. **Major Rhonda Cornum, M.D.** **Captain Raul Marin, M.D.**

AEROMEDICAL ASPECTS OF HELICOPTER AIR COMBAT



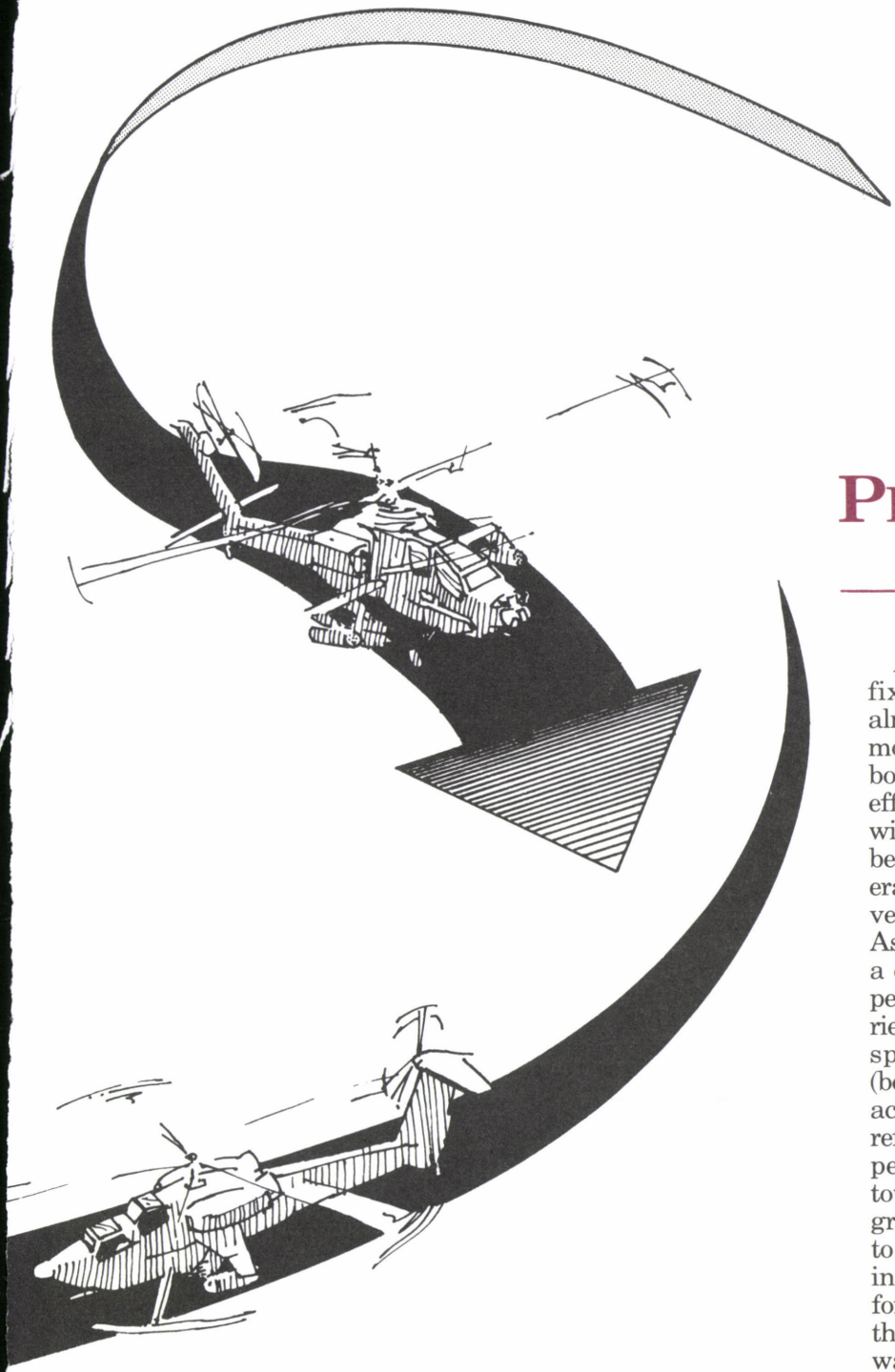


FIGURE 1: The combination of high workload and repetitive low-level Gs makes air combat the most demanding type of flying.

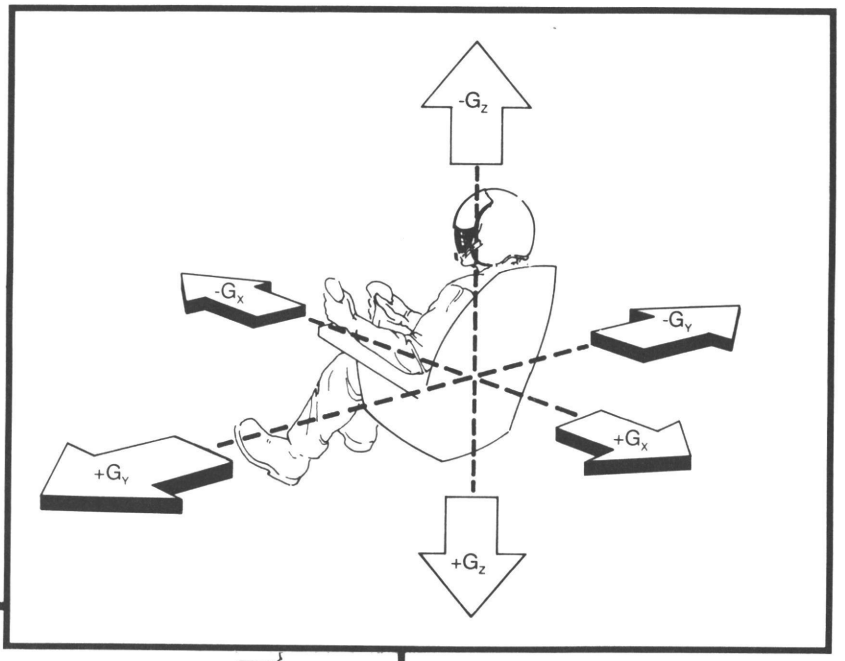
PHYSIOLOGICAL FACTORS

Although high-performance, fixed-wing aircraft can pull almost three times the "Gs" of modern helicopters, the human body potentially can suffer ill effects well within the rotary-wing ACM envelope as well. Let's begin with a definition: Acceleration is the rate of change in velocity and is measured in Gs. As an automobile speeds up in a curve, say from 20 to 30 miles per hour, the occupants experience both a linear (because their speed increases) and radial (because their direction changes) acceleration. The term "one G" refers to the speed at which a person normally is attracted toward the earth's surface by gravity. When the pilot is exposed to "three Gs," his weight has been increased threefold. Thus, the force applied to him is equal to three times his body weight. The way in which the human body responds to a given G-force depends on several factors—the quickness with which the force is applied, the direction of the force and the intensity and duration of the force.

The human body experiences G forces in three main directions: up and down the spinal cord, the z axis; across the shoulders, the y axis; and front and back

through the chest, the x axis (figure 2).

If the force goes toward the feet, back or left shoulder, it is referred to as positive. If it goes toward the head, chest or right shoulder, it is referred to as negative. Another way of naming these forces relates to the direction that the pilot's eyeballs would be displaced by the accelerative force. Thus, as the pilot accelerates forward, a +Gx force or "eyeballs-in" force is applied. As the pilot decelerates, a -Gx or "eyeballs-out" force is experienced. Likewise, if the AH-64 pilot suddenly pulls upward, a +Gz or "eyeballs-down" force is applied.



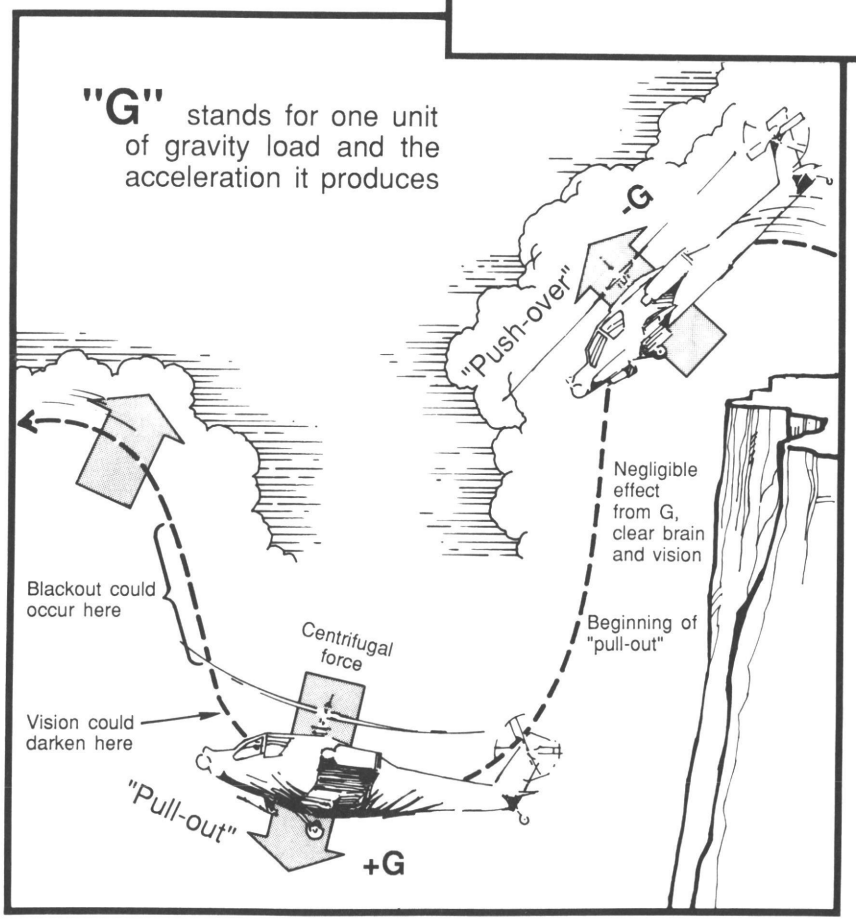


FIGURE 2 (above): Diagram of G directions. The human body experiences G forces in three main directions.

FIGURE 3 (left): A helicopter diving and the physiological effects of G forces.

Since Gx and Gy normally are not encountered in flying, we won't discuss them further; all "Gs" mentioned will be in the z axis.

Positive G Forces

In typical aircraft maneuvers, G forces are applied along the spinal cord toward the feet (+G forces). These forces cause movement of body components toward the feet; blood, the most fluid component of the body, tends to move the easiest.

Fortunately, the arteries and veins, which contain the blood, have the capacity to "squeeze" blood from the feet and legs toward the heart and brain. This is due to both an automatic nervous system reflex and a

- fatigue
- dehydration
- poor physical condition
- inadequate diet
- illness
- inexperience
- sunburn
- high rate of G-onset
- improper anti-G straining maneuver

FIGURE 4 (above): Factors decreasing G tolerance.

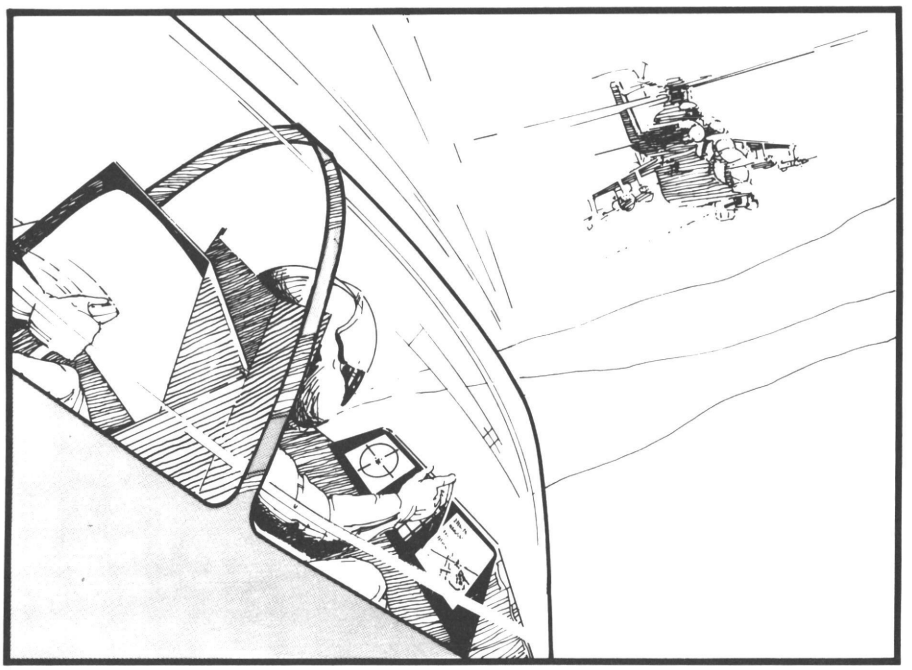


FIGURE 5 (right): Unexpected Gs can cause a pilot to miss his aim-point by two to three push buttons.

milking action by the muscles of the leg (figure 3).

Unfortunately, as G forces are applied, the ability of the automatic regulatory system to ensure a continuous flow of blood to the heart and brain is overwhelmed. Even at 2.0 to 2.5 Gs, blood pressure at the level of the eye and brain begins to decrease. While there is considerable variability among individuals, most persons begin to experience "gray-out" or fuzziness of the visual fields around 3 to 4 Gs. Further increase in G level leads to total loss of vision (blackout) around 4.0 to 4.5 Gs. At this stage, the subject can no longer see, although fully conscious. Once 4.5 to 5.0 Gs are reached, unconsciousness usually results. This is termed G-induced loss of consciousness. It has claimed many high-performance jets as well as pilots over the past few years.

Happily for us, even those rotary-wing aircraft that are capable of aerobatics cannot sustain positive Gs for very long. Since susceptibility to Gs is a function of onset rate and duration, as well as magnitude, it is unlikely that Army rotary-wing pilots will have significant G-induced changes in vision or consciousness. However, a number of factors can affect G tolerance (figure 4). Army aviators flying ACM should be especially aware of these factors since they are frequently encountered in field operations. For those aviators who do "gray-out," or "black-out," a sensible strategy under most circumstances is to back off the Gs a bit until vision returns (just as fighter pilots in World War II did). There will be times, however, when backing-off is not tactically wise. Any Army aviator who notes these physiological effects of G forces should consult with a flight surgeon. There are techniques that can assist pilots in sustaining Gs.

Negative G Forces

Negative Gs are not as well tolerated by humans as +Gs. These forces are experienced during sudden pushover maneuvers, or in fixed-wing aircraft also during outside loops. At low levels of -G (1 to 2), the head feels full and flushed because of blood rushing to the head. Greater than -2 Gs usually causes a reddening of vision, progressing to "red-out," eye pain and headache. Because -G maneuvers are uncomfortable, pilots tend to avoid them. Although helicopters are only capable of limited negative Gs, there is a potential hazard: Even mild -G maneuvers can make the pilot more susceptible to subsequent +Gs. This means that if an aviator follows a vigorous pushover (-G) with a strong pitchup, the effects of the +G are likely to be more severe.

Another important caution. Even low-level Gs, in any direction, can affect manual dexterity in the cockpit severely. This is no small matter, especially considering the new generation of multifunction displays and touch-screen controls. An unexpected 2 G load could cause a pilot to miss his aim-point by two or three push-buttons (figure 5).

PERCEPTUAL FACTORS

While some air combat engagements may involve only tracking a target from a stationary hover, others will require rapid changes in aircraft heading, attitude and altitude to maintain contact with the enemy aircraft. Although some Army aircraft are equipped with helmet-mounted sighting systems, which allow off-axis target acquisition, weapons systems generally require the pilot to physically align the aircraft with the target. This greatly adds to pilot workload. Of course, all of the perceptual illusions and pitfalls that are important in normal aviation are still important in ACM; however, there are some specific ways that helicopter air combat can affect the human sensory systems that deserve mention.

Visual Factors

Visual acuity. One of the most important tasks in air combat is the visual identification and tracking of enemy aicraft. It is critical, therefore, that pilots have the best possible visual acuity. The flight surgeon should be consulted promptly if an aviator is having problems acquiring or tracking targets. Of course, aircrew requiring spectacles must wear them when flying at any time. In addition, some pilots will benefit from special glasses prescribed for use at night only. The flight surgeon will be happy to discuss these options with the aircrewmember. The pilot with the better vision definitely has an advantage in helicopter air combat.

Height illusions. An awareness of altitude is critical in ACM, for aircraft often lose altitude when performing high-bank maneuvers. Different types of terrain can fool a pilot into thinking he is higher than he actually is. When flying over desert, snow or calm seas, aircrewmembers should be aware of the reduced visual cues available for altitude determination. Continued cross-check of instruments, particularly the radar altimeter, is extremely important under these conditions. A smoky and hazy battlefield will also create the illusion of exaggerated altitude because of the obscuration of the underlying terrain. These illusions are particularly treacherous at night.

Autokinetic illusion. If a pilot in a darkened room fixates his eyes on a static, solitary light, the point of light will appear to move. This is a common visual illusion that is not well understood, even to this day. In the air combat environment, it would be easy to mistake a distant stationary light for a moving aircraft. The autokinetic illusion can be reduced or eliminated by visual scanning; don't stare at the lights!

Reversible perspective illusion. It can be difficult to determine the direction a distant aircraft is moving (i.e., moving toward or away from the observer). This is an important sensory decision since it will obviously affect the choice of air combat maneuver. Excellent visual acuity is very important here; however, other cues can help: Monitor the relative size of the aircraft and compare its positive relative to the surrounding terrain. Probably most important, realize that a single quick glance should not determine your entire battle plan.

Blind spot. When searching for a target, remember there are areas of the retina that are nonfunctional. The day blind spot, which is really present at night as well, is located at the area on the retina where the optic nerve exits the eyeball. Since it is off-axis, it is not usually noticed. However, if a pilot is using one eye to search for a target (such as with a monocular sighting system or if the canopy obstructs the view of one eye), the day blind spot may obscure important details in the peripheral vision. The night blind spot is centrally located because of the lack of night vision in the central fovea of the retina. It is critical to maintain a good scan to avoid the effects of these holes in the visual field (figure 6).

Dip illusion. Several U.S. Air Force mishaps involving "controlled flight into the terrain" have been attributed to this illusion, which generally occurs during loose formation flying. When following another aircraft, it is common practice for trail

pilots to maintain relative aircraft position by keeping the leader's aircraft stationary on a reference point, such as a spot on the windscreen or immediately above the head-up display (HUD). Using the HUD as an example, and a depression angle of 2 to 4 degrees, which will vary according to pilot posture, seat height, etc., we can show how this illusion might cause an accident (figure 7).

If the trail aircraft is 75 feet behind the leader, the pilot may believe he is at the correct altitude, but he is actually 2.5 to 5.3 feet lower than lead. Although this is unlikely to be a significant difference, consider the effect when the pilot uses the same reference point when following at 1,000 feet—he is now 35 to 75 feet below his leader. Seeing lead successfully negotiate an obstacle, trail will feel that he, too, will pass safely although he is actually too low. The "dipping" sensation that the pilot gets upon realizing that he is lower than previously thought gives the illusion it's named. Helicopter pilots flying in nap-of-the-earth environment must maintain awareness of their own aircraft position relative to the terrain at all times.

Vestibular Factors

Somatogravic illusion. Changes in the G vector that stimulate the gravity-sensing organs in the inner ear (otoliths) cause these illusions. The brain often misinterprets these forces as changes

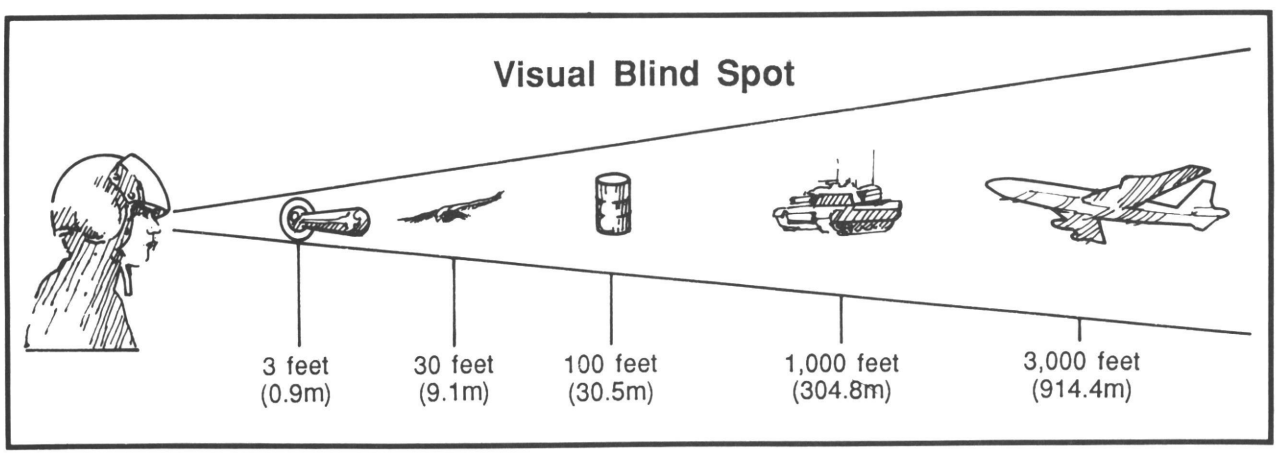


FIGURE 6: The night blind spot can conceal surprisingly large objects.

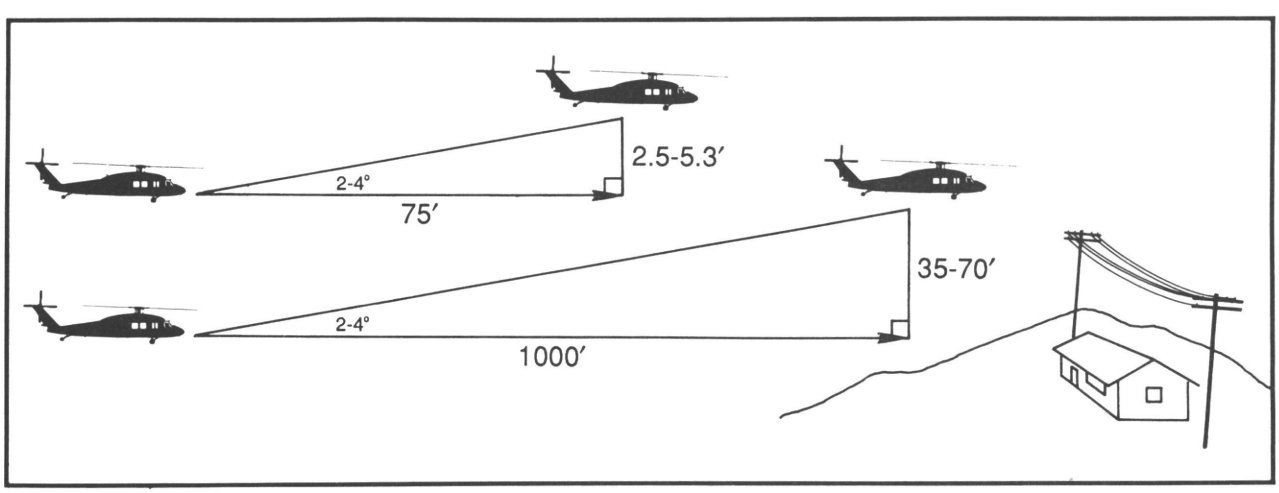


FIGURE 7: The dip illusion—normally the vertical separation between lead and trail aircraft in contour flight is acceptable (top pair of aircraft). When following at a greater distance, but using the same visual cues, the trail aircraft is much lower than anticipated.

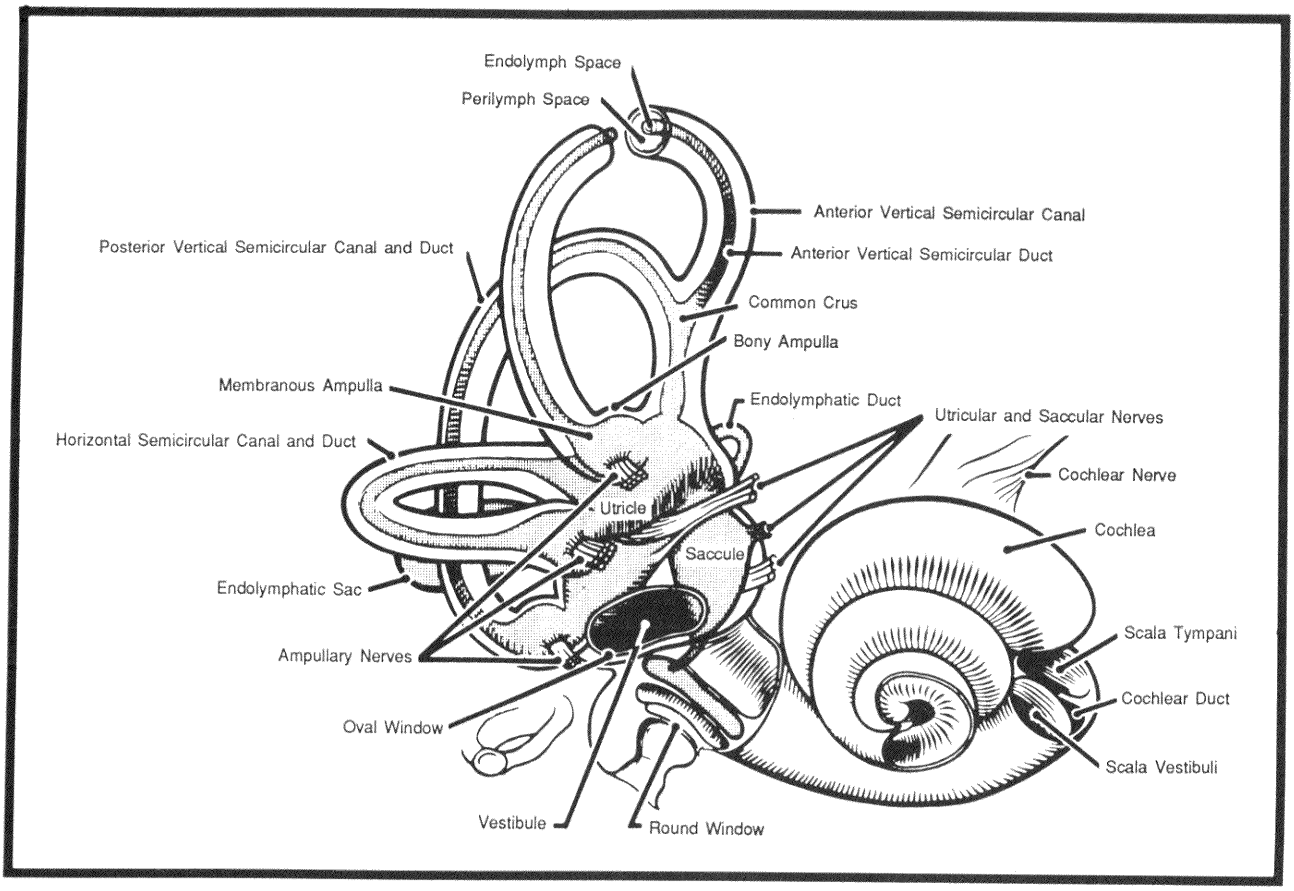


FIGURE 8: The human vestibular system. The utricle and saccule make up the otolith organs.

in the direction of acceleration. In air combat, this is most likely to occur when the pilot directs his attention inside the cockpit (to adjust radios or activate weapons, for example), thereby changing the direction of the perceived gravity vector, particularly when the aircraft is pulling Gs.

Coriolis illusion. If the pilot maintains a turn for a time and then suddenly moves his head, the fluid movement inside the semicircular canals of the inner ear is rapidly changed from canal to canal. This can give the pilot a strong sense of roll, pitch and yaw (figure 8).

Since helicopter air combat will usually occur under visual meteorological conditions (VMC), these vestibular illusions can be controlled by regaining an awareness of the location of the horizon. However, these vestibular traps have caused accidents in VMC, and should be remembered. Sudden head movements are a natural part of aircrew actions in the cockpit, but may be disorienting, especially at night.

Proprioceptive Factors

While on the ground, we receive constant input from sensors in our muscles and skin. These sensors subconsciously inform the brain of limb position and body forces; they become unreliable in flight (especially ACM) because the gravity vector can change so quickly. Don't rely on "seat of the pants" flying for orientation cues (figure 9).

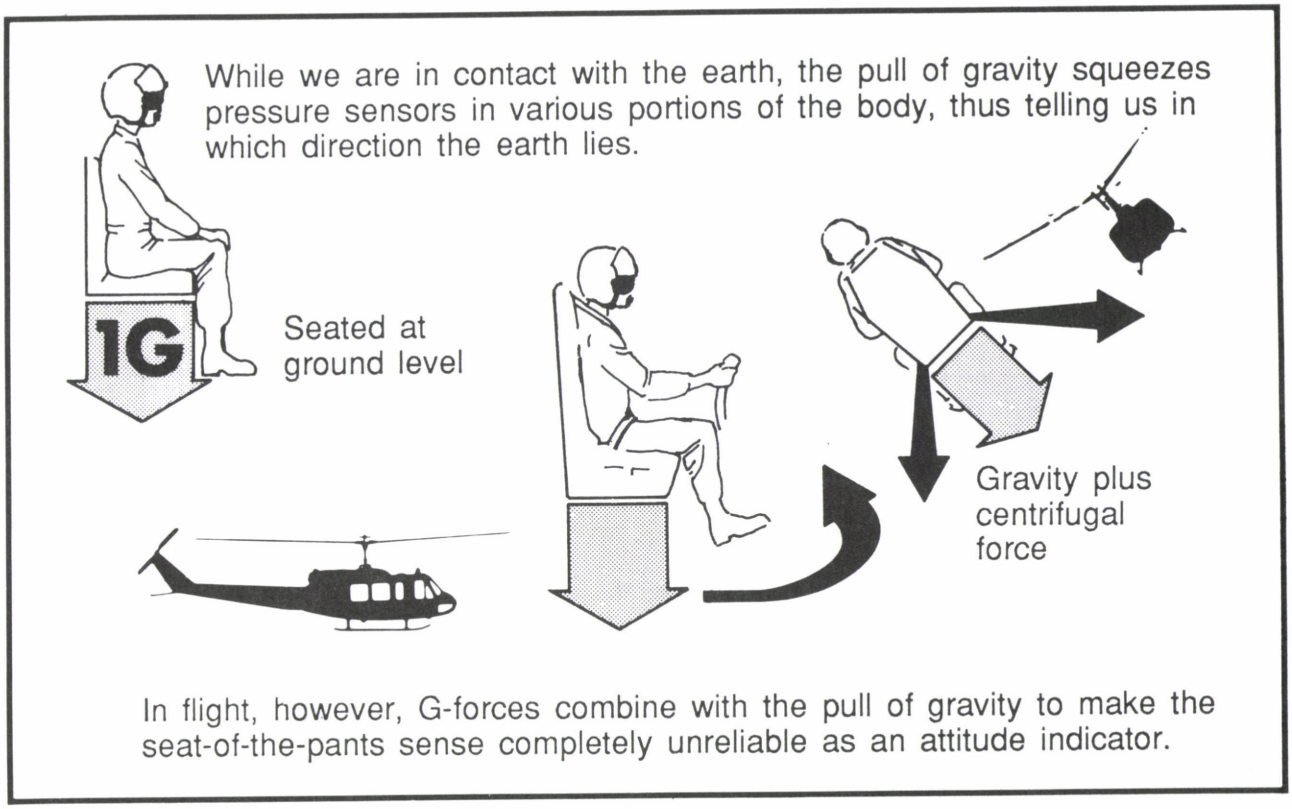
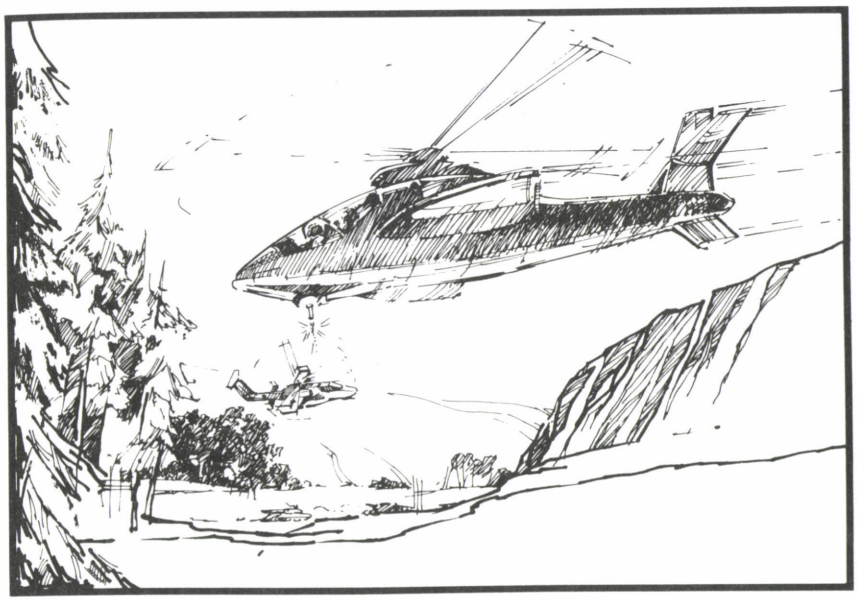


FIGURE 9: Proprioceptive illusions of flight.

FIGURE 10: Pilot fixation on target is probably the most deadly hazard to helicopter air combat.



BEHAVIORAL FACTORS

Target Fixation

Probably the most deadly perceptual hazard in rotary-wing air combat is target fixation or fascination. This occurs when aircrewmembers ignore orientation cues and focus their attention exclusively on the target. A pilot may become so intent on pursuing an opponent that he loses awareness of the horizon and altitude. In helicopter ACM, there is little margin for error. Maintain situational awareness!

Workload

Today's modern combat helicopters require more and more brainpower of the pilot. During air combat, it is easy to become

task saturated, particularly when the battle isn't going well. Imagine trying to assess damage to the helicopter systems, the copilot and yourself simultaneously—all while maintaining visual contact with the enemy as well as the ground.

Crew Endurance

It is well recognized that performance is degraded by fatigue, and air combat is very tiring indeed. Many helicopter pilots report that the combination of high workload and repetitive low-level Gs make ACM the most demanding type of flying. Current recommendations from the U.S. Army Aviation Center, Ft. Rucker, AL, specify that a crew fatigue factor of 2.0 should be used in computing flight time restrictions.

Ego

In the past, Army aviators usually have been matched against either stationary targets or moving targets controlled by nonaviators. All of this changes with the arrival of air combat training. Pilots will practice and compete against their peers—and then analyze their mistakes in excruciating detail during an afterbrief. This type of flying tempts the naturally competitive aviator to go beyond what is prudent and safe to accomplish the mission—in this case, to kill the other aircraft. Commanders must ensure that a healthy and safe training environment is maintained; this must be constantly stressed to pilots. (In current air combat training, the maneuver limitations are 30 degrees pitch-up, 30 degrees pitch-down and a 60-degree angle of bank.) While nobody wants to discourage competitiveness, aggressiveness or a healthy aviator ego, remember that the probable kill of an impact with the ground is 100 percent, much worse than any opponent an aviator will ever face.

Cockpit Coordination

Studies have shown that a majority of problems with aircrew performance are due to breakdowns in crew coordination, not to a lack of technical knowledge and skill. In the air combat environment, this will be particularly important. Pilots will be shifting their attention rapidly in and out of the cockpit, with little margin for error. Crews should understand their cockpit communication responsibilities before the mission. Several instructional packages are in use, both in military and civilian aviation, that can help pilots improve their cockpit coordination; this instruction should be a part of air combat training.

CONCLUSION

Although the role of helicopter air combat in Army tactics is problematic, certainly at least some, and probably many, rotary-wing pilots will be taking advantage of the increased agility and maneuverability afforded by today's high-performance helicopters. It is essential that these rotary pilots understand the potential hazards of this mode of flight.

Commanders, flight surgeons, standardization personnel and instructor pilots should ensure that adequate safety measures are taken during air combat training. They also should ensure that pilots performing helicopter ACM are aware of the physiology of G forces, and the perceptual and behavioral pitfalls of this type of flying.

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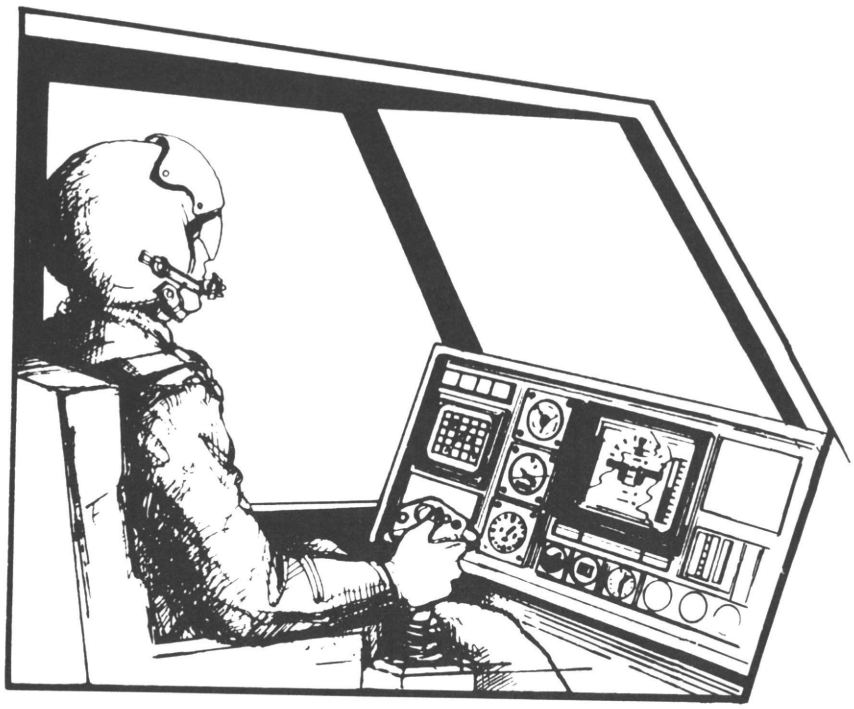

EXTENDED OPERATIONS AND SOLDIER JUDGMENT:

A HUMAN-SYSTEM DESIGN CHALLENGE

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THE NEED FOR including human engineering in the development of military systems has always been intuitive and a part of major systems acquisition. Further, the U.S. General Accounting Office continues to promote the growth of human engineering efforts in the military. However, earlier system complexities and operational requirements were well bounded, which meant that system designers could rely on the adaptive and accommodative capacities of the soldier.

Presently, operational requirements and technological potential have been growing exponentially. In the context of current and evolving system acquisition practices, those who buy military systems must be aware of and sensitive to the needs and expectations of the soldier. This awareness and sensitivity can be realized only through an understanding of system deficiencies directly related to the limitations in human-system design.

Intelligent systems

Clearly, technological innovation is changing the way the military services conduct business.

Tactical systems are becoming much more sophisticated in many ways, including—

- Flexibility in addressing a more variable threat spectrum.
- Detecting and classifying potential threats at greater distances.
- Capability to deliver a greater ordnance payload with high precision.

Much of this sophistication lies in the system's ability to preprocess large amounts of the available tactical data and then present summary information to the soldier for action.

Futuristic combat systems are likely to exploit and integrate into final tactical solutions the information about the soldier's experience, training and ability for abstract and judgmental reasoning. These futuristic systems will elicit and use the information from the decision maker as a resource to complement machine solutions to tactical problems.

Current systems are now freeing the soldier from many of the manual control tasks once central to their operation, such as targeting. They have instead replaced these tasks with those that put a high premium on the cognitive abilities of the soldier. Intelligent systems are requiring more intelligent soldiers. It is likely that the judgment and decision making skills of the future soldier will become more critical than ever.

Human limitations—fatigue and performance

Realistic scenarios often will necessitate that operators perform their duties for extended periods or in sustained operational settings. From a design perspective, this translates into need for flexible systems that adjust to a variety of tactical problem configurations. It also means that the systems need to accommodate to changes in the physiological and psychological state of the operator as well.

Research has clearly demonstrated that an operator's ability to perform tasks over time varies considerably. As tasks become more complex and difficult to perform, the effects of time engaged in performing the tasks become more profound.

The early Walter Reed Army Institute of Research studies showed that, as subjects become fatigued or sleepy, the *rate* at which they perform tasks becomes greatly reduced. This observation led to the formation of the "lapse hypothesis," which argued that when subjects become fatigued, a kind of mental lapse would overcome them. This lapse would force them to stop performing a task until the lapse had passed. This hypothesis, in part, explains why missed signal detections occur more frequently in surveillance and other vigilance tasks the longer an operator has been on duty.

In these early Walter Reed studies, researchers examined the effects of fatigue on primarily analytical kinds of tasks: these tasks could be characterized as having either right or wrong answers.

For example, the mental addition of a set of numbers yields one and only one correct answer. No matter how close a person is to the right answer, it is still not correct. The characteristic of having a very precise and absolute task solution underscores the deterministic nature of such tasks. (For example, 2 and 2 always equals 4 and nothing else.) The manifestation of fatigue in tasks, like mental addition, was a significant reduction in the rate at which the tasks were performed. In other words, fatigue caused the people to slow down during the performance of these tasks to maintain task accuracy.

On the other hand, tasks that require using probabilistic information (inference tasks) appear to generate a different response profile as a result of fatigue. These tasks most closely resemble the

process of making judgments in operational situations that are often ill-defined and uncertain. This class of task is nondeterministic in nature, having a range of acceptable problem solutions, some better than others.

Preliminary findings from decision research indicate that subjects performing probabilistic tasks during extended operations—

- *Do not* reduce the rate in which they perform the tasks when fatigued.
- Become less and less accurate over time.
- Believe after testing they performed tasks very well.

These findings bring up some interesting and difficult issues for design engineers. It may be true, indeed, that judgment and decision making behaviors significantly change as a function of time-on-task and that these skills are becoming critical to optimal system performance. If so, the designer must understand their dynamics.

In addition, assessing operator fatigue during the performance of judgment and decision making tasks may prove difficult. Operators do not appear simply to become slower at performing such tasks when fatigued, even though their performance deteriorates over time.

Future implications

One may argue that tactical systems are becoming easier to operate from a *manual-control* viewpoint. On the other hand, it is clear that these same systems are becoming more difficult to operate from a *cognitive-control* viewpoint. It is likely that the soldier's skills at being a "good judge" or "good decision maker" will mean the ability to make sense out of an uncertain, high-risk, rapidly evolving tactical scenario. This task will be made easier through the interaction with "intelligent" systems that can assist in interpreting the operational environment.

It is crucial that system designers recognize that the cognitive abilities of the soldier vary over time. Designing a system with the ideal soldier in mind may doom the system in application, because a soldier's critical performance occurs during combat. An ideal soldier is one who is well rested, alert, in perfect health and is maintaining a constant level of performance. During combat, the soldier is not well rested, encounters many forms of stress, and is possibly injured. His performance is changing as a function of these and other dimensions.

Combat system design is a critical task that requires careful and deliberate assessments of the total environment. Complete machine solutions to very difficult tactical problems are unlikely. Therefore, the soldier's experience, judgment and capacity for integrating diverse informational elements will be necessary. Both extended operations and highly advanced combat systems mean that new and challenging problems face design engineers and human factors professionals.

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DIOPTER FOCUS ADJUSTMENT OF APACHE IHADSS

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THE U.S. ARMY Aeromedical Research Laboratory (USAARL), Ft. Rucker, AL, recently conducted an anonymous questionnaire survey of 58 Ft. Rucker AH-64 Apache instructor pilots. Many of the pilots registered at least one visual complaint (visual discomfort, headache, blurred vision or disorientation) occurring at least occasionally while flying or after flying the Apache. Many of their comments indicated that symptoms occurred during long flights and/or flying with out-of-focus display symbology.

Since we suspected that Apache aviators might be using an improper procedure for focusing the helmet-mounted display (HMD) using the dioptric adjustment, as a second part of our study we went to the flight line and measured the HMD dioptric settings that 20 Apache pilots made using whatever procedures they normally use before departure. The results confirmed our initial suspicions. The desired focus setting should have been 0 or, at most, a low amount of negative dioptric power. However, we found that the range of pilot dioptric settings was 0 to -5.25 with a mean of -2.28. The positive focusing effort (accommodation) by the eyes to offset these relatively large negative HMD dioptric settings is likely a major source for headaches and

visual discomfort during and after long flights. When we demonstrated the proper HMD focus adjustment technique to three pilots and had them repeat the procedure, the repeat focus settings for all three were between 0 and -1 diopter. The focusing procedures that our aviators apparently had been instructed to use were in error, because they forced the pilot to use excessive levels of eye accommodative effort to overcome the negative HMD setting.

Ideally, no accommodative effort should be induced, which is the same condition as when the eyes are viewing distant objects. This is accomplished by initially setting the diopter ring to the full-plus position. Unfortunately, there are no markings on the HMD to indicate this position. Therefore, to adjust the HMD to full plus, turn the ring, with the integrated helmet and display sight subsystem as worn, fully counterclockwise (cathode ray tube (CRT) backed all the way out). The imagery will appear blurred. Then turn the ring slowly clockwise until the raster lines (gray scaly center line) *first* appear in sharp focus and *stop*. Further clockwise rotation will not improve sharpness and will stimulate your eyes.

It is also important to have the correct mental set. Do not assume that, since the CRT face is close to the eyes, you have to focus into the HMD to see it clearly. To assist in having the image in clear focus when the eyes are relaxed for infinite focus, look out the windscreen at the most distant object available when making the diopter adjustment. Again, the proper adjustment procedure is to rotate the ring into plus power (counterclockwise), reduce the power until you first obtain a clear image, and stop. *Do not* rotate the ring further as this will almost always leave the HMD adjustment in a position that will stimulate your own accommodation away from the relaxed distance focus.

If you are an Apache pilot, you can help us determine whether these suggestions are helpful. Compare your visual comfort when the diopter focus adjustments were made as described above versus with the method you had previously used. You can provide feedback to us at USAARL by calling Dr. Isaac Behar or Mr. Clarence E. Rash at AUTOVON 558-6813/6814. Incidentally, in a third part of our study, we gave 10 high-time Apache pilots a thorough visual function evaluation. All came through with flying colors.

MANP

Manpower Personnel Integration (MANPRINT) Staff Officer Course (MSOC) and

THE PURPOSE of MANPRINT training is to prepare military and civilian personnel to integrate manpower, personnel, training, human factors engineering, health hazards and system safety considerations throughout the materiel development and acquisition process. The 3-week MSOC course is directed toward action officers. The 1-week MSTC course is directed toward individuals who manage the acquisition process. Participants are recruited from the U.S. Army Materiel Command (AMC) and the U.S. Army Training and Doctrine Command (TRADOC), other services and industry.

The MSOC is designed for Active Army officers (01 through 04), warrant officers, noncommissioned officers (E7 through E9), civilians (GS-07 through GS-13) and industry representatives. Typical attendees are assigned, or on orders, to a combat development, training development, materiel development, Department of the Army Staff materiel acquisition staff officer position, or industrial assignment in a MANPRINT functional area.

The MSOC training schedule at Ft. Belvoir, VA, for FY 1990

22 Jan 90 — 9 Feb 90

5 Mar 90 — 23 Mar 90

2 Apr 90 — 20 Apr 90

30 Apr 90 — 18 May 90

4 Jun 90 — 22 Jun 90

9 Jul 90 — 27 Jul 90

RINT TRAINING COURSES

MANPRINT Senior Training Course (MSTC) have openings

The MSTC is designed for TRADOC/AMC senior leadership general officer (GO)/senior executive service (SES) positions, senior managers of industry, Active Army officers (04 through 06) and civilians (GS-13 through GM-15) assigned to a combat development, training development or materiel development position.

The MSTC is hosted by a TRADOC or AMC command. The first day of the course is attended by TRADOC/AMC senior leaders (GO/SES) and their primary staff. The host commander and TRADOC/AMC counterpart commander are leading the system workshop. They are emphasizing MANPRINT implementation, using actual system development, materiel change and procurement examples for an ongoing or recently completed acquisition program at the proponent agency or school (host command).

The MSTC training schedule for FY 1990

9 — 11 Jan 90	**Ft. Belvoir, VA**
12 — 16 Feb 90	**Ft. Leonard Wood, MO**
19 — 23 Mar 90	**Picatinny Arsenal, NJ**
16 — 20 Apr 90	**Ft. Huachuca, AZ**
14 — 18 May 90	**Ft. Monmouth, NJ**
18 — 22 Jun 90	**Ft. Lee, VA**
23 — 27 Jul 90	**Natick, MA**

For additional information, write U.S. Army Soldier Support Center, National Capital Region, 200 Stovall Street, Alexandria, VA 22332; or call Captain John M. Lucas, chief of the MANPRINT Training Office at AUTOVON 221-2098 or Commercial 202-325-2098.

Wearing Walk-Around Restraint Harnesses

Only two walk-around safety harnesses are approved for use in Army aircraft: Harness Assembly, Aircraft Safety Personnel Restraining, national stock number (NSN) 1680-00-169-0656, part number 1680-EG-033; and the Safety Vest Assembly, Hoist Operator, NSN 1680-00-982-9973, part number 214-070-321-101 or AL 1010-1.

The Harness Assembly, known as the gunner's restraint or monkey harness, has parachute harness-type construction with no incorporated mesh vest. It has two shoulder straps that connect to the center of the waist strap by a parachute ejector snap. It also has two leg straps that connect to the waist strap with parachute ejector snaps.

The Safety Vest Assembly has the full upper torso mesh vest with four front strap-and-snap closures. It also has two leg straps with adjustable buckles.

In 1987, the Safety Vest Assembly was mistakenly procured by using an unapproved configuration according to part number AMTC-SV-101 that used the original NSN 1680-00-982-9973, reference aviation life support equipment message 87-10. The user can identify this unapproved version of the hoist operator's vest. It has a reduced amount of mesh vest material and only one front (chest) closure located low on the torso when closed. Because of the low mounting of the single front strap, part number SV-101, the user can fall out of this harness when leaning or bending. Restraint harness users should ensure they do not use the SV-101 part number.

Aircrew personnel must ensure they wear the restraint harness with the correct NSN and part number and that the vest fits properly. They must wear harnesses over all flight clothing/survival vests and armor. Wearing these harnesses under this equipment may impede or prevent safe egress from aircraft.

Users must attach the restraint harness pigtail to an aircraft tie-down fitting. This fitting must support the aircrewmember's weight plus any gravity (G) forces acting upon the aircraft in flight or during an accident. This of course can be almost impossible to figure out. No one can predetermine G forces before an accident and aircrews do not exceed the aircraft operational limitations. Therefore, a good rule of thumb: any tie-down fitting with a rating of 1,000 pounds in all directions normally will be adequate to provide safe restraint

to aircrewmembers. There is, however, a "catch-22." Therefore, aircrews **must** know their aircraft operator's manual cargo tie-down data.

Figure 6-11 in the UH-1H/V operator's manual shows all floor tie-down fittings are good for 1,250 pounds vertical, but *only* 500 pounds in other directions. Therefore, UH-1 Huey floor tie-down fittings are not acceptable for harness use. One could use more than one pigtail, but this impedes egress by giving the user one more item to unlatch before set free. On the other hand, bulkhead tie-down fittings in the UH-1 are acceptable for restraint harness use. It cannot be overemphasized that soldiers know the tie-down fitting data for their aircraft.

The other important safety item on the restraint harness is to ensure the pigtail snap hook has the safety pin installed according to Technical Manual 55-1500-204-25/1, *General Aircraft Maintenance Manual,* paragraph 1-154D(2d), and figures 1-13, 1-14 and 1-15, pages 1-60 and 1-62 in change 37. This is the snap hook that attaches to the tie-down fitting.

Point of contact is Mr. Jim Dittmer, AMCPM-ALSE, AUTOVON 693-3573, or Commercial 314-263-3573.

If you have a question about personal equipment or rescue/survival gear, write PEARL'S AMC Product Management Office, ATTN: AMCPM-ALSE, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798 or call AUTOVON 693-3573 or Commercial 314-263-3573.

U.S. Army Class A Aviation Flight Mishaps

	Number	Flying Hours	Rate	Army Fatalities	Total Cost (in millions)
FY 89 (through 31 January)	9	474,705	1.90	9	$36.0
FY 90 (through 31 January)	11	475,008*	2.32	11	$50.1

*estimated

AVIATION MEDICINE REPORT
Office of the Aviation Medicine Consultant

Where Have All the Flight Surgeons Gone?

As the course director for the Army Flight Surgeon Primary Course at Ft. Rucker, AL, since April 1987, I have noted an alarming trend in Army Aviation medicine. The following article examines the effect of the loss of individual flight training upon the numbers and quality of flight surgeons being produced.

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The opinions expressed in this article are those of the author and do not necessarily reflect the views of any Department of Defense agency.

CAREER MANAGERS at the U.S. Total Army Personnel Command have a difficult task to recruit and retain physicians. Reasons for poor physician recruitment and retention are many: noncompetitive salary, inadequate administrative support, inadequate nursing support and slow career progression.

Flight surgeons have been the exception. In the recent past, there were as many flight surgeons as the Army Medical Department would allow, and the Army Flight Surgeon Primary Course (AFSPC) had many more applicants than training positions.

Today the situation has changed. Applications for the AFSPC are at the lowest point since 1983. For the first time ever, young physicians are being *forced* to become flight surgeons! Individual unit aviators and commanders will soon see involuntary flight surgeons at the unit level. Aviation medicine was once a popular primary care specialty; now the Army cannot recruit enough physicians to fill an AFSPC class. What could have caused such a significant shift in motivation? LOSS OF FLIGHT TRAINING!

To understand the devastating effect the loss of flight training has had on aviation medicine, consider the following scenario. You are a successful doctor practicing in your hometown. Being a patriot, you are also the doctor for the local Army National Guard unit. In considering whether or not to attend the AFSPC, you will weigh several factors:

- What will attendance cost me? The AFSPC weeks. Absence from my practice for 6 weeks result in about $16,500 in lost income

(according to the American Medical Association's book, *Physician Marketplace Statistics, 1988).* I will also lose income from patients who will switch physicians in my absence; office staff who must be paid despite my absence; and the expenditures office and equipment that accrue whether I am there or not. Do I want to sustain such financial losses? No!

- Will the AFSPC enhance my military career? Perhaps.
- Will the AFSPC improve my civilian practice? No.
- Do I want to be separated from my family and friends for 6 weeks? No!
- How about my yearly vacation? I probably won't be able to afford one after 6 weeks at Ft. Rucker. Will my family appreciate no vacation this year? No!

The "No's" obviously are overwhelming.

If an additional consideration is: Do I want to learn to fly an Army helicopter? The response: **ABSOLUTELY**!

The active duty physician has reasons not to become a flight surgeon as compelling as those of the Reserve Component doctor just mentioned. One of the biggest negative considerations is an 18-month commitment incurred by course attendance. Again, the additional incentive of learning to fly an Army helicopter seems to make all adverse considerations fade into insignificance.

When budget cutters eliminated the flight training portion of the AFSPC, they never imagined the severe consequences that Army Aviation is now encountering. In the most recent AFSPC, there were four physicians who did not want to become flight surgeons. These doctors agreed to attend the AFSPC only after being threatened with an assignment more undesirable than that of a flight surgeon.

The flight surgeon's job is a demanding one. Many nonclinical, yet essential, activities must often be completed during off-duty time: flight line hazard inspections; in-flight observation of aircrewmembers; review of the medical portion of the preaccident plan; knowing contingency plans; and participation in unit physical training and social functions.

The conscripted flight surgeon may avoid any activity that must be done outside of routine duty hours and do only what is strictly required. How many aircraft and aircrewmembers' lives must be lost before the budget cutters realize the false economy of eliminating flight training from the AFSPC?

The elimination of flight training has not only affected recruitment of physicians into the specialty of aviation medicine; the loss of that training has also degraded the quality of the average course graduate. Consider the type flight surgeon you want making aeromedical decisions about your flying career. The AFSPC student now experiences aviation from a passenger's perspective. Even an experienced passenger has little appreciation for the complex tasks that an aviator performs to complete a mission safely. Do you want a passenger making decisions regarding your fitness to fly? With elimination of individual flight training from the AFSPC, aeromedical decisions are now made by passenger flight surgeons.

Flight training for flight surgeon students is absolutely essential to ensure that Army Aviation medicine attracts the brightest and the best physicians that the Army has to offer. For our flight surgeons to make sound aeromedical decisions, they need flight familiarization training, which will give each an aviator's perspective of aircraft operations. A passenger's perspective is inadequate and invites faulty aeromedical decision making. Army Aviation will experience a steady decline in the quality of the "typical" flight surgeon until an incentive and training vehicle equal to individual flight training is returned to the AFSPC.

The Aviation Medicine Report is a bimonthly report from the Aviation Medicine Consultant of TSG. Please forward subject matter of current aeromedical importance for editorial consideration to U.S. Army Aeromedical Center, ATTN: HSXY-ADJ, Fort Rucker, AL 36362-5333.

Come Now, A Productive Field Training Exercise?

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ACCORDING TO Field Manual 25-100, *Training The Force,* a field training exercise is a high-cost, high-overhead exercise conducted under simulated combat conditions in the field. Senior noncommissioned officers (NCOs) from the U.S. Army Aviation Logistics School (USAALS), Ft. Eustis, VA, met in May 1988 to discuss this premise and speculate on beneficial alternatives.

What if USAALS could develop a shared training field exercise? It would provide leadership positions for the Aviation Logistics Advanced Noncommissioned Officer Course (ANCOC)/Basic Noncommissioned Officer Course (BNCOC) student. The exercise would also provide opportunity for the Career Management Field 67 advanced individual training (AIT) students. Then they could actually erect tents, operate field stoves, use camouflage netting systems and run a wire communications network.

The ANCOC/BNCOC students occupy company-level leadership positions from first sergeant through shop chief/team leader. They also supervise the setup of the company area by the AIT students.

What if this shared-training field exercise provided the AIT students the opportunity to perform actual maintenance on category A and category B aircraft? This would reinforce the military occupational specialty (MOS) skills learned in the school. *What if* it also provided the instructors with a vehicle to evaluate student ability? *What if* it at the same time instilled self-confidence in the soldier and upgraded the quality of the training aircraft in the school?

The USAALS shared training field exercises, implemented in October 1988, made all this possible. The exercises commenced with a scenario that encompassed MOS reinforcement training, creature comfort and field survival. The aviation unit maintenance scenario began in January 1989. AIT students performing aviation maintenance is premised on them receiving most academic instruction before the exercise. Also, they can perform aviation maintenance during the exercise as well as when they arrive at the receiving unit.

The AIT students, supervised by ANCOC/BNCOC students and subject matter experts, have successfully completed *5,313* man-hours of aviation unit level overflow maintenance on trainer aircraft. Had this overflow maintenance gone to the contractor, it would have cost USAALS an additional *$154,135* during fiscal year 1989.

Exercise topics to better prepare students to function in a field environment are as follows: field safety; survival in a nuclear, biological and chemical environment; aircraft maintenance in a field environment (do it safer, accurately and cleaner); setup of the general purpose medium tent; operation of field stoves (potbelly and Yukon); area or equipment camouflage; and use of field phones.

Plans for the USAALS shared training field exercise include upgrading the field site and equipment to aviation intermediate maintenance standards. Plans also include developing and implementing a battle damage assessment reaction course. This course will challenge the NCO student to find and assess the status of a downed aircraft, then assemble a multiskill level team and take corrective action. Also under review is the incorporation of students from the aviation officer courses on Ft. Eustis into the scenario.

The bottom line: today's aviation maintenance AIT soldier receives superior training at a lower cost.

A Drama Needing A Happy Ending

Mr. Fred Kersey
Directorate for Maintenance
U.S. Army Aviation Systems Command
St. Louis, MO

A LONE U.S. ARMY helicopter on a cargo mission encountered engine trouble and crashed in a remote outside continental United States (OCONUS) location at 1737 hours on 10 January 1987. Only a few injuries and no fatalities occurred. The aircraft, however, was severely damaged and could not be flown. The operating unit retrieved the aircraft back to the host base. Two years later, however, the unit rotated back to its parent organization in CONUS *leaving the aircraft behind.*

A dilemma, yes! Why after 2 years was the damaged aircraft still there? What should have happened? What is needed for the future? From our vantage point at the National Maintenance Point, this dilemma is a too frequent and common occurrence—and an unnecessary one.

My organization is the Depot Operations Division in the Directorate for Maintenance at the Aviation Systems Command (AVSCOM). The division is tasked to plan, fund, arrange for and oversee the depot-level overhaul and repair of Army aircraft to include crash-damaged aircraft. In past years, the repair of crash-damaged aircraft, such as the UH-1 Huey, did not present the critical problem as it does today. Parts were plentiful and comparatively easy to fix. The Corpus Christi

How do we prevent neglected, damaged aircraft?

Army Depot (CCAD), TX, could repair these aircraft by using basically 1950s technology. Also, the Army had enough aircraft to replace those lost to the operating unit. These basic steps show how to fix crash-damaged aircraft:

- Predict annually how many crash-damaged aircraft to repair within a year.
- Include necessary funding to repair the aircraft in the Command Operating Budget of AVSCOM.
- Remember that CCAD can normally meet the needs of repair and overhaul. CCAD includes these requirements in its annual repair programs.
- Begin aircraft repair as funds become available and depot schedules permit.

Seldom was there a need to establish an alternate plan for an Army or commercial facility to do the repair. Today, the picture has changed and here are a few reasons why:

- Highly complex aircraft resulting from technological advancements in aircraft design and performance.
- Increased costs for repair and overhaul of aircraft and their complex systems.
- Reductions in our organic depot maintenance capability and capacity due to economical factors and availability of technical repair data.

Army Depot Versus Commercial Repair

Despite these realities, the repair of crash-damaged aircraft is a top priority. When the organic depot cannot absorb the total repair and maintenance requirement, the division looks to competent commercial facilities to accomplish some of the work. The frequent lack of technical data on newer aircraft caused the division to become dependent on sole-source contracts of the original manufacturer for certain repair work. Today, under the Competition In Contracting Act of 1984, the division has goals to increase the number of programs designated for open or limited competition. Otherwise, it must completely justify a sole-source contract.

One accomplishment under this goal was the recent competitive breakout award of a 3-year minimum/maximum contract to cover the UH-60 Black Hawk helicopter. This award is expected to be a clear-cut advantage toward timely support of crash-damaged helicopters. Also, AVSCOM expects bids for a major UH-1 helicopter retirement contract soon. This contract will eventually allow for more space at CCAD for repair of newer CH-47 Chinook, AH-64 Apache and UH-60 helicopters.

The Depot Operations Division is committed to give crash-damaged aircraft the advantages of improved organic depot effectiveness. The division also has goals for expanded competitive contracting. To achieve this expanded competition, the division works with engineering, product assurance and technical publication elements of AVSCOM. These efforts also help to prepare the organic depot for new and technically advanced work.

The Neglected Aircraft

What should have been done to take care of the aircraft and why wasn't it done? For reasons unknown, the unit or its parent organization did not or was unable to follow published guidelines in obtaining disposition instructions for damaged

aircraft. Soldiers should have prepared an Estimated Cost of Damage (ECOD) Report, using a DA Form 2404, Equipment Inspection and Maintenance Worksheet. They submit this form according to Technical Bulletin 43-0002-3, *Maintenance Expenditure Limits for Army Aircraft*

The ECOD was 2 years overdue. In this instance, the ECOD did not arrive in the Depot Operations Division until the summer of 1989, more than 2 years after the accident. Normally, the ECOD is prepared and submitted immediately after accident investigation is completed. The Depot Operations Division is not equipped, however, to handle all the details in this regard for the unit or its supporting elements. It will, nevertheless, do everything it can to help, but first it needs to know the problem!

Paramount to this problem is the need to prevent further deterioration of the aircraft through delays in handling of the aircraft. In the case of this forgotten aircraft, the Depot Operations Division promptly acted with the AVSCOM Transportation Office, the owning unit and the host base commander for two items: first, the immediate shipment of the aircraft back to CONUS; and second, the inspection evaluation and a cost estimate of repair at a contractor's facility.

The division assumes that the operating unit with minimal staffing was unable to complete the ECOD. Additionally, the hectic nature of the pending transfer caused the delay in reporting of the damaged aircraft. Also, the division attempts to convey the critical need for early notification of crash-damaged aircraft directly to field units and through the AVSCOM Logistics Assistance Representatives (LARs). This allows the division to provide optimum response once the final ECOD is received from the field. In extreme emergencies, the division considers providing onsite assistance. This helps accomplish ECODs and provides immediate disposition instructions.

How To Obtain Assistance

ECOD preparation is necessary for reporting damaged aircraft beyond the repair capability of the aviation unit maintenance (AVUM) or supporting aviation intermediate maintenance/aviation classification and repair activity depot maintenance unit. The user should notify the LAR or AVSCOM for help. If necessary, depot maintenance personnel will help prepare the ECOD. Write to the Commander, AVSCOM, ATTN: AMSAV-MDP, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798; or call AUTOVON 693-3116, or Commercial 314-263-3116. The crash-damage program does not yet have, and may never have, a happy ending, but it improves each day. Through AVSCOM's commitment and partnership with the field, it will improve the crash-damage program.

The chief of Depot Operations Division sums it up this way: "In the world of maintenance, from AVUM to depot level, perfection is an elusive thing, never quite achieved. Therefore, we must work to do a little better each day."

FOR YOUR INFORMATION

Please print the telephone number change for the Aviation Systems Command Feedback Center, St. Louis, MO. AUTOVON 693-1758 or Commercial 314-263-1758.

The Aircrew Training Manual (ATM) Section at Aviation Training Brigade, Ft. Rucker, AL, has a 24-hour hotline to receive questions on ATM issues. An answering machine will record calls after duty hours. The number is AUTOVON 558-ATMI. POC CPT Robertson, chief, ATM Section.

Corpus Christi Army Depot, Corpus Christi, TX, began a 4-day, 10-hour workweek on 14 January 1990. The normal duty hours are 0700 to 1730 (Monday through Thursday) Central Standard Time.

All major maintenance and supply functions will be closed on Friday.

We strongly urge customer units have their transient crews arrive at the depot on Mondays to begin their inventories and inspections before the aircraft are in/out processed.

Captain Richard D. Koethe
3-115 Field Artillery
U.S. Army National Guard
Memphis, TN

The opinions expressed in this article are the author's and do not necessarily represent those of the U.S. Army Aviation Center nor the Department of the Army.

Employment of COPPERHEAD

A Tactical Scenario

"The Soviet tanks and BMPs filled the landscape like an avalanche. The enemy [NATO forces] was somewhere at hand but not to be seen. The British tanks were there all right, firing not directly from the flank but far back, in well-chosen positions behind low crests in undulating ground.

"Now the enemy's antitank helicopter gunships were coming in with their deadly guided weapons. These would zoom down, attacking the ZSU-23 air defense guns and missile launchers, and then withdraw to open the way into the defense for the fixed wing American A-10 Thunderbolts storming in with tremendous weapon fire, their swift and thunderous onslaught on tanks and BTRs followed up again by the helicopter antitank gunships. Armored vehicles in some numbers, whether tanks or BTR, fell victim to these attacks, but attacking aircraft suffered too. No sortie withdrew without explosions in the air and flaming wreckage left on the ground."[1]

THE SITUATION described is a fictitious one. The problem that vividly presents itself is the same as in any combat situation: how to maximize the destruction of enemy forces while reducing to the lowest extent possible losses to friendly forces and, finally, accomplish the assigned mission. Under the most ideal and optimistic force ratios that may occur, North Atlantic Treaty Organization (NATO) forces will be heavily outnumbered on the ground, face an opponent with numerous air defense weapons and be forced to maximize in every way possible all fire support means.

The introduction of the aviation brigade into the division, and more specifically the attack helicopter battalion, has given an enormous increase in firepower to the maneuver commander. *A key question arises, how can the field artillery best support maneuver?* In the context of providing supporting fires for a commander facing large numbers of enemy armored forces, one important consideration must be how to defeat the significant quantities of enemy air defense weapons to maximize the effectiveness of both attack helicopter and fixed-wing air assets.

The following is a discussion on one possible employment technique in a tactical environment by incorporating existing organizations and weapons systems in a specific manner.

Organization and Equipment

The concept being proposed will not require additional equipment or personnel to implement. Rather, the intent is to focus employment of all existing organizations and equipment to accomplish a specific goal—destruction of the enemy's air defense artillery (ADA) weapons.

The key players in this scenario are—

- Ground brigade commander and his subordinate battalion commanders.
- Attack helicopter battalion commander.
- 155 mm direct support (DS) battalion.
- Brigade and battalion fire support officers (FSOs).
- Fire support teams.
- Air liaison officers.
- Joint air attack team (JAAT) composed of—

-Attack helicopter company (AH-64 Apache or AH-1 Cobra with its aeroscouts).

-Air Force close air support (CAS) aircraft.

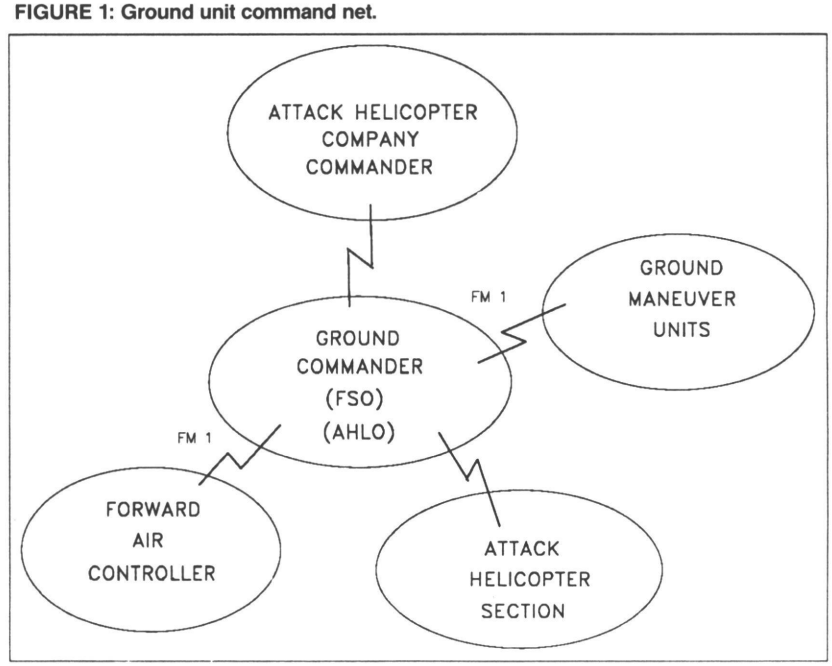
-Artillery fire support (from DS battalion to the ground brigade).

The only assumptions made for purposes of this discussion are as follows: existing fire support channels have been established and are being used; fire support personnel are present; attack helicopter and fixed-wing air support assets are available, and coordination between field artillery and aviation assets has been and will continue to be accomplished; plus limited quantities of the M712 Copperhead cannon-launched, guided projectile are onhand. The idea proposed is not new in terms of doctrine, but the intent is to emphasize the capability of all elements working in unison for a specific objective. In short, employ Copperhead against enemy ADA weapons to maximize the effectiveness of both Army and Air Force assets being employed in the battlefield air interdiction modes.

Communications

Two primary communications nets must be in place and operational—a ground unit command net and a JAAT/CAS command net, both of which are frequency modulated (FM). The ground unit command net is depicted in figure 1.

FIGURE 1: Ground unit command net.



1. General Sir John Hackett, *The Third World War: The Untold Story. New York, MacMillan, 1982, p. 139.*

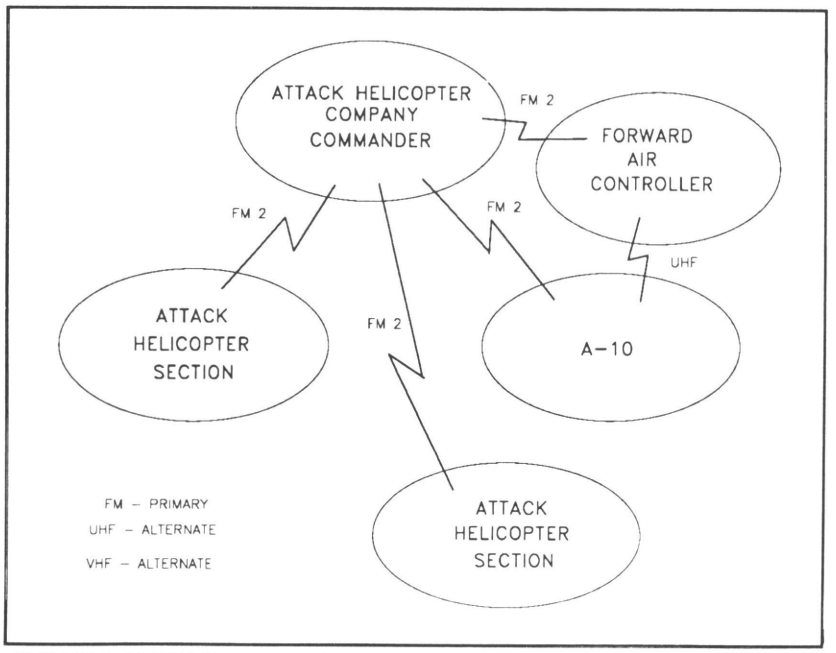


FIGURE 2: JAAT/CAS command net.

U.S. Brigade-Level Task Force

- ☐ Two mechanized infantry battalions (task organized).
- ☐ One armor battalion (task organized).
- ☐ One 155 mm self-propelled artillery battalion (direct support).
- ☐ One engineer company (direct support).

Soviet Motorized Rifle Division

- ☐ Three motorized rifle regiments equipped with 1 BMP (infantry combat vehicle) and 2 BTRs (armored transporters).
- ☐ One T-80 tank regiment.
- ☐ One artillery regiment.
- ☐ One antiaircraft regiment equipped with 16 ZSU-23-4s (Soviet antiaircraft self-propelled gun mounts) and 20 SA-6 Gainful SAMs.

FIGURE 3: A typical array of U.S. and Soviet forces.

Through this net, the ground maneuver commander is capable of both command and control (C^2) for all the important players that will be required to make the concept work. In particular, the attack helicopter battalion can coordinate effectively with the FSO located with the maneuver commander or with the aviation brigade.

With the JAAT/CAS command net depicted in figure 2, the attack helicopter battalion is capable of coordinating the actions of the various fire support and aircraft that are available. Field Manual (FM) 1-112, *Attack Helicopter Battalion,* stipulates that it would be preferable if Army very high frequency (VHF) is used; however, any Army frequency band can be employed if VHF is not present.[2]

The question may arise, why bother to address the issue? The answer is, simply because existing publications in fire support inadequately address the subject. FM 6-20, *Fire Support in the AirLand Battle,* talks about both Army aircraft and JAATs. On attack helicopters, the discussion centers on their capabilities and limitations.[3] The FM touches on use of responsive fires to support their use as follows:

"The commander must provide responsive fire support (from available air, ground, and sea resources) that protects and ensures freedom of maneuver with the enemy in deep, close, and rear operations."[4]

When attack helicopters *are* employed, continuous coordination is required. Concerning C2 for JAAT operations, FM 6-20 merely states:

"Upon receipt of a JAAT mission, the aviation commander assumes responsibility for the coordination and execution of the JAAT operations. He should be keenly aware of the ground and air tactical plan."[5]

Execution

The following is a straightforward scenario of how Copperhead could be used to support a maneuver commander in a combat situation. Once again, the concept is predicated on the fact that all fire support coordination agencies are in place and operational. The force array (figure 3) is typical of what may be faced by NATO forces in a defensive posture.

As the Soviet motorized rifle division enters the zone of the defending brigade-level task

force, forward observers located in the forward positions of the maneuver elements begin attriting enemy air defense systems, primarily ZSU-23-4s (Soviet antiaircraft self-propelled gun mounts) and accompanying surface-to-air (SAM) missiles (figure 4).

The most significant drawback to the use of Copperhead is the fact that the projectile and laser designation system is range dependent in terms of acquiring and tracking a target. As such, it is critical that these targets be preplanned to the maximum extent possible to determine the best firing positions for the batteries and locations for the observers.

With the advent of both the AH-64 and OH-58D Kiowa helicopters and the increased lasing capabilities of both systems (in some cases up to 200 percent more than ground lasing systems), this disadvantage is negated to a large degree. After ADA weapons have been destroyed, brigade and battalion FSOs, working in conjunction with the JAAT, will focus attention on the armor or motorized rifle elements of the Soviet first echelon.

When considering the application of Copperhead against a specific target-type, in this case ADA weapons, the principle of target value analysis and target priority must be applied. In this particular case, ADA weapons have been determined by the maneuver commander, in coordination with the fire support coordinator at the appropriate level, to be "priority targets." The rationale for this is that, with one Copperhead round, it is possible for an observer to take out one tank *or* one mobile ADA weapon that would pose a significant threat to low-flying (and relatively vulnerable) aircraft and

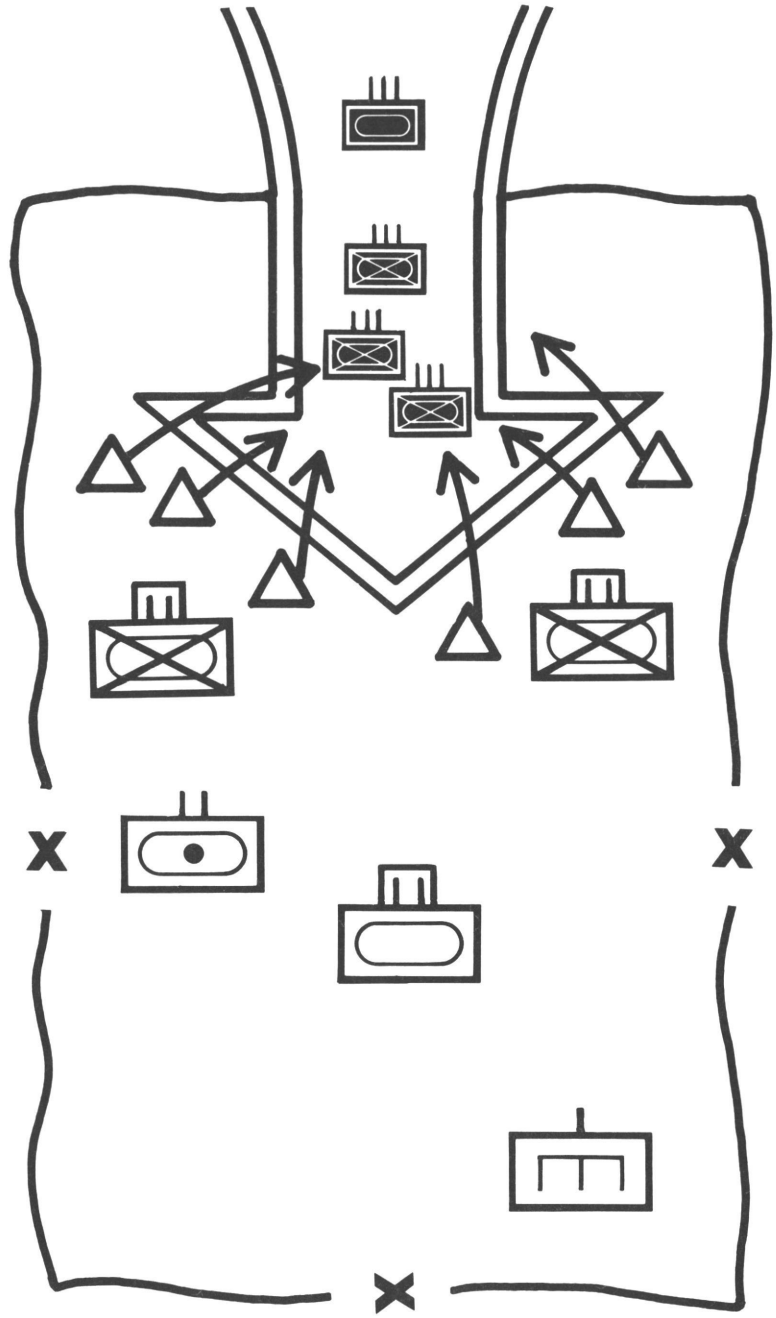


FIGURE 4: Maneuver elements attriting enemy air defense systems.

2. Field Manual 1-112, *Attack Helicopter Battalion,* Headquarters, Department of the Army, Washington DC, July 1986.

3. Field Manual 6-20, *Fire Support in the AirLand Battle,* U.S. Army Field Artillery School, Ft. Sill, OK, 1988, p. 2-14.

4. Ibid., p. 3-1.

5. Ibid., p. 2-15.

helicopters. Combining the effects of multiple observers against multiple ADA weapons in the enemy's first echelon would allow for most (if not all) of the mobile ADA weapons to be destroyed, thereby allowing the JAAT(s) greater unhindered access to massed armored formations.

The question that must be asked is, which target is more important? The answer, depending upon the situation, is both. There *will* be times when Copperhead *should* be reserved for armored vehicles. In this case the emphasis is on opening the way for the massive destructive power inherent in attack helicopters and aircraft. The intent in this situation is to make ADA weapons accompanying first echelon Soviet elements the *primary target* and focus a specific weapon against a specific type target for the maximum destructive power possible. The result of this particular scenario will be a higher target payoff than could be obtained if Copperhead were employed strictly against tanks or protected armored vehicles. Using this concept, Copperhead is employed against the *least protected element,* Soviet ADA weapons. By employing this technique, the enormous firepower of attack helicopters and ground attack aircraft units can be optimized against armor-type targets while a scarce resource, Copperhead, can be focused in a more directed manner.

In a more fluid tactical environment, either offensive or defensive, the same basic intent should be followed: focus Copperhead against ADA and allow the integration of attack helicopters and aircraft to be employed in a more protected environment. By combining the use of carefully planned and executed barrier and minefields (either conventionally emplaced or with field artillery to slow and channelize enemy forces), this concept will gain further effectiveness.

photo by Warren Weaver

The M712 Copperhead is a cannon-launched, guided projectile; a "bullet with a brain."

In practical terms, and by doctrine, it is an attack helicopter company commander who controls the JAAT. Strict coordination between the JAAT and field artillery elements is crucial for the success of this concept. Such coordination is already possible through the S3/air or FSOs, located with the maneuver elements, who talk with both maneuver and artillery units.

Results

The possible results that could be achieved by using this concept are enormous. Rather that one Copperhead round taking out one tank or armored personnel carrier (APC), that same round can be used to destroy an ADA vehicle that threatens aircraft. When and if doctrine must ever be put to the test, this fictional account could be reality.

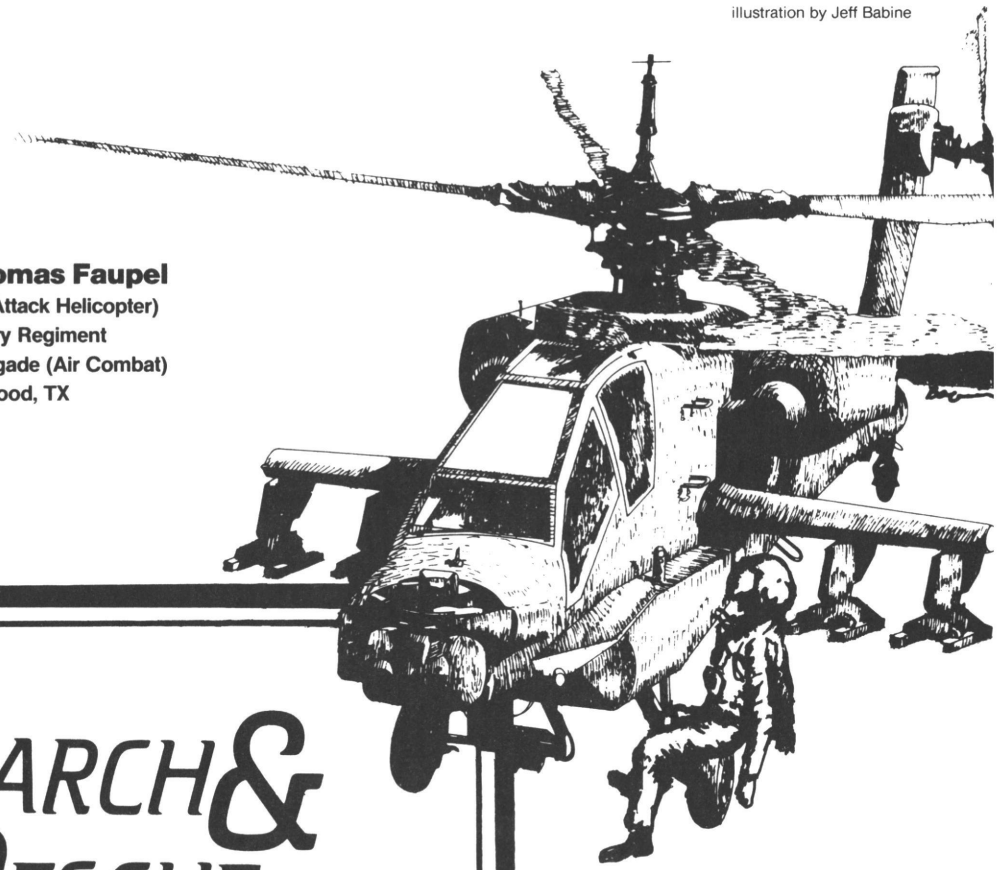
. . ."As for many another, this was to be Captain Nekrassov's last battle. His weakened battalion now came under heavy air attack from U.S. Apache antitank helicopters, operating with U.S. A-10 Thunderbolts, and as an organized fighting unit, was completely destroyed. Some of Nekrossov's men survived, but he did not care. He did not even know. By this time he was dead."[6]

6. Hackett, p. 175.

MONTHLY WRITING AWARD

Captain Thomas Faupel
3d Squadron (Attack Helicopter)
6th Cavalry Regiment
6th Cavalry Brigade (Air Combat)
Fort Hood, TX

illustration by Jeff Babine



SEARCH & RESCUE

IN THE DEEP ATTACK

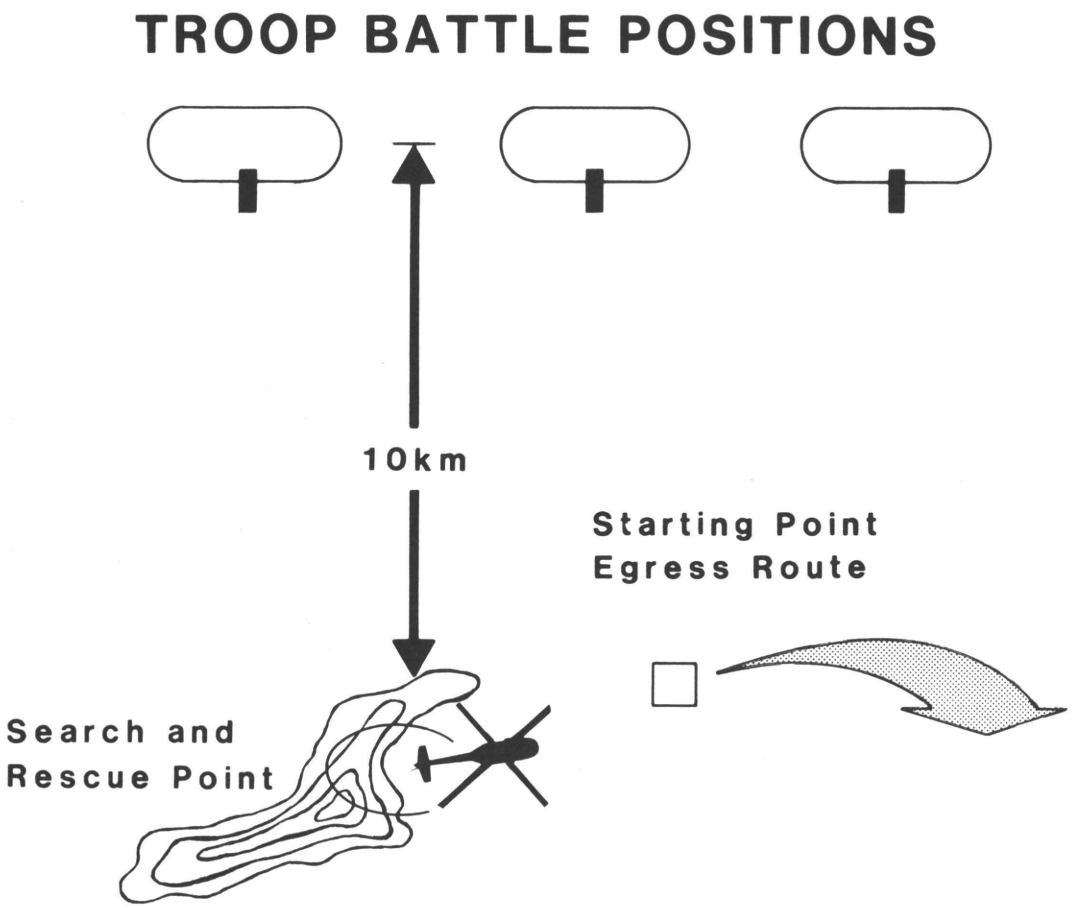
LIEUTENANT CAPALLI squirmed in his seat. It was getting harder to see the difference in the forward looking infrared (FLIR) between live tanks and the burning hulks. The snow on the ground helped—the hot T-80 tanks showed up well against the snow. LT Capalli tried to speak, but his throat was dry and no words came out. He swallowed hard and called over the intercom, "Left, left, move left!"

Chief Warrant Officer (CW2) Sailman responded, "Roger."

CW2 Sailman looked to his left to ensure the way was clear before he moved the AH-64 Apache. He saw another AH-64 to his left. "That'd be 624," he thought. He increased collective a bit and guided his aircraft over the treetops and to the left. "Old Ivan is taking a beating," thought CW2 Sailman. The 3d Squadron, 6th U.S. Cavalry, 6th Cavalry Brigade had caught the 114th Guards Tank Regiment in march column, hurrying to the front, and was really giving them a bloody nose. In a matter of minutes most of the tank regiment was in flames on the highway below the Apaches.

The squadron broke through the forward line of own troops (FLOT) about 15 minutes later. The return trip was, as usual, tense but uneventful. Corps had done a great job of finding a seam in Ivan's lines. The corps coordinated the suppression of enemy air defense plan as well as the electronic warfare support. Their orchestration was extremely

illustration by Jeff Babine



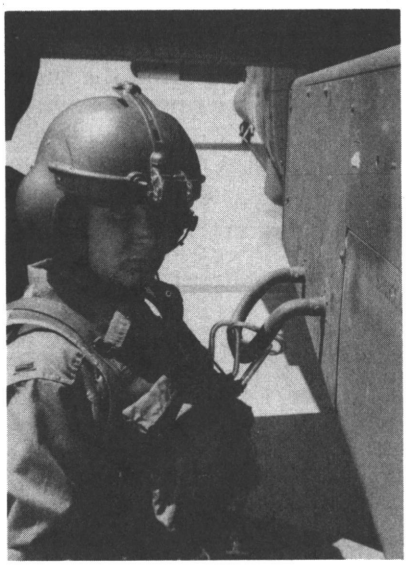
The downed pilot pickup plan.

effective. During the trip out was when all hell usually broke loose. By this time, the bad guys were well aware that someone was in their rear area doing tremendous damage. They had all their airborne and air defense artillery radars attempting to acquire the squadron on the way out. Ivan was hurting and was willing to pay any price to take out the AH-64s. Ivan was bad enough, but the squadron had friendlies at the FLOT to worry about too. The ground troops had been taking a beating from Threat helicopters. Now, they were nervous when any helicopter appeared along the FLOT. During the last cross-FLOT mission, the squadron lost an Apache and a UH-60 Black Hawk was badly shot up.

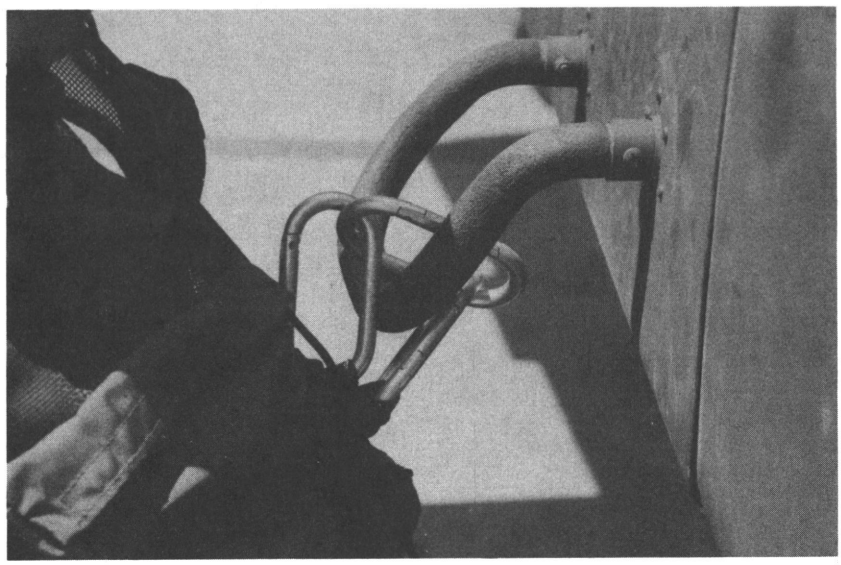
LT Capalli picked out another tank. The T-80 moved off the road in an attempt to hide but the FLIR could pick up the temperature difference. The tank's turbine exhaust heated the trees surrounding his hide position. He ranged the tank with the laser and checked to see that he had a HELLFIRE on the proper code. His heart was pounding wildly as he pulled the firing trigger to the first detent.

An orange fireball rose up from the trees and detonated just to the rear of the Apache. CW2 Sailman was momentarily blinded by the explosion. The Apache shook violently and started to spin to the right. He tried to regain control of the aircraft. He caught a glimpse of the number one engine fire light before he looked outside and saw the trees "coming up at him." LT Capalli set off the fire bottles on the crippled engine as the Apache ripped through some small trees on the edge of a woodline. The aircraft came to rest on its right side in the snow among some small pine trees.

The crew quickly unstrapped themselves. The smoke filling the cockpit indicated they had only a few seconds to get out. CW2 Sailman hit the emergency jettison handle and the side canopies



Vest shown hooked to AH-64 step



Closeup view of the hookup point.

blew away. LT Capalli's face was covered in blood. He had struck the optical relay tube during the impact and was bleeding profusely. The cold air engulfed his body. He could feel consciousness slipping away. CW2 Sailman caught the lieutenant and eased his body to the ground. Blood was everywhere and LT Capalli's eyes were glassy.

Flames engulfed the cockpit. The sudden warmth from the fire and CW2 Sailman's voice brought him back to reality. He felt the heat singe his face. CW2 Sailman checked them out, drew his revolver and helped LT Capalli stumble toward the taller trees to the nine o'clock of the burning helicopter.

A helicopter suddenly appeared and moved toward the treeline, keeping its distance from the burning remains of the Apache. LT Capalli and CW2 Sailman peered cautiously from the trees. The fire illuminated the helicopter enough for CW2 Sailman to identify it as an Apache. The crew of 624 had seen the explosion and swung over to pick up the downed crew. CW2 Sailman helped LT Capalli to the waiting Apache. He eased him onto the tire, and hooked the snap link attached to the lieutenant's survival vest to the step on the side of 624. Once LT Capalli was secured to the Apache, CW2 Sailman ran to the other side, seated himself on the tire and snapped on to the Apache. The pilot of 624 flashed a "thumbs up" to the wheel riders. CW2 Sailman responded with a thumbs up and 624 lifted off.

The wind beating against LT Capalli was fierce. He fought to stay conscious. He tried to hold on, but had no strength left. His world once again went black. The noise made it hard to think. CW2 Sailman tried to remember how far they were from the search and rescue (SAR) bird. It could only be a couple more kilometers (km) away. He felt the helicopter begin to descend. He looked into the darkness but saw only treetops. He felt the helicopter begin to slow then he saw the ground. A few yards away he saw the soft glow of the UH-60's cockpit lights.

LT Capalli felt a hand touch him. He looked up and saw the UH-60's crewchief. He flashed a thumb up and tried to unhook himself from the Apache. He fumbled with the snap link but was unable to release himself. Then he felt the Black Hawk crewchief's hand unhook the snap-link. The crewchief helped LT Capalli to the ground and to the waiting Black Hawk. CW2 Sailman came around from the other side of the Apache and together they boarded the Black Hawk. Both aircraft lifted off and dashed to the start point of the egress route to join the rest of the squadron.

The Black Hawk touched down in the assembly area as the sun broke over the horizon. LT Capalli's head was pounding, but he managed a faint smile as the medics lifted his stretcher off the

Extraction vest

helicopter. CW2 Sailman saw some soldiers in the chow line outside the mess tent. "I wonder what's for breakfast," he thought.

Downed Pilots—the Problem

The above story is fictitious but it could well be a reality. As the doctrine of the deep attack continues to unfold, the squadrons that go cross-FLOT must reckon with the problem of downed aviator pickup. The 3d Squadron, 6th U.S. Cavalry, 6th Cavalry Brigade is working on a solution.

First and foremost, the "heavy cav" employs sound tactics to avoid detection and to defeat enemy air defense weapons. The squadron goes in low, fast and in areas where the enemy isn't. The squadron selects routes in and out that minimize exposure to the Threat. The S3 places the routes over swamps and steep or other "no-go" terrain. He avoids placing routes near roads or wide open terrain. Staying low keeps the aircraft among the ground clutter on radar. Perhaps, more important, the squadron goes cross-FLOT at night to defeat enemy optically guided air defense weapons. Furthermore, the squadron uses the inherent capabilities of the Apache to violently engage the enemy at maximum standoff ranges. Careful employment of the Apache notwithstanding, aircraft still will be lost on the wrong side of the FLOT.

Downed Pilots—the Plan

The heavy cav downed pilot plan has three main parts. The *first* is the *wingman* concept. Each Apache has another looking after it. They provide mutual security on the entry and exit routes and in the battle positions. If one Apache goes down, another is responsible for picking up the downed crew. Once the downed crew is picked up, the wing Apache takes the downed crew to a waiting UH-60 SAR aircraft.

The wing Apache stays with the UH-60 until the squadron recrosses the FLOT. The Apache does not attempt to return to the battle position. Most likely, the aircraft in the battle positions will expend their ammunition and begin their egress while the wing Apache is recovering the downed crew. If the wing Apache did attempt to reenter the battle positions the possibilities of fratricide, midair collisions or being left behind are greatly increased.

The *second* part of the SAR plan is the *UH-60 SAR aircraft* concept. Whenever the squadron goes deep, a UH-60 follows the last troop. The regular crew and a medic with a complete aid bag are onboard the UH-60. The Black Hawk takes the same route as the Apaches. When the Black Hawk reaches the release point, it leaves the flight and moves on its own to the downed pilot pickup point.

The S3 must carefully select the downed pilot pickup point. The pickup point should be centrally located in the squadron area and about 10 km behind the battle positions. At this distance, the Black Hawk is not too far away from the Apaches in case a crew is coming in on their wingman's strut. It also allows the Black Hawk to come forward to pickup crews in case of an unforeseen situation. The pickup point should have masking terrain but at the same time afford an unobstructed view of the starting point of the egress route. The Black Hawk crew watches the egress route for the Apaches.

The pickup point should not be near roads or built-up areas. The S2 ensures there are no known or suspected enemy in the area. The downed pilot plan is an "all risk" situation for the crew of the UH-60. They depend upon stealth to avoid detection. If an Apache brings in a downed crew, the wing Apache's pilot makes a short radio call announcing their situation. The Black Hawk crew knows an aircraft is inbound. Hopefully, any aircraft approaching the pickup point will be the

Apache with the downed crew.

The squadron habitually maintains radio silence until enemy contact. Once the fight is joined, the Black Hawk crew monitors the battle over the radios. The crew will know how the battle is going. They'll hear if any Apaches go down. They'll also hear when the Apaches leave the battle positions.

When the Black Hawk crew hears the Apaches leave the battle positions, the crew concentrates on the start point of the egress route. Sometimes, depending on the illumination, the Black Hawk crew can see the Apaches and join them. Other times the Black Hawk simply waits for a specific time to pass then proceeds to join the Apaches. Once joined, the Black Hawk crew make a short radio call announcing they have joined the flight. If the Black Hawk does not join the flight, they make their way back across the FLOT along the same route as best they can. With the fielding of the external stores support system, the Black Hawk can add additional HELLFIREs to the fight and also increase its range with the addition of auxiliary fuel tanks.

The *third* part of the downed pilot pickup plan is an *extraction harness* sewn into the standard SRU-21 survival vest. The harness consists of heavy nylon straps that encircle the aviator's body. The aviator's weight is supported by the nylon straps and not by the vest. The aviator attaches himself to the pickup aircraft by means of a standard snap link. The Apache has several areas to which the aviator can attach—the steps, the strut and the wings.

The vest is not an original heavy cav design but comes from a 101st Division design. The 3/6 Cavalry originally tried to have an extraction harness made locally, but could not get approval to modify the survival vest. Several aviators in the unit remembered having extraction harnesses at Ft. Campbell, KY. The squadron S4 contacted 101st Division aviation life support equipment (ALSE) for information. The trail from Ft. Campbell led to Natick Research Laboratories. The ALSE division at Natick Laboratories had already produced several modified vests for the 101st. The personnel at Natick were helpful and offered two options.

The first option would be to purchase the modified vest through Natick Laboratories. Natick would contract a firm to produce the vests. The squadron would just send the vests to Natick. The second option would be to modify the vests locally. This option would require Natick Laboratories personnel to inspect the modification. However, units should evaluate needs or requirements before expending funds for vest modifications. A new vest, with this modification built in, is now in accelerated procurement.

The extraction vest is the linchpin of the downed pilot plan. The harness allows the closest aircraft, usually another Apache, to recover the downed crew. This capability quickly gets the downed crew out of the battle positions. The alternative, establishing downed pilot pickup points, forces the downed crew to evade the enemy in the hope that a recovery aircraft can make it back across the FLOT. In this situation, the crew must move on the ground, across unfamiliar territory. The odds are stacked against a crew on the ground.

The importance of getting the aircrew back is not trivial. In past wars, the military expended great effort to recover aviators. The problem always has been time. It always takes time to get the recovery aircraft to the downed crew. It is during this time that the aircrew runs the risk of capture. The 3d squadron's plan puts time on the side of the downed crew.

Extraction vest

Culminating Points

IN AVIATION OPERATIONS

Major Russell S. Forshag
Headquarters and Headquarters Detachment
223d Aviation Battalion
APO New York

ARMY AVIATION, one of the newest members of the combined arms team, is undergoing an evolutionary process. That process will make it a decisive player on the battlefield of tomorrow. Congress and Army leaders recognize that the future on mid- and high-intensity land warfare will be characterized not only by a violent, fast-paced, ground maneuver battle but also by a battle in which the armed-helicopter will fight alongside the ground force in close and rear operations as well as into the depths of the enemy's formations. The Army budget demonstrates the emphasis placed on Army Aviation. Congress approved increased buys of scout, attack and utility

helicopters to beef up our force structure. The light helicopter experimental (LHX) program, although refocused on the scout/attack variant, is alive and well in this time of austere budgets.

HELICOPTER EMPLOYMENT

With the quantum improvements in combat capabilities of our newest combat helicopters and the potential of the LHX comes the inevitable doctrinal debate over how best to maximize the helicopter's employment on the battlefield. Liddell Hart's 1920 to 1930s postulation on armored warfare ushered in the age of the tank. Not since then has the character of maneuver warfare been at such a crossroad as now with the potential offered by the armed helicopter on the battlefield.

As with any evolutionary system, the helicopter has its own inherent limitations no matter how promising its capabilities. Aviation doctrine is still maturing with new concepts and precepts. One doctrinal issue that bears examination is the concept of culminating points and their application in aviation operations.

Not until the revision of Field Manual (FM) 100-5, *Operations,* was the subject of culminating points contextually described in any one U.S. Army doctrinal source of literature. In the 1986 version of FM 100-5, an appendix discussed culminating points within the framework of "Key Concepts of Operational Design." Along with "the center of gravity" and "lines of operation," "culminating points" share equal billing.[1]

A strategic culminating point may result from the failure to apply all the elements of national power or the loss of a particular element of national power during the pursuit of certain offensively oriented military objectives. Our involvement in Vietnam is a case in point. Militarily, we were vastly superior to the forces we faced. However, we were forced to end operations because the national will of the U.S. public would not support continued efforts.[2]

Many examples of operational culminating points also can be found in history. General George M. Patton's Third Army dash across France is a well-studied case in point.[3] At the tactical level, events that produce culminating points are clearly

1. U.S. Department of the Army, FM 100-5, *Operations* (Washington, DC: U.S. Government Printing Office, May 1986), p. 181.

2. Harry G. Summers Jr., *On Strategy: The Vietnam War in Context* (U.S. Government Printing Office, Strategic Studies Institute, U.S. Army War College, Carlisle Barracks, PA, 1983), for a thought-provoking examination of why we terminated our operations in Southeast Asia.

3. James A. Huston, Army Historical Series, *The Sinews of War: Army Logistics 1775-1953* (Office of the Chief of Military History, U.S. Army, Washington, DC, 1966), pp 525-530; and FM 100-5, p. 182.

defined and evident. Examples of events that cause tactical culminating points are—

- The depletion of onboard stocks of fuel and ammunition.
- The loss of a significant amount of combat forces resulting from ambush or fires from an unexpected direction.
- A breakdown in the synchronization of the combined arms employment that allows a defender to defeat the attacker piece-by-piece, stripping infantry protection from the tanks.[4]

A culminating point is normally associated with offensive operations. It is within this context that one finds the most clearly understood examples. A culminating point is simply that point in time or space at which the attacker's strength no longer significantly exceeds that of the defender. Attempts to continue offensive operations beyond this juncture with the same tempo or along the same direction or thrust result in a stalling of the offensive by lack of resources or overextension of lines of communication (resupply).

In addition, the attacker runs a great risk of counterattack and possibly outright defeat by the defender. It follows that one key ingredient to ensure the success of an offensive is to secure the decisive objective, for a given operation, before reaching the culminating point. From the defender's perspective, a key ingredient to the success of the defense is to structure the operation in such a way as to cause the attacker to reach his culminating point at the time or place on the ground that favors the move to a counteroffensive by the defender.[5]

Culminating points are most commonly associated with the depletion of available logistic resources to continue the battle. The interdiction of supply lines to forward units, the inability of the support echelons to maintain the pace of the maneuver forces or the lack of transportation to move supplies forward may result in reaching a culminating point.

Other factors, too, can produce a similar situation. For example, a significant rear area threat may exist that causes the allocation of forward combat forces to counter that threat. This can deplete the strength of the forward maneuver elements to such an extent that the required force ratios for the offensive are reduced to an unacceptable level. Fighting an offensive battle across terrain that is favorable to the defender or fighting battles to the point of human exhaustion are examples of other than logistical factors.[6]

In examining these examples of culminating points, an offensively minded army should attempt to discover methods and techniques to identify the approach of a culminating point. It must attempt to predict, in the course of a battle, or more properly in an operation, when that culminating point will occur given the selected objective. In analyzing the various mechanisms designed to defeat a defensive force, one must ensure that the culminating point will occur at some reasonable point after the defeat mechanism has been applied. When defending, one can also apply the same methodology in an attempt to predict an attacking enemy's culminating point to enhance his own defensive operations.[7]

Not since then (1920 to 1930s) has the character of maneuver warfare been at such a crossroad as now with the potential offered by the armed helicopter on the battlefield.

A way of accomplishing this to diligently apply the concept of wargaming that is a vital component of the estimate process.[8] Most of our wargaming methodologies are based upon the intuitive feel of an experienced staff and commander as to how they believe the battle will flow. The use of computer simulations enables us to fight a battle with software, given various assumptions, which produces an outcome. Unfortunately, this does not replicate a real world scenario in a temporal sense. The U.S. Army prefers to rely on intuitive feel for how a battle may progress under a given course of action and flavor it with certain elementary planning factors.

The Soviets, however, have refined this wargaming process by the application of scientific norms.

From studies of historical battles during the Great Patriotic War, the Soviets have developed "norms" that allow a "scientific substantiation" of what we would term the commander's concept of the operation. During the process, the commander outlines his "decision." The staff verifies the feasibility of the plan. If certain norms are not met (i.e., an offensive runs out of steam before the decisive objective is taken), the staff informs the commander. He then, if appropriate, modifies the plan to eliminate or reduce the identified deficiency.[9]

A similar logic applied to the planning of our operations to avoid reaching unplanned culminating points at the wrong time in our own operations. Constant reflection on the five elements of the battlefield framework during the wargaming process assists the commander in this effort. Planners must always consider the close, deep and rear operations as well as security operations to the front and flanks and reserve operations supporting the close operation.

Planners should consider each of these elements and how to synchronize them given the structure of the plan. Then they should apply the rates of march, terrain, relative combat power and logistical planning factors found in the appropriate manuals to account for applied combat power and its available sustainment and performance capabilities. This is translated into time or perhaps a point on the ground, or a relative configuration with respect to an enemy force; i.e., an operational thrust into an enemy's flank or rear. The synchronized plan then has some reasonable assurance of avoiding the culminating point until well after the objective is taken.

Using the same process when in the defense and attempting to predict the enemy's culminating point during his given offensive operation will assist in the effective employment of all our assets to help defeat him. By synchronizing one's efforts to hasten the enemy's culminating point, the planner gets "inside the adversary's decision cycle," a cliche of contemporary doctrine.

FACTORS PRODUCING CULMINATING POINTS

Employment of Army Aviation in AirLand Battle doctrine brings to mind several factors that can produce culminating points. The employment envelope, crew, weather and aircraft capabilities, all have various inherent or associated components that can elicit culminating points. They must be considered when planning the use of this component of the combined arms team. Although these considerations are most commonly associated with attack helicopter operations, they apply equally to assault helicopter operations as well.

Employment. In examining the employment envelope, three concerns stand out: The aviation force must concern itself with the air-to-ground threat, small arms to air-to-ground guided missiles; the threat posed by the type of flying done, primarily nap-of-the-earth (NOE) and night; and the air combat threat. While not necessarily a culminating point in the classic sense, the employment envelope must be carefully analyzed

A culminating point is simply that point in time or space at which the attacker's strength no longer significantly exceeds that of the defender.

4. FM 100-5, p. 181.

5. Ibid.

6. Ibid.

7. Ibid., pp. 181-182.

8. The technique of wargaming as applied during the estimate process is described in detail in chapters 4-7 of Command and General Staff College Student Text 100-9, *The Command Estimate,* July 1987.

9. The topic "Soviet troop control" normally describes this process. John Hemsley, *Soviet Troop Control: The Role of Command Technology in the Soviet Military System* (Brassey's Publishers Limited, Oxford England, 1982), chapter 5.

to avoid causing an unexpected culminating point (attrition of forces) during an aviation operation. The need for local air superiority, suppression of enemy air defense along an air corridor or the selection of routes that avoid terrain flight hazards (mountains, canyons, built-up areas with lots of wires) yet provide cover and concealment, is critical to avoid high attrition rates of aviation assets. If an opposing force can structure its side of the battle to cause the other side to fight under unfavorable conditions, it stands a good chance of increasing the attrition rate of the aviation asset, thus preventing its decisive employment (e.g., air defense ambushes, air combat operations, or surprise concentrations of an air defense belt). Failure to properly account for these elements can have disastrous results in a ground operation if aviation provides a major share of the combat power.

Aircraft Capabilities. Another aspect in the employment envelope is the type of mission aviation is called upon to perform. Our doctrinal manuals state that attack helicopters can be used to fix enemy forces or block their movements.[10] Up to a point, one can concur that attack helicopters possess this capability. But, given their limited endurance onstation and the nature of the target and the air defense threat one is told to expect, it is plausible to posit that a delay, harass or disrupt mission is more reasonable.

To block or fix a force, one must deny its freedom of movement on the ground. Attack helicopters are a vital ingredient in this effort when employed in conjunction with the ground force.

Once the battle is joined, the environment will become extremely dangerous for our thin-skinned aircraft to sit in one place and slug it out attempting to stop such a force.

A better technique is to use an aviation force with a fixing ground force and to target the helicopter against any maneuvering portion of the enemy formation attempting to bypass the fixing ground force. This technique helps reduce the risk of encountering a culminating point brought about by high attrition of the helicopter force by maximizing the maneuverability of the helicopter. Also, it takes advantage of its standoff firepower and targeting the helicopter against a moving enemy with a now degraded air defense umbrella.

Crew. Another factor that can cause a culminating point in aviation operations concerns the endurance of the crews. Army Regulation (AR) 95-3, *General Provisions, Training, Standardization and Resource Management,* spells out the crew endurance program for the Army under peacetime conditions. Upon examination, the two pilots who usually crew an attack helicopter are limited to a cumulative total of about 5 hours flying time per 24-hour period under day NOE flight modes or about 3.5 hours flying time at night with night vision devices (NVDs).[11] The most common flight envelope includes NOE and/or nighttime flying with NVDs. Given the capability of our modern attack helicopters to fly and operate much longer than a 5-hour stretch (with fuel), one quickly finds that crew endurance becomes the limiting factor.

The use of computer simulations enables us to fight a battle with software, given various assumptions, which produces an outcome.

Couple this with the current manning levels (essentially two pilots per cargo, utility and attack aircraft) and one realizes the impacts that combat crew loss and the requirement for continuous operations (day and night) can have on the ground commander's plan. Attack battalions are designed to fight as a battalion with all companies working together on the mission. Crew endurance is a limitation that will always affect aviation planning. Peacetime safety considerations limit forces in training from fully exploring this built-in culminating point. Not only does force structure impact (only one pilot for every seat), but also the endurance limits imposed by ARs. During the Falklands Campaign, British helicopter usage rates exceeded the peacetime usage rates by more than three times over. This placed tremendous

strain on the flight crews in terms of numbers and durations of missions.[12]

Another aircrew consideration involves the training of these crews. With the sophistication of the new helicopters, a great deal of time is required to qualify a pilot in the aircraft. It takes about 9 months to produce a helicopter pilot and about another 10 weeks to qualify him in the AH-64 Apache. In a longterm conflict, the training cycles could be accelerated. But under a short war scenario, it is impossible to replace crews lost in combat in a timely manner. This results in quickly reaching a culminating point in aviation employment because of lack of crews, or at the least, a severe restriction on the use of these assets for all but the most valuable targets.

In examining the force structure of aircrews today, one finds an increasing number of female pilots. Under the current rules of employment, their primary focus is on combat support and service support missions and aircraft types. It can be reasonably expected that these crews will suffer less attrition over time as a war progresses, while the male combat crew attrition continues to climb. The logical solution, short term, is to shift the male crews from combat support and combat service support duties to attack or assault duties. However, as the war progresses, and given the time to train an attack or scout pilot, it is evident that the point will soon be reached when we have empty seats in attack aircraft. In certain war scenarios when possible defeat looms on the horizon, this situation might dictate filling seats with the female pilot. It takes less time to transition a female into an attack aircraft than to train a brand new male student. Another alternative is to train nonrated crewmembers in those essential gunnery skills needed to operate the aircraft weapon systems. Then one finds a sophisticated attack helicopter crewed by one pilot and a nonrated gunner. The wisdom of this approach has yet to be proven.

The flight time available to the rotary-wing aircraft (about 2 hours per fuel load) always has been a limitation on its employment. Limited endurance time during a battle forces a commander to be very careful about when, where, how far and how long to commit these assets. The use of mobile forward arming and refueling points (FARPs) and the cycling of companies of helicopters can provide more combat time over the battlefield but usually at the expense of a reduced combat punch at the one decisive point and place. If a commander misreads the requirement in either case, the selected option may result in not enough firepower throughout the operation or maximum firepower when it is not needed.

Weather. The last major factor that can cause a culminating point is weather. Current weather conditions affect aircraft performance such as payload, speed, hover heights and simply the ability to fly at night or under limited visibility. The newer attack helicopters have a better capability in all these areas. The use of thermal forward looking infrared systems allows better employment in fog and at night. However, extremely dense fog, smoke, heavy rain storms and high winds can ground the system and prevent its employment in the ground commander's scheme of maneuver. Planning employment of aviation under forecasted deteriorating conditions can force a culminating point to occur during the

To block or fix a force, one must deny its freedom of movement on the ground.

10. U.S. Department of the Army, FM 1-111, *Aviation Brigade* (Washington, DC, U.S. Government Office, August 1986), chapter 3, p. 6.

11. AR 95-3, *General Provisions, Training, Standardization and Resource Management* (Washington, DC: U.S. Government Printing Office, September 1988).

12. Presentation to Parliament by the Secretary of State for Defence by Command of Her Majesty, *The Falklands Campaign: The Lessons* (London, Her Majesty's Stationary Office, December 1982), p. 20.

battle when conditions become too severe to continue the flight. When coupled with the limited endurance time, this aspect becomes a significant factor in the culminating point equation.

ACTIONS TO LIMIT EFFECTS OF CULMINATING POINTS

The following are some recommended actions to consider when planning aviation operations to limit the effects of culminating points on our operations: When examining the aviation employment envelope, ensure the ground maneuver command fully understands the aviation arm's strength and limitations. Always strive to ensure that the combined arms philosophy is fully applied in every effort involving aviation. To guarantee a combined arms effort, foster a mindset that there is really no such thing as aviation-pure operation. Given the adversary, our forces always need the U.S. Air Force assets, intelligence assets, artillery and other types of combat multipliers. This causes the enemy to fight different systems during the same battle and prevents him from focusing his power on just one.

Aviation combat power must be employed in the proper way. Trying to block or fix a moving force on the battlefield is a bit much to do effectively unless it is in conjunction with a ground maneuver force. To delay, disrupt and harass him is better.

We are doing well in the training arena today for our pilot population. However, certain portions of basic flight training can be curtailed in wartime (instrument qualification). We must develop and test a training program now to shorten basic and advance aircrew training that can be implemented immediately in wartime.

The issue of female pilots in attack aircraft is a touchy one, but one we cannot afford to ignore in peacetime. One can foresee certain scenarios in which we would have no choice but to use every pilot to get the job done. Maybe we cannot use them now in attack aircraft, but if push comes to shove, a future commander in war may have to make a decision to put them up front. Developmental training programs for nonrated gunner qualification may also offer a possible approach.

We need to improve our mobile FARP capability. An old rule is that your logistics have to be as mobile as your maneuver. A case in point is the purchase of the new heavy expanded mobility tactical truck for the heavy divisions. It is essential that we beef up our attack battalions with more lift to allow us to exploit our true flexibility.

Finally, the studied application of the wargaming process and the resulting synchronization of the battle that accounts for all combat multipliers and extraneous factors (weather, terrain, enemy courses of action, etc.) must be taught and ingrained in our officer corps. Only then can we fully maximize our assets to defeat a foe superior in numbers if not quality.

The employment envelope, crew, weather and aircraft capabilities, all have various inherent or associated components that can elicit culminating points.

SUMMARY

The above are not all the factors that impact on culminating points in aviation employment. Culminating points can be predictable to a certain extent in all types of operations and can be avoided with proper planning and initiative. The smart ground and aviation commander must constantly account for these factors to prevent the adverse impact of various culminating points in aviation employment during the battle and ensure that a true combined arms team is brought to bear upon the enemy.

AVIATION PERSONNEL NOTES

Preference Statements

Professional development training significantly changed in recent years. Career-track training and aircraft qualification courses have been impacted on by budget constraints and implementation of programs that have placed enormous demands on the personnel management system. Foremost has been the Aviation Force Modernization Program and the implementation of the Total Warrant Officer System (TWOS).

The effect of force modernization, TWOS and budget constraints has resulted in a system that selects and trains to meet specific requirements. To have an influence on the system and to optimize your opportunities, you need to make your preference known.

The best way to communicate your desires to your career manager is on the DA Form 483, Officer's Assignment Preference Statement. Often we tend to make trivial the preference statement; but rest assured, if your preference is unknown, your best chance is hit or miss.

Additional Requirements for Processing Alcohol Waivers

Army Regulation (AR) 40-501, *Standards of Medical Fitness,* and AR 600-85, *Alcohol and Drug Abuse Prevention and Control Program,* state that aviators with a medical diagnosis of alcohol abuse or alcohol dependence are unfit for flying duty.

AR 600-105, *Aviation Service of Rated Army Officers,* states that medically unfit aviators can only be returned to flying duties with a waiver approved by the commander, U.S. Total Army Personnel Command (PERSCOM).

The Department of the Army Alcohol Policy Letter dated 25 March 1985 mandates successful rehabilitation to remain in the Army. Determination of success can take up to 12 months. As a result, one can anticipate a minimum of 12 months in a nonflying status.

The commander, PERSCOM, recently announced additional requirements for processing alcohol waivers. Waivers are now contingent upon total abstinence from alcohol, active involvement in sobriety programs and involvement by flight surgeons and unit commanders in the individual's rehabilitation. Additionally, PERSCOM now requires chain of command recommendations to include at least one general officer endorsement to accompany each alcohol waiver packet.

The intent is not to punish the recovering officer, but to enhance safety and unit readiness through successful rehabilitation and chain of command involvement.

Review and Analysis of the Calendar Year (CY) 1989 Master Sergeant (MSG) Selection Board

The review and analysis for the CY 1989 MSG selection board for career management fields (CMFs) 67 and 93 military occupational specialty was released in late October 1989. The Aviation Branch selection rate was 15.9 percent above the total Army average. Leaders need to know the factors used to ensure that Aviation Branch soldiers remain "above the best":

- The enlisted evaluation report (EER)/ noncommissioned officer evaluation report was the backbone of the selection process. Review of the EER revealed the same historical problems that led to the development of the new evaluation form.
- The new DA Form 2166-7, Noncommissioned Officer Evaluation Report, was considered to be a vast improvement as a management tool. Even so, raters still have problems justifying excellence ratings.

• Soldiers need to review their DA Form 2-1, Personnel Qualification Record-Part II, more closely for accuracy. Many forms were sloppy and difficult to read. Also, many were not in agreement with the information found on the microfiche.

• The board noted numerous problems with photographs. Many were attributed to the photographer's lack of attention to detail; however, other discrepancies reflected on the individual soldier. Wrinkled and poorly fitted uniforms reflect low self-esteem, lack of pride, and are inexcusable.

• The board seriously questioned the NCO height/weight data. This information gave the impression that the chain of command protected obviously overweight NCOs.

• Civilian education discriminated in picking the best qualified from among the fully qualified. It served as an indicator; however, skill qualification test scores should not be sacrificed in pursuit of college credit. Job knowledge must be paramount.

• Assignment patterns concerned board members. However, soldiers were evaluated on demonstrated performance. The evaluators' statements on potential were also a strong consideration.

The health of the NCO corps was considered to be good across both CMFs 67 and 93. The Directorate of Aviation Proponency (DAP), U.S. Army Aviation Center, Ft. Rucker, AL, highlighted the key problem areas identified by the board. In addition, DAP challenges the leadership and the individual to take note and ensure these same problems do not recur as a result of inattention to detail.

Attention All Aviation Logistics Officers (AOC 15D)

The Soldier Support Center has distributed the Area of Concentration (AOC 15D) *Army Occupational Survey Program* booklet to the field for the second time. Response from the first shipment averaged 31 percent. This level of return is too low to meet statistical data requirements. Every AOC 15D officer should receive a survey. The support center urges AOC 15D officers to fill out a survey.

Mrs. Jacqueline Boyd, AUTOVON 221-6389, has these surveys. The address is Commander, USA Soldier Support Center, ATTN: ATNC-MOT-D (Mrs. Boyd), 200 Stovall St., Alexandria, VA 22332-1333.

The U.S. Army Aviation Logistics School POC is Mr. Gene Smith, AUTOVON 927-6356.

Underwater Training For Army Helicopter Crews

Control of quotas for underwater egress training was centralized in October 1988 and is now handled exclusively by the major Army commands (MACOMs) and Headquarters, Department of the Army (HQDA). The U.S. Navy no longer allows direct unit coordination with the various Navy training sites to receive training quotas.

During the third fiscal quarter of each year, HQDA will request MACOM input for training requirements for the following year. The MACOMs request training under three priorities: essential, necessary or desirable. HQDA then allocates those quotas from the Navy to the MACOMs.

Units wishing to participate in underwater egress training should make sure to incorporate their requests into their respective MACOM message. Requests are due at HQDA no later than 15 July each year.

Unit commanders with allocations for fiscal year 90 training should review attendance prerequisites for the training in HQDA message 271250Z, September 1989, subject: Change to attendance prerequisites for USN underwater egress training for Army flight crews. This review by the commanders ensures students comply with attendance prerequisites. A large class of Army students recently experienced a 49-percent failure rate that was due largely to inadequate or non-existent screening at the unit level.

Units should direct questions to their respective MACOM aviation officers. MACOM POCs may contact HQDA, ATTN: DAMO-TRS, AUTOVON 224-4990.

PERSCOM Aviation Directory

This annual aviation directory is for your information and general use. It gives you the points of contact (POC) to help you manage your career.

OFFICER DIVISION

Commercial (202) 325-XXXX
AUTOVON (AV) 221-XXXX

LTC(P) Michael Dallas	Chief, Aviation Branch	-0794
MAJ Wayne Davis	LTC Assignment Officer	-0794
MAJ Keith Stafford	LTC Assignment Officer	-0794
MAJ Frank Prindle	MAJ 15/54 Assignments	-7822
MAJ Allen Baker	MAJ Assignments	-7822
MAJ Beth Garrity	Company (CO) Grade Functional Area/Reserve Officers' Training Corps/ U.S. Army Recruiting Command	-9366
CPT(P) Jeff White	CO Grade 15/15T, Military Educational Level (MEL) 6	-9366
CPT Mark Kulungowski	CO Grade 15/15T (MEL 7)	-9366
Ms. Brenda Twyford	Aviation Accessions (Aviation Officer Basic Course/Initial Entry Rotary Wing)	-9366

AVIATION PLANS AND PROGRAMS

AUTOVON 221-8156

MAJ Sandy Smith	Chief
CPT Kelly Thomas	Naval Engineering Test Pilot School/Astronaut Program
SGM Bernard Berger	Aviation Schools
Mrs. Jean Bell	Aviation Career Incentive Pay
Mrs. Margie Brown	Medical Waivers/ Department of Army Orders

AVIATION COLONELS' ASSIGNMENTS

LTC Tim Couch	AV 221-7867

WARRANT OFFICER DIVISION

Commercial (202) 325-XXXX
AUTOVON 221-XXXX

COL Mike Moseley	Division Chief	-7831
LTC Randy Beckman	Deputy Division Chief	-7831
MW4 Butch Davis	Chief, Professional Development	-7843
CW4 Bob Houser	Professional Development Officer	-7843
CW3 Stan Freeman	Boards	-7843
MW4 Tom Story	Chief, Aviation Branch	-5226
CW4 Bill Saunders	153B	-7835
CW4 Tim McGee	151A, 152B, 152C, 152D, 153C	-5227
CW4 Dave Heaton	153D	-7836
CW4 Meade Roberts	152F	-5223
CW4 Curt Oldroyd	152G	-5225
CW4 Don Conaway	154, 155, 156	-1682
Ms. Mary Ann Ashley	Aviation Warrant Officer Candidates	-5283
CW4 Al De Lucia	Chief, Personnel Action	-7833
CW2 Barry McRae	Personnel Actions Officer	-7834

AVIATION ENLISTED ASSIGNMENTS

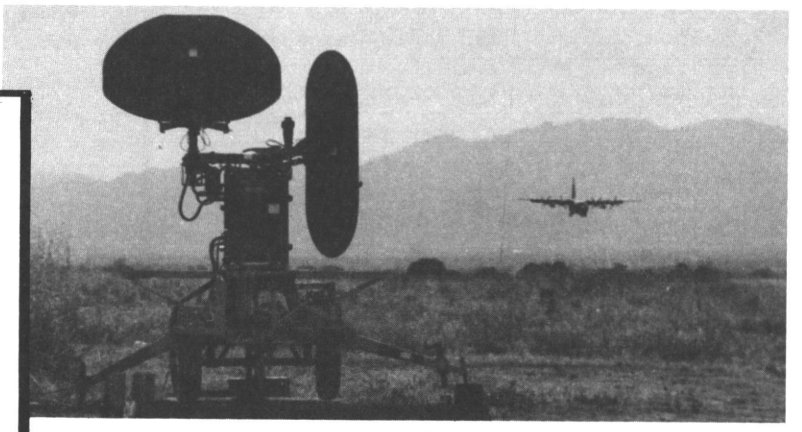
AUTOVON 221-8322/8324/8325

LTC Chris Guppy	Chief, Aviation Transportation Branch
SGM Walter Cole	Branch SGM (67Z50)
MSG Esquire McCoy	NCOIC, Aviation Branch (67Z50)
MSG Billy Goodwin	Career Advisor (67Z50)
SFC(P) Carl Ferebee	Career Advisor (67U40)
SFC Joe Prescott	Career Advisor (93P40)
SFC Wilbert Dabney	Force/Modernization NCO (67Y40)
SFC John Collins	Career Advisor (67T40)
SFC Roderick Lutz	Career Advisor (67Y40)

Tactical Ground Controlled Approach

Master Sergeant Thomas Guthrie
Sergeant First Class Kenneth Taylor
Flight Inspection Technicians
Systems Evaluation and Maintenance
U.S. Army Air Traffic Control Activity
Fort Rucker, AL

TAC GCA . . .This is Flight Check One Four Zero. Your glidepath angle is two point five eight degrees. The minimum acceptable angle for a 3-degree glidepath is two point eight degrees. Have maintenance make any necessary adjustments and we will make another check.



A C-130 flying a ground controlled approach at Palmerola Air Force Base, Honduras.

WE IN AIR TRAFFIC control (ATC) maintenance have all been on the receiving end of one of these transmissions from the flight check aircraft. For the young technician just starting out, it can be a panic-filled experience.

Failure of ground controlled approach (GCA) radar to pass a flight inspection (flight check) usually can be attributed to several things: improper systems alignments, damage during transportation or component failure. We can control or prevent each of these to some degree.

Preparation is essential for a successful mission. Accomplish preventive maintenance checks and services before field deployment. This ensures adequate time for controller and maintenance personnel to identify problem areas and take corrective action. The corrective action may include system alignment or repair by organizational or support maintenance personnel. Don't wait until the last minute.

Improper preparation for shipment of the radar system often results in damage to sensitive items. Flexible wave guides and the elevation feedhorn assembly are two of the most commonly damaged items. Damage to either of these sensitive items may result in a limited or nonoperational status of the radar system. Minor damage to the elevation antenna feedhorn support arms may cause an improper glidepath angle. To prevent damage, prepare the equipment for shipment according to the system technical manual.

Although the radar system may be installed and operational, a component failure may occur. Component failures may be electrical or mechanical. Some failures occur naturally; others can be caused by incorrect maintenance techniques. The

availability of repair parts will ensure minimum downtime caused by unpredicted failures. For this reason, it is essential that the prescribed load list (PLL) accompanies the system during deployment. Safe transportation of the PLL is as important as safe transportation of the radar system.

Soldiers should take steps to ensure proper packaging and storage of these repair parts during transportation to the field site. In the January 1988 *Aviation Digest,* an ATC Focus article identified the packaging material that soldiers should use to safeguard repair parts.

Once the radar system is deployed and operational, soldiers in the unit should request a flight inspection. A flight check will determine the system's ability to provide accurate course-line and glidepath information. Accurate information is essential to safety. If the radar fails to meet prescribed tolerances found in Technical Manual (TM) 95-225, *United States Standard Flight Inspection Manual,* only the alignments connected to the particular problem, not a complete system realignment, is necessary.

The following steps list the alignments that affect the glidepath angle/course line of aircraft radar target returns. When soldiers do the steps in sequence, they should be able to identify and correct any alignment problems.

Note: Do only the azimuth (AZ) portion of the steps if course-line information was not in tolerance. Do only the elevation (EL) portion of the steps if the glidepath angle was not in tolerance.

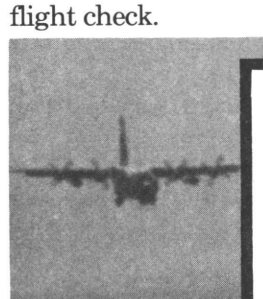
- Level the receiver-transmitter (R/T) (TM 11-5840-281-12-1, *Operators' and Organizational Maintenance Manual, Radar Set AN/TPN/18A,* para 4-24, pg 4-52).
- Check the 10- to 35-degree actuator (TM 11-5840-281-12-1, para 4-27, pg 4-76) or (TM 11-5840-281-34-1, *Technical Manual, Direct Support and General Support Maintenance Manual, Radar Set AN/TPN/18A*, para 3-18, pg 3-54).
- Check the R/T power supply adjustments (TM 11-5840-281-12-1, para 4-41, pg 4-139).
- Check the data potentiometers: EL (TM 11-5840-281-34-1, para 3-17, pg 3-54); AZ (TM 11-5840-281-34-1, para 3-20, pg 3-59).
- Check the electronic filters: EL (TM 11-5840-281-34-1, para 3-17, pg 3-54) or (TM 11-5840-281-12-1, para 4-43, pg 4-141); AZ (TM 11-5840-281-34-1, para 3-20, pg 3-59) or (TM 11-5840-281-12-1, para 4-44, pg 4-142).
- Check the control-indicator power supplies (TM 11-5840-281-12-1, para 4-42, pg 4-140).
- Check the artificial angle volts dial alignment (TM 11-5840-281-34-1, para 3-36, pg 3-99).
- Check the cursor sawtooth generator and comparator alignment (TM 11-5840-281-34-1, para 3-43, pg 3-100).
- Check the sweep delay (TM 11-5840-281-34-1, para 3-43(14), pg 3-101).

If the radar still fails to pass the flight check, repeat the above steps. If the radar fails again, check further:

- Verify that operators use correct dial divisions: EL (TM 11-5840-281-12-1, para 4-28, pg 4-90); AZ (TM 11-5840-281-12-1, para 4-28, pg 4-93).
- Check the sighting data (measurements) to include the ground angle.

If all the checks continue to come out correctly and the radar still fails to pass the flight inspection, the radar probably has some type of physical damage; for example, a bent or defective clinometer mounting bracket or a bent feedhorn. At this point, the user should request assistance from that individual's support maintenance unit.

Anyone who has worked in ATC maintenance knows of several ways to pass a radar flight check by mechanically and electrically circumventing proper methods. Soldiers must know, however, how critically GCA affects aircraft and flight crews during instrument meteorological conditions. This knowledge is enough to prevent anyone from circumventing the system. Proper preparation for a tactical deployment and use of spare parts and maintenance manuals are all it takes to pass a flight check.



TAC GCA . . .This is Flight Check One Four Zero. Your glidepath angle is 3 degrees. You can't get any closer than that!

Readers are encouraged to address matters concerning air traffic control to Commander, USAAVNC, ATTN: ATZQ-ATC-MO, Fort Rucker, AL 36362-5265.

Dealing With An In-Flight Emergency

CW3 Jeffrey Conner
Flight Standardization Division
Directorate of Evaluation and Standardization
U.S. Army Aviation Center
Fort Rucker, AL

DEAL WITH AN in-flight emergency? No sweat, "I've got my checklist in my flight suit pocket, don't I?" If you feel that's the level of knowledge you need to deal with any in-flight emergency that requires referencing the checklist, then don't step over this article—it's aimed at you.

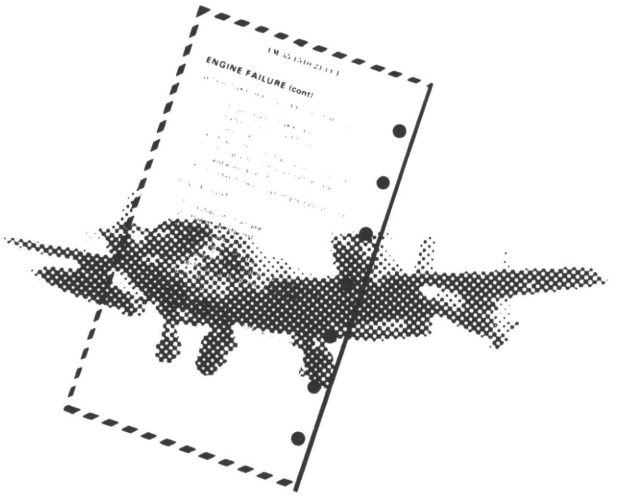
The "School of Hard Knocks" teaches that you can pursue three basic activities on the ground before flight that will significantly enhance your ability to successfully cope with an in-flight emergency.

- Learn how your emergency procedure portion of your checklist is subdivided into 10 classifications and how to locate different emergencies.
- Understand the rationale behind the sequence of steps instead of just rote memory.
- Develop a plan to pace yourself so you can better control the rate at which you respond and react to unplanned events.

First, the Army aviator who works hard to know the emergency checklist organization will be insurance premiums ahead. *Stop* and get out your checklist. Take a few minutes to review the 10 basic classifications covering the emergency procedures: engine; propeller/rotor; fire; fuel; electrical (elect); hydraulics (hyd); landing and ditching (ldg/dtch); flight controls (flt con); bailout or ejection (bail-out)(eject); and mission equipment (msn/eqpt). What you look for is the scheme used to systematically list the various emergencies within each classification. For example, are the emergency procedures contained in the engine section arranged alphabetically or in rank order, from major to minor? Next, review the procedures within each section to identify those emergencies that require cross-referencing. Can you in fact find the cross-referenced procedures quickly?

The second activity to add to your bag of tricks is the ability to see and follow the rationale for the sequence of steps in each emergency procedure. Who designs things like that? Someone with a good head on his shoulders, like you.

Picture yourself seated at a conference table at the U.S. Army Aviation Systems Command. At your 9, 12 and 3 o'clock positions are two other Army aviators and several aircraft manufacturer's structural and systems engineers. Your task today is to develop a set of procedural steps that will logically take an aviator or aircrew from the onset of an emergency situation to a successful landing. The sequence of steps you must choose must include not only all the required switch actions to keep the aircraft flying, but also the best course of action to work around failed or degraded



systems. Ask yourself, as you examine each emergency scenario, have you done all that you can do for that pilot or aircrew who is relying on your expertise and judgment to bring that aircraft safely home?

That's the process. Smart people are trying to design a fail-safe system to help you solve a problem with your aircraft. That is why a smart Army aviator like you should be able to discern their reasoning and rationale. If you can page through the emergency procedures section of your checklist and understand the rationale for the sequence of steps in each procedure, you are prepared for any emergency in the checklist. The confidence this feeling builds is well worth your time.

Third, while understanding that the layout and scheme of each emergency procedure is important, "referring to the checklist" must first be put in proper perspective. First and foremost, fly that hunk of iron. Then, in any emergency situation, is there any switch or control movement that must be done immediately to maintain control? If the answer is yes, it is most likely underlined and that is what you should be doing while flying the aircraft. If the answer is no, your reaction should be to maintain aircraft control and analyze the situation while you get pointed away from the ground and headed toward home or some other suitable airfield. Those critical initial actions must be done at the proper pace to avoid hasty or incorrect actions.

After dealing with these priorities, work on attaining the proper altitude and airspeed for the return trip. While completing the checklist procedure, declare the emergency.

At this point, when it's time to dig out the checklist, your cockpit management can help or hurt you. Do you strap the checklist to your leg or do you keep it in some other part of the cockpit? If you keep it in some other part of the cockpit, is it secure? If you are a single pilot, can you maintain altitude and airspeed without the checklist ending up on the floor?

Now that it is the time to refer to the emergency procedures section of your checklist, you are ready. You know how the emergencies are sequenced and ranked.

If the emergency develops close to the field, instead of heading toward home or some other suitable landing area, you may have to obtain maneuvering airspace while you accomplish the checklist procedure and set up for the approach. After all, not every emergency requires an immediate landing to best deal with the situation. After you have completed the checklist, contact air traffic control and state your intentions. Pass on the necessary information for the folks who will be supporting you on the ground until you are safely shut down.

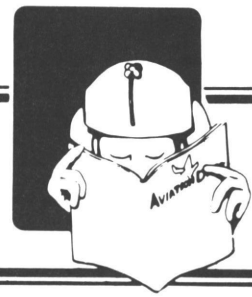
The final step is easy, but important. If the type of approach for the emergency is listed in the checklist, then that is what you fly. If it is not defined, select the approach option that provides the greatest safety margin. Then think about what could go wrong after touchdown. Make a plan to cover what-ifs, like position of ground vehicles or aircraft control difficulties.

The most important thing during an emergency is pace yourself, don't rush. Knowing the sequencing of emergencies and understanding the rationale for the steps will help you pace yourself. Don't confuse proper pace with an inappropriate sense of urgency. The latter can draw you to a faulty conclusion or actions that may not be reversible.

Ready to deal with an in-flight emergency?

DES welcomes your inquiries and requests to focus attention on an area of major importance. Write to us at: Commander, U.S. Army Aviation Center, ATTN: ATZQ-ES, Fort Rucker, AL 36362-5208; or call us at AUTOVON 558-3504 or Commercial 205-255-3504. After duty hours call Fort Rucker Hotline, AUTOVON 558-6487 or Commercial 205-255-6487 and leave a message.

VIEWS FROM READERS



Editor:

Reading Mr. Rowe's article, "Touchdown Emergency Procedure Evaluation" (April 1989, *Aviation Digest*), reminded me of a pilot in command (PC) checkride given to two young pilots some time ago at Ft. Campbell, KY. Both pilots were told to strap-in, in front. "Bad Bart" then conducted the ride from the back! When asked, his rationale was simple; if he did not have confidence in them, why should he make them PCs. After all, would their passengers have the opportunity to assume the controls if something went wrong?

Mr. Rowe's casual statement that, "on the average, aviators continue to need verbal or physical assistance to complete prohibited maneuvers. . ." is paramount to an indictment of incompetence against those of us who must abide by the moratorium. Given the thousands of soldiers who annually entrust their lives to our skills, can we abide by our sacred trust to ensure their safety and welfare? Likewise, are aviation units combat ready, if we, the pilots, are not prepared to deal with the probable failures, which will be caused by hostile fire?

The monetary savings resulting from the moratorium are documented and, on the surface, may justify this action. The issue could be raised, however, that similar savings can be made by restricting such activities as nap-of-the-earth or night vision goggles flight. To quote from Brigadier General Patrick H. Brady's excellent article "When I have your Wounded" (*Army,* June 1989), "Repetition, not avoidance, is vital in dangerous training. You don't get good at something you will have to do by avoiding it."

Whether or not we as aviators, or even Directorate of Evaluation and Standardization (DES), believe in the moratorium is academic. Conversely, the training tasks, prohibited or not, are more than academic. If training aviators to standard in their basic aircraft is unacceptable, the Army has a moral responsibility to employ alternate means such as greatly enhanced simulation or special/modified trainer aircraft. Costs would be high, but no more so than the cost of incompetence in the next war. Certainly, if DES supports this decision, they should be at the forefront in finding a solution to the training void. Conversely, if they believe the situation is acceptable "as is," let them evaluate our performance of prohibited maneuvers from the back seat!

CW2 Clifford N. Cox
1-211 AHB
Utah National Guard
Salt Lake City, UT

The *Aviation Digest* received the following response from COL Michael H. Abbott, director, Directorate of Evaluation and Standardization, U.S. Army Aviation Center, to CW2 Cox's letter:

Although touchdown emergency procedure (TDEP) training no longer includes actual touchdowns to the ground, the basic principles of the maneuvers continue to be taught. TDEP training mishaps (their high volume helped inspire the moratorium) are now virtually nonexistent. Mishaps requiring the application of the emergency procedures have shown no increase in airframe damage, personal injury or loss of life. Current policy has reduced the risk to the aviator, crew and passengers.

It is unlikely that combat will provide an environment in which an aircraft can land to a hard surface from 1,000 feet at 90 knots. Most likely, the aircraft will be in a low altitude, low speed environment with unforgiving terrain. Survival of the aircrews on the battlefield will depend extensively on their ability to avoid enemy imposed touchdowns. In keeping with that requirement, time previously dedicated to TDEP training is now more wisely spent enhancing tactical proficiency.

The evidence overwhelmingly supports the moratorium.

Editor:

I enjoyed your lead article "Origin and Evolution of Army Aviation, Part I: The First Century" in the June 1989 issue of the *Aviation Digest.*

LTC Joseph M. Watson, TXARNG, was inducted into the Army Aviation Hall of Fame in 1989. It appears that as early as 1936, then LT Watson was conducting tests in support of his theories of aerial reconnaissance and artillery adjustment in rented aircraft from Stinson Field

in San Antonio, TX. In 1940, LTC Watson, along with Mr. Piper (the president of Piper Aircraft) conducted a 2-day test at Camp Beauregard, LA, using the light aircraft as an artillery observation platform.

Again, in November 1940, LTC Watson, Mr. Piper (himself) and other Piper personnel flew missions for 14 days in *rented Cubs.* The report submitted supported LTC Watson's concept that he had been preaching since 1936.

It would appear, if the above information is correct, that LTC Watson is truly the founding father of Army Aviation and should be recognized in the history of Army Aviation. Please pass this information to Mr. Kitchens, the branch historian.

I have enjoyed the *Aviation Digest* for many years. Keep up the good work.

CW3 AL Cargen
U.S. Army (Retired)
San Antonio, TX

Editor:

There is a message authorizing just about all of Army Aviation personnel to wear the Aircraft Crewman Badge (DA message 86-94, paragraph 2). It states, "Due to an administrative error, not all soldiers graduating from an aviation MOS producing course have been awarded the Aircraft Crewman Badge."

Paragraph 4 of this DA message listed MOSs that were affected by this error; however, it did not list MOSs in the 93 series. Is this an oversight? To my knowledge the majority of the 93Ps (Aviation Operation Specialists) will only be assigned to aviation units, it seems reasonable that they should be able to wear the aviation wings and feel just as proud to be a part of aviation as 66, 67 and 68 series.

Throughout my military experience (7 years as a 93P), 93Ps—also known as 71Ps—have been excluded from being referred to or treated as a part of aviation. Now with the publishing of this DA message, we are being singled out once again.

For further comment on this letter, please contact me at AUTOVON 314-2198 or Commercial 808-656-2198/1347.

SGT Terrence Q. Williams
Aviation Operation Specialist
Schofield Barracks, HI

The following reply was received from the Directorate of Aviation Proponency, U.S. Army Aviation Center, Ft. Rucker, AL:

PERSCOM Msg 241500Z May 1989, subject: Confirmation of Criteria for Aircraft Crewman Badge, clarified and confirmed the criteria for award of the Aircraft Crewman Badge contained in paragraph 5-27b(1), Army Regulation 672-5-1.

All soldiers who successfully complete courses of instruction that lead to award of an MOS in CMF 67 will be awarded the badge upon graduation and award of MOS.

PERSCOM Msg 161500Z June 1989, subject: Aircraft Crewman Badge, further authorized those soldiers formerly in CMF 28 who were reclassified to a 68-series MOS, the Aircraft Crewman Badge.

Point of contact is MSG Lockaby, AUTOVON 558-4313.

Editor:

First, I'd like to thank you for your past support of America's veterans. Second, I'd like to request your help again. The ACT (Vietnam) Chapter, 11th ACR, is planning our next reunion and request the following information be published:

WHO: Air Cavalry Troop (Vietnam), 11th Armored Cavalry Regiment.
WHAT: 6th Annual Reunion.
WHEN: 9 to 12 May 1990.
WHERE: Ft. Knox, KY.
POC: James Angelini, secretary, 2512 Lower Hunter's Trace, Louisville, KY 40216-1352, Commercial 502-449-1220.

Again, we'd like to thank you for your continued support of America's veterans.

James Angelini

Editor:

The U.S. Air Force Survival School would appreciate your assistance in our survivor interview program.

By printing the attached request for survivor information, you will be helping us obtain factual stories for our instructors to use during student training. Your assistance is greatly appreciated.

HQ ATC/DOTZ point of contact is SMSGT Gander, AUTOVON 487-4070.

COL Robert M. Negley Jr.
Director, Flight Operations
Headquarters, Air Training Command
Randolph, AFB, TX

Do you have a survival story you would like to share? We are looking for people like you who have experienced a survival episode, either military or civilian, which can be used to enhance U.S. Air Force survival training. We will use your valuable experience to let others know what might be expected and how they might feel. Please contact us at 3636 CCTW/DOV, Fairchild AFB, WA 99011-6024, AUTOVON 352-2371 or Commercial 509-247-2371/2171.

Readers can obtain copies of material printed in any issue by writing to: Editor,
U.S. Army Aviation Digest, *P.O. Box 699, Fort Rucker, AL 36362-5042.*

Captain James R. Bullinger
U.S. Army Aviation Officer Advanced Course 89-4
U.S. Army Aviation Center
Fort Rucker, AL

ALMOST EVERYONE associated with Army Aviation is aware that the United States Army Aviation Center, Ft. Rucker, AL, provides helicopter flight training to the United States Air Force (USAF) and to our North Atlantic Treaty Organization allies. In just about every flight class, you will find a handful of either Dutch, Norwegian, German, Danish or USAF students. However, most people are not aware that the Aviation Center also provides helicopter flight training, entirely in Spanish, to our Latin American (LATAM) allies. At Ft. Rucker one small unit is responsible for providing Spanish language flight training—E Company, 1st Battalion, 223d Aviation Regiment, Aviation Training Brigade (ATB).

E Company originated in January 1984 as the United States Southern Command (SOUTHCOM) Flight Training Detachment. Stationed at Ft. Rucker, the SOUTHCOM detachment was formed at the request of the U.S. Department of State to provide flight training assistance to El Salvador. In 1983 the Salvadorean Air Force (FAS) found itself suffering from a lack of qualified helicopter pilots. To keep the helicopters flying, the FAS began placing fixed-wing pilots in the cockpits to serve as copilots. It is important to understand that these fixed-wing copilots did not receive any type of helicopter flight training. They were intended to help with the navigation and radio calls while the pilots flew the aircraft. After a pilot in command was shot during a combat operation and the untrained copilot crash landed the aircraft, the FAS realized it needed a better solution to its problem of helicopter flight training.

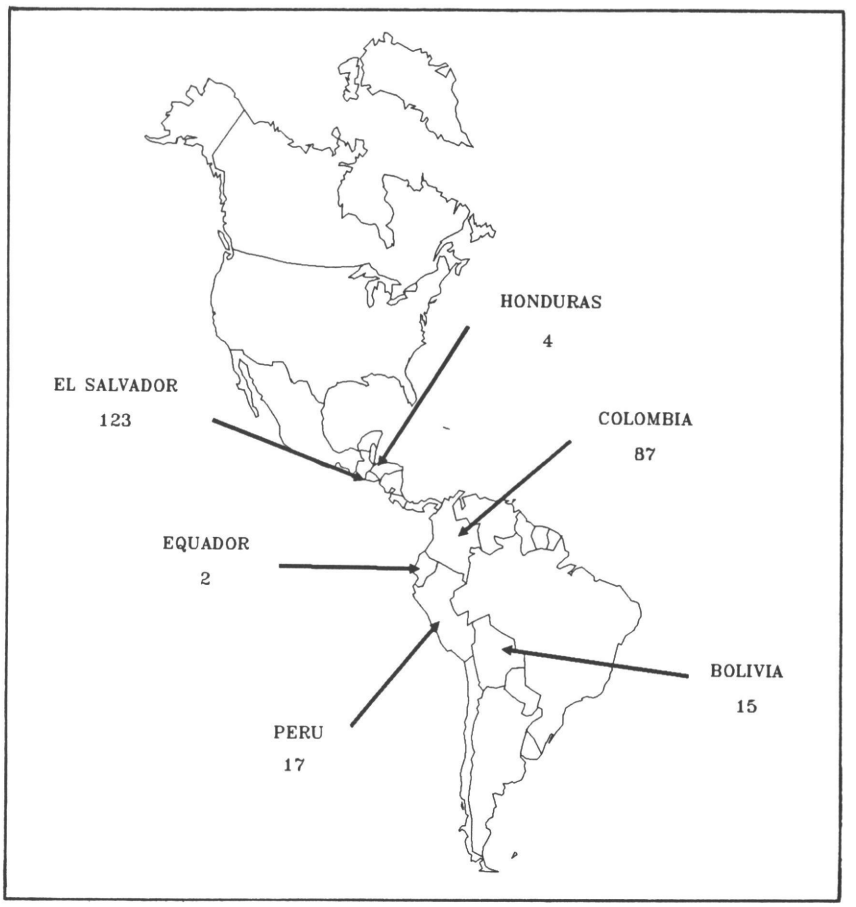
The SOUTHCOM detachment initially was created to develop and run a one-time UH-1 Huey copilot qualification course. The course was to consist of a combination of general academics and 75 hours of flight instruction. The FAS students were to receive UH-1 systems, maintenance, flight simulator training and basic day tactics as part of the course instruction. Normally, developing and executing a flight training program around the UH-1 aircraft would not be difficult. However, this time the training program was to be taught completely in Spanish. But why did the training have to be in Spanish?

There were several factors that dictated teaching in Spanish. First, English is still not a second language for most Latin Americans. It would take a long time to teach English to a comprehension level that would allow FAS students to understand aviation concepts. Second, teaching English would add to the cost of the training. El Salvador, because of the insurgency, was already hurting financially. Third, the FAS needed pilots trained quickly to continue the fight against the insurgents.

Since the SOUTHCOM detachment was only to be in business for a short period of time, no formal Table of Distribution and Allowances (TDA) was established. ATB, then the Department of Flight Training (DOFT), used its own Spanish-speaking aviators to begin forming

the unit. DOFT finished filling the SOUTHCOM unit with additional assigned Spanish-speaking personnel after a directed military overstrength was granted. Because no one expected the training program to last, only minimum resources were dedicated. The instructor pilots (IPs) were faced with translating all of the materials needed to run the course and to provide the academic instruction.

Twenty FAS students arrived in early 1984 and after 90 days were graduated from training. Because of the effectiveness of the course, the FAS requested a second iteration be run to train 20 more pilots. After the second class completed training, the FAS made a third request. In April 1985 the copilot training program was expanded into a 20-week course to train new helicopter pilots. The program was called the Spanish Language Helicopter Pilot Course (S-LHPC). The course consisted of 137 hours of academics, 15 hours of flight simulator and 115 hours of flight training. As a result of the quality of aviators El Salvador was getting, other LATAM countries began requesting quotas for the S-LHPC. Since then training for Latin America has continued to increase.



1985-1989 E Company graduates from Latin American countries.

Today E Company's mission, simply stated, is to provide initial and advanced helicopter flight instruction, in Spanish, to LATAM aviators. It sounds simple enough, but this continues to be one monstrous task. Stop and consider the resources required to train just enough English-speaking initial entry rotary wing (IERW) students. Ft. Rucker uses a contractor to provide all academic instructors and flight instructors for the preflight, primary and instrument phases of IERW. For the remaining phases, Ft. Rucker uses many military and civilian subject matter expert academic instructors from different directorates and a multitude of military flight instructors specializing in either combat skills or night flying. A UH-1 IERW student will have 45 or more academic instructors and at least 5 different IPs during the course. E Company must accomplish its Spanish version of IERW, and other advanced flight instruction programs, with only 6 academic instructors and 14 IPs. In addition to flight instruction, the company also assists with student administration.

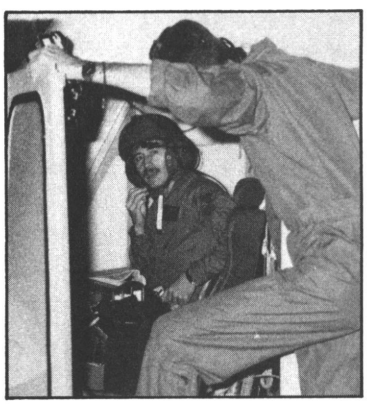
To accomplish its mission, E Company is organized into five elements: a headquarters section, an operations section, an academics section and two flight platoons. The headquarters section is responsible for the daily running of the company and ensuring the standardization of flight instruction among unit IPs. The operations section coordinates aircraft, stagefields, classrooms and flight simulators in support of student training. Operations also produces the weekly training schedules and manages the unit flight hour program.The academics section duties will be discussed later in this article. The two flight platoons provide all aircraft and flight simulator instructions. In all, 21 personnel are assigned to the unit.

The biggest challenge E Company faces is maintaining qualified IPs. To be fully mission qualified, an individual must be a contact, tactics, night vision goggles (NVG) and instrument IP; and the individual must be able to instruct fluently in Spanish within these areas. Training for a newly assigned aviator may take up to 1 year. He must first complete the Aviation Center's method of instruction (MOI) courses in order to teach flight training to students. This includes contact MOI,

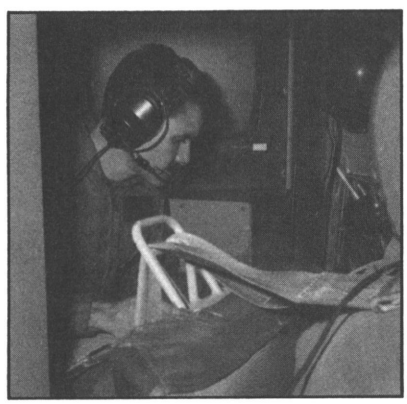
photographs by CW2 Carlos M. Zayas

The latest graduates from class 90-01 of the Spanish Rotary-Wing Qualification Course were 9 pilots from the civil police force in Peru.

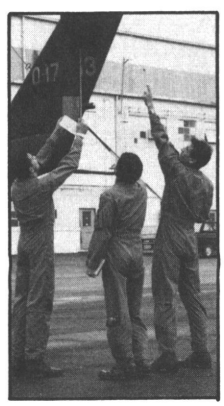
IP CW3 Felix Rodriguez (left) discusses UH-1 flight simulator training with students CPT Miguel Limo (center) and CPT Ricardo Murrugarra (right).



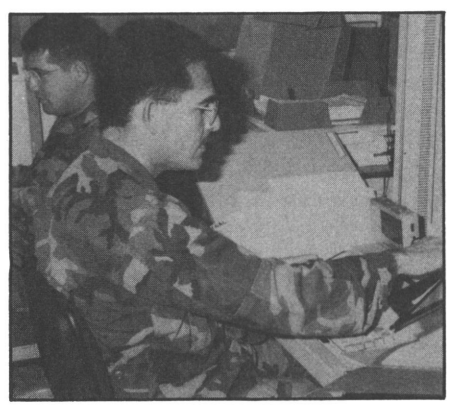
CW3 Dennis Maxwell prepares CPT Carlos Landauro to begin flight training period in the UH-1 flight simulator.



Instructor pilot CW3 Felix Rodriguez (with headset) instructs CPT Ricardo Murrugarra (in helmet) in the UH-1 flight simulator.



CW2 Fred Gomez (right) shows preflight to CPT Dario Hurtado (left) and CPT Julio Lopez (center).



SFC Isidro Almodovar (foreground), a U.S. Army military operations NCO, translates lesson plans for SGT Nestor Torres.

combat skills MOI and NVG MOI for the UH-1 aircraft. Then the aviator undergoes unit instrument IP training, and finally Spanish MOI. During Spanish MOI the aviator learns to use and teach the correct, standardized Spanish phraseology.

Once trained, an IP needs continuous refresher training to maintain his instructing and flying skills. When the company is not engaged in training LATAM students, the IPs may carry English speaking students in other Aviation Center flight courses. During most of 1988 E Company had virtually no LATAM students to train. So the IPs were used to help train a backlog of IERW UH-1 combat skills students.

The company's six academic instructors (AIs) have an equally tough job to perform. They prepare, translate and present all of the academic instruction in Spanish for eight different programs of instruction (POIs). What adds to their difficulty is they must be knowledgeable in about 198 blocks of instruction. The subject matter is identical to what is taught in the English version rotary-wing POIs. For example: in the S-LHPC alone the AIs present 137 hours of academics. As soon as an AI finishes one block of instruction, he immediately begins reviewing and preparing the next block for the following day. In the case of S-LHPC, this process continues for 20 weeks.

When the AIs are not supporting POIs with academic instruction, they are engaged in the laborious task of translating course materials into Spanish. Every time a change is issued for a dash 10 manual, a programed text, or a student handout, or when a field manual or training circular is revised, the material must be retranslated. This is a time-consuming process because the AIs must manually type the material into their word processor, translate it, edit the draft, re-edit it, then print and reproduce it.

E Company now has six UH-1 courses and two UH-60 Black Hawk courses. All of the courses have been approved by the Department of the Army. With the exception of S-LHPC, all of the courses are awaiting final approval of their POIs from the Army's Training and Doctrine Command. The eight available courses of instruction are shown in the figure at right.

For a small unit that was established to provide a one-time copilot training program for El Salvador, E Company continues to endure. The toughest hardship E Company has had to face for the past 5 1/2 years is not having an approved TDA from which to work. The ATB has maintained E Company's existence by taking aviators out of its resources and requesting a directed military overstrength. Presently E Company is awaiting an approval for a 23-man TDA. Despite the lack of resources, the unit has managed to provide high quality instruction to LATAM countries.

Since its beginning, E Company has provided training for 123 Salvadorean aviators. Other LATAM aviators trained include: 4 from Honduras, 2 from Ecuador, 15 Bolivians, 17 Peruvians and 87 Colombians. With the continued problems of insurgencies and narcotics trafficking facing our LATAM allies, there is no doubt E Company will continue to play an important role in the training of aviators.

For personnel desiring more information on E Company's training programs, they may contact the unit by calling AUTOVON 558-6541/6233 or Commercial 205-255-6541/6233.

E Company Latin American Courses

COURSE	LENGTH
Spanish Language Helicopter Course (S-LHPC/UH-1)	20 weeks
Rotary-Wing Qualification Course (S-RWQC/UH-1)	11 weeks
Instrument Refresher Training Course (S-IRTC/UH-1)	2 weeks, 2 days
Instructor Pilot Course (S-IPC/UH-1)	6 weeks
UH-1 Transition Qualification Course (S-UH-1 TQC)	4 weeks, 3 days
Night/NVG Qualification Course (S-N/NVG/UH-1)	4 weeks, 3 days
UH-60 Transition Qualification Course (S-UH-60-TQC)	6 weeks
UH-60 Refresher Training Course (S-UH-60 RTC)	2 weeks

TACTS/ACMI

Adapted to National Guard Helicopters

Captain Mark S. Stigar
D Company, 113th Aviation
Nevada Army National Guard

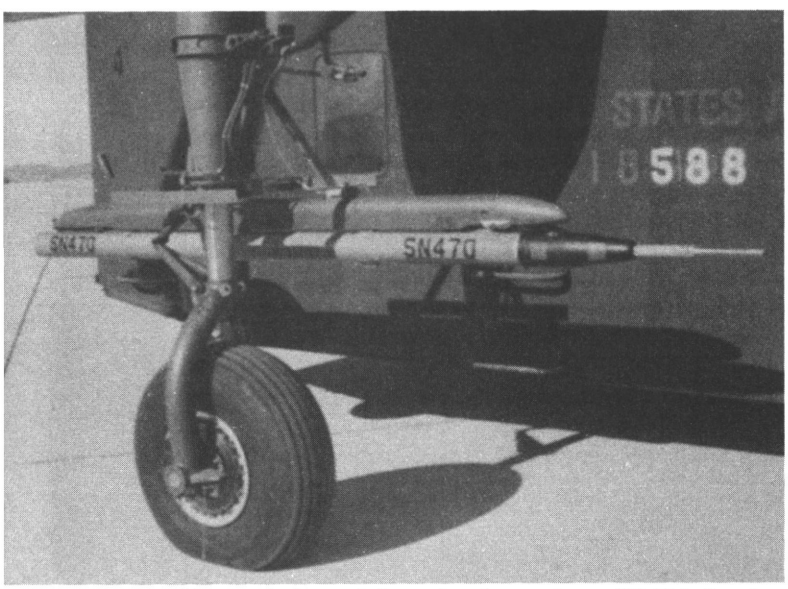
YOU MAY HAVE had your first encounter with the tactical aircrew combat training system (TACTS) in the movie "Top Gun." The hero watches as his flight is relived on a large screen television. He's debriefed on his air combat maneuvering instrumentation (ACMI) for the day in three dimensional computer graphics as flight data is displayed on adjacent screens. You watch as flight crews fight to survive or are "killed" without a drop of blood.

The electronic battlefield became operational for the U. S. Navy in December 1973. Analysis of air-to-air combat experiences in Southeast Asia led to the establishment of the TACTS/ACMI mission: ". . .to provide a means of safely training aircrews and evaluating their effectiveness in all aspects of air combat maneuvering." Since then, the U. S. Air Force (USAF) has adopted the same system, calling it air combat maneuvering instrumentation. Currently, 13 systems exist worldwide.

TACTS/ACMI allows aircrews of both supersonic tactical aircraft and now helicopters to experience combat conditions without requiring live firing at targets. The system simulates airborne weaponry while the aircraft flies in a typical combat environment. Simultaneously, the action, displayed in detail, can be seen at a control console on the ground. Post mission debriefing occurs, showing all engagements, both successes and failures, by video replay in the classroom.

TACTS/ACMI system has four subsystems:

- Airborne instrumentation subsystem (AIS).
- Tracking instrumentation subsystem (TIS).
- Control and computation subsystem (CCS).
- Display and debriefing subsystem (DDS).



photograph by SSG Steven C. Brown

Airborne instrumentation subsystem pod on a CH-54 helicopter.

The AIS, commonly referred to as "the pod," mounts on any AIM-9 Sidewinder launcher rail. Weighing 126.5 pounds, the AIS is 9.5 feet long and 5 inches in diameter. The AIS is tipped by an air-data sensor probe, behind it a dipole antenna. The body of the AIS includes the following: radar altimeter; signal conditioner; transponder; power supply; digital interface unit; digital processor; and an inertial interface with three gyros and three accelerometers. Powering the AIS are the aircraft's 28 volts, direct current, and 115 volts, alternating current, electrical systems.

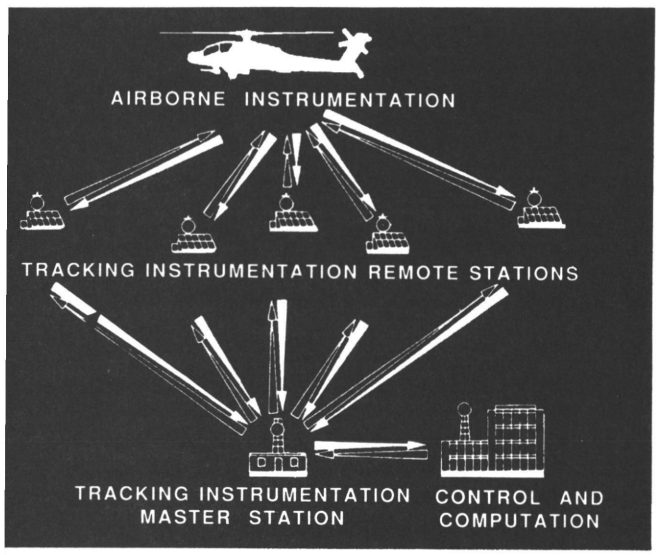
The TIS has a master station and any number of solar/battery powered remote stations. These remote stations pick up pod transmissions and relay the information to the master station that relays the information to the CCS.

The CCS or master computer interrogates each pod-equipped aircraft every 100 milliseconds. This information tells attitude, velocity, position, acceleration, angular rate of change and weapons' data. All of the remote TIS stations in range of the aircraft relay this information back to the CCS. This allows the CCS to compute vector, relative position and weapons' simulation from each aircraft without radar.

The last subsystem, the DDS, provides range monitoring by trainers from video displays in three dimensional/real-time graphics and is recorded for postflight crew debriefing. The DDS provides the trainer and aircrews with needed information: aircraft location; altitude; flight paths; attitude; relative aircraft position; range terrain; computer cockpit view; and depth cueing while on the range. The system will simulate air-to-air, air-to-ground and surface-to-air weapon trajectory.

Current western land-based range locations include: Marine Corps Air Station Yuma, AZ; Naval Air Station (NAS) Fallon, NV; Nellis Air Force Base, NV; Luke Air Force Base, AZ; and Holloman AFB, NM.

During 1983, the Marine Corps began to test ways for high performance aircraft to counter the growing helicopter threat. As a result, the Marines began to develop air-to-air combat with their helicopters and trained aviators in these skills. The Marine's AH-1T and J Cobras became TACTS/ACMI capable a few years ago because of the aircraft becoming Sidewinder capable. During 1985, the development of new software fine-tuned the system for the slower moving helicopters.



The Nevada Army National Guard aviation units based at the Reno/Stead airport consist of a heavy helicopter headquarters and headquarters company, heavy helicopter company (CH-54A Tarhe) and an air ambulance detachment.

To improve training and demand more from Guard members, the Nevada Army National Guard coordinated the use of the NAS Fallon electronic warfare range in 1987. The range allows aviators to use terrain flight tactics against various threat air defense weapons. Feedback was immediate from radio communication between the threat and the aircraft. The range officer notified Guard members if their aircraft was being tracked or when they broke track by using the proper tactics. Engagements were continuously video taped for later viewing during debriefings. Limiting this exercise was the range of the video camera, which only captured the engagements by the weapons.

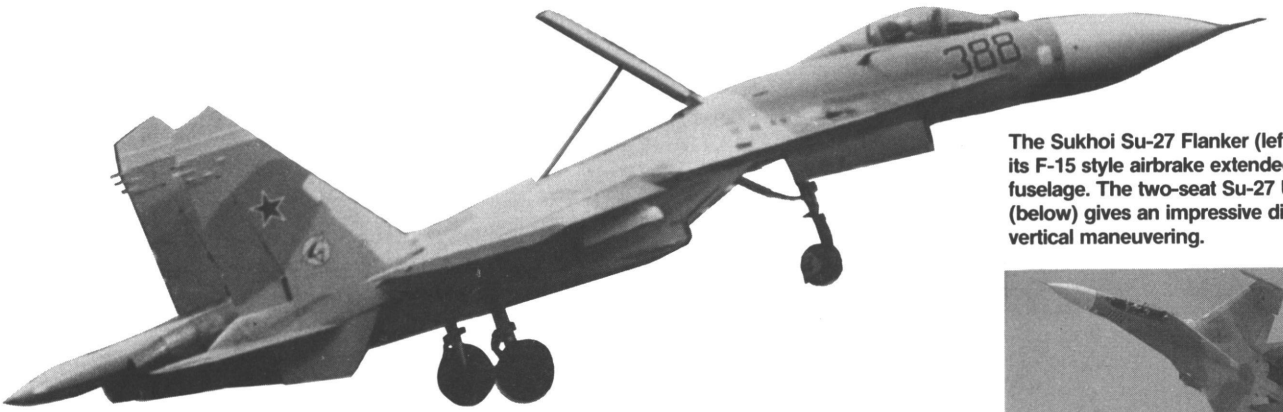
To improve on this excellent training in January 1988, a Sidewinder launcher rail was attached to one of the CH-54A aircraft. The effort was not to conduct air-to-air with "Skycranes" but to use the TACTS/ACMI system to gain additional feedback from the training. The U. S. Army Aviation Systems Command, St. Louis, MO, approved the method of launcher attachment in March. In April, the system was used for a multiservice exercise conducted at NAS Fallon.

The exercise combined CH-54A, UH-1V Huey and FA-18 Hornet aircraft, joined with U. S. Army and USAF special operations forces, Reserve Officers' Training Corps cadets and other local unit members. The CH-54As and FA-18 aircraft were TACTS/ACMI pod equipped. The UH-1V aircraft could not mount the TACTS/ACMI, because they lacked substantial hard points to attach the Sidewinder launcher rail. The helicopters were task organized into two flights each with an instrumented CH-54A. The unit's safety officers functioned as range safety officers from the DDS to prevent any possible conflicts between Navy and Army aircraft. In addition, they were able to observe the area of operation from video monitors and had radio communication with all ground and air elements.

During the exercise, Army aircraft were informed of any threat engagements or kills. At the end of the exercise, Guard members were debriefed at the DDS. The entire exercise was presented on a large screen color display from the time of entry into the 2,100-square mile range to the time of exit. Along with the TACTS/ACMI computer graphics, flight crews could examine their flight data—speed, altitude, attitude and gravity; range safety data; pilot performance; and the other aircraft in the exercise. Aviators also watched video tapes of threat weapon engagements from the gunner's view and their arrival at the target areas and landing zones. Use of these excellent training devices was just the beginning of the continued effort to explore ways this system can improve training.

The future fielding of the Stinger missile system on Army aircraft requires new training methods and systems. TACTS/ACMI may be the best and most inexpensive answer to this new requirement. Ranges are already developed, built and used by the Navy and Air Force. Future hardware development for an AIS pod designed to interchange with the Stinger system is needed. In addition, the associated software for the CCS will be required.

Can the need for realistic air-to-surface simulations for the AH-64 Apache with modifications to the TACTS/ACMI system be satisfied? Also, can current ranges be adapted to simulate the HELLFIRE, 2.75-inch folding fin aerial rockets and 30 mm weapon systems? The TACTS/ACMI system is an excellent aid to training; increases realism; eliminates any ambiguity; improves debriefing; and, most importantly, continues to challenge flight crews.



The Sukhoi Su-27 Flanker (left) shows off its F-15 style airbrake extended above the fuselage. The two-seat Su-27 UB Flanker (below) gives an impressive display of vertical maneuvering.

all photographs by the author

Paris Airshow Review

CW4 Charles T. Robbins
Arizona Army National Guard
Silver Bell Army Heliport
Marana, AZ

The Paris Airshow is a biennial event in which the U.S. and foreign nations demonstrate their newest commercial and military aircraft to the international market. The U.S. has participated in this event since 1965. In 1971, the USA National Pavilion, an exhibition facility, was opened to display the latest state-of-the-art in U. S. aviation technology. The latest event occurred in June 1989 and is described in this article by an American author who gives us a glimpse of the latest Soviet aircraft.

"PUGACHOV'S COBRA" was what the announcer called it when the Soviet Su-27 started its slow speed, high angle-of-attack (AOA) pass in front of the airshow crowd. While maintaining controlled level flight, the aircraft increased its AOA to 120 degrees, and for 1 or 2 seconds flew tail first by the crowd before resuming a normal flight attitude.

Named after Victor Pugachov, test pilot for the Sukhoi aircraft design bureau near Moscow, the maneuver completed what some highly experienced Western test pilots watching described as the most impressive jet fighter flight demonstration they had ever seen. This was just one of many highlights the Soviets performed at the 1989 Paris Airshow.

A biennial event, the Paris Airshow is the world's leading showcase for new commercial and military aircraft being presented to the international market. It also is a tremendous source of prestige for those nations with participants in the airshow.

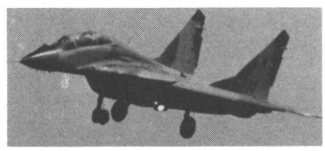
The two-seat Sukhoi Su-25 UT Frogfoot (above) provided daily flight demonstrations. The Su-25 (right) saw action in Afghanistan.

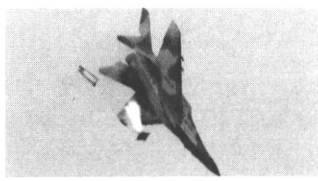
Notable in the 9 through 18 June 1989 airshow was that many of the major North Atlantic Treaty Organization (NATO) programs for aircraft to be placed into service during the 1990s did not yet have flying prototypes. The Soviets brought 12 aircraft, both military and civil, most of which had not been seen in the West before. This show of Glasnost (openness) turned out not only to be a strong bid by the Soviets to increase its share of the international aerospace market, but also allowed Westerners a close-up inspection of many aircraft that they only had sparse information about previously.

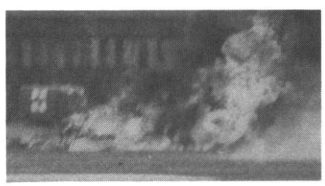
Leading the flight displays were the single- and two-seat versions of the Sukhoi Su-27 (NATO codenamed Flanker) that alternated daily performances. Designed as a long-range air superiority fighter, the Flanker is similar to the American F-15, but larger, more powerful and more maneuverable. The Flanker has an internally mounted 30 mm cannon and can carry up to 10 air-to-air missiles. The pilot uses a helmet sight system to direct an infrared target designator and tracker ball located just in front of the cockpit. A laser rangefinder and a 5-foot diameter radar also provide inputs to the fire control system. This may be an upgraded version of a similar system used in the MiG-29 (NATO codenamed Fulcrum) that claims a first round hit.

The Flanker, like the Fulcrum, is able to be deployed from unprepared landing areas with rugged landing gear, oversized tires, debris deflectors and foreign object damage screens that automatically extend over the engine air intake ducts whenever the aircraft is on the ground. In wartime, this could prove to be a significant tactical advantage over runway dependent Western designs.

Another aircraft not seen in the West before was the Sukhoi Su-25 (NATO codenamed Frogfoot), a ground attack aircraft that is used extensively in Afghanistan. A single seat example remained in the static display area throughout the airshow, while the two-seat Su-25 UT (also designated the Su-28) flew daily performances. The Frogfoot also is designed to operate from tactical areas and, when deployed, carries its own maintenance kit, spare parts, test set and electrical generators in four underwing







Clockwise from far left: The two-seat Mikoyan MiG-29 UB Fulcrum before its flight demonstration, on final approach, the moment of decision for Mikoyan test pilot Anatoly Kvotchur as he ejects directly in front of the crowd, and the view of the crash.

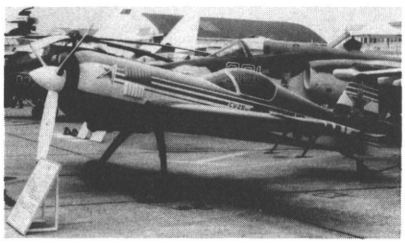
pods. The two Tumansky R-195 turbojet engines are designed to run on jet fuel, aviation gasoline, auto gas and diesel—any fuel that might be found in a war zone. The Su-25 has an internally mounted, two-barrel, 30 mm cannon with a firing rate of 50 rounds per second. Up to 10,000 pounds of guided and unguided bombs can be carried underwing. Demonstrating effortless loops and rolls, the Frogfoot has considerably better flight performance than the West's closest counterpart, the A-10.

Evolution of the Frogfoot continued throughout the Afghanistan War and many survival modifications were made to the aircraft. Special attention was given to limiting the damaging effects on the airframe and engines by ground-to-air missiles. The single seat Su-25 on display is reported to have been hit by a Stinger missile and obviously survived.

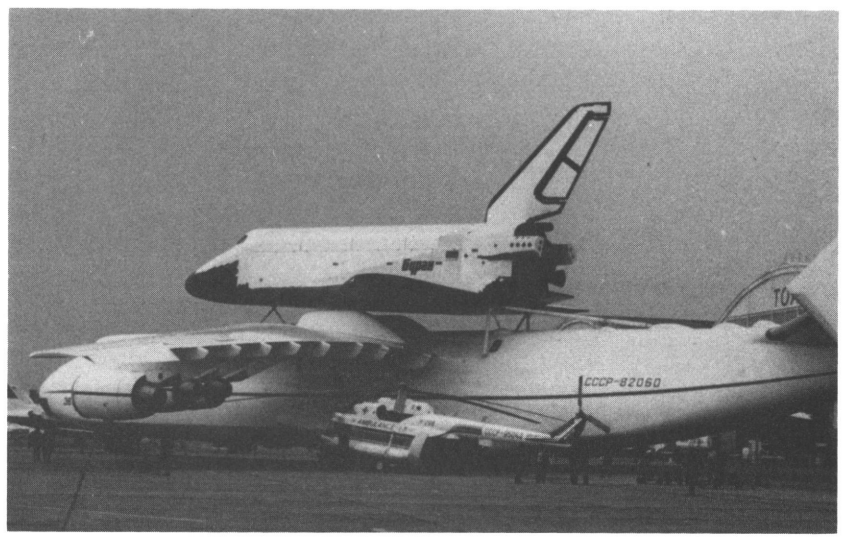
Not only did the Soviets provide the best flying at Paris, but they also provided the best crash. At the opening press day, a MiG-29 making a low-speed, high-AOA pass experienced a flame-out in its right engine when the pilot advanced throttles. The resultant asymmetrical thrust caused an immediate roll and dive from 500 feet above the ground. The pilot was able to eject and survive even though the ejection was outside the design parameters of the seat. Subsequent analysis of photos and a video showed that his parachute was not completely open until he was within 20 feet of the ground. The pilot, Mikoyan test pilot Anatoly Kvotchur, was only slightly injured and he gave a press conference several days later and expressed an interest in continuing to fly in the airshow. He is the same pilot who demonstrated the MiG-29 at the 1988 Farnborough Airshow in England. A few days after the crash, the two-seat MiG-29 UB took over the Fulcrum flight display with a different pilot.

Some other noteworthy Soviet aircraft at Paris included two prototypes of airliners scheduled to enter service in the mid-1990s: the Tupelov Tu-204 medium range airliner that appears to be a copy of the Boeing 727, and the Ilyushin Il-96-300 four-engine, long-range, wide-body transport similar to the European Airbus Industries A-340, an airplane that hasn't even been built yet.

The small Sukhoi Su-26M competition aerobatic airplane, which was flown daily, will be the first



The Sukhoi Su-26M (above) aerobatic competition aircraft will be the first aircraft exported directly from the Soviet Union to the United States.



The An-225 Myria with the Space Shuttle Buran (right). The An-225 is the world's largest and heaviest aircraft with a gross weight of 1.3 million pounds.

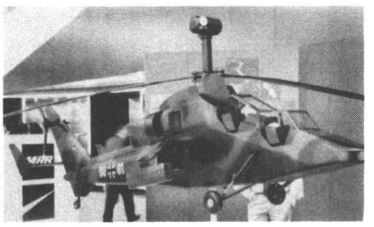
Soviet-produced airplane to be imported directly into the United States. In 1990, three examples are expected to arrive in Florida.

The Antonov An-225 Myria (Dream) arrived with the Soviet Space Shuttle "Buran" riding piggyback. This first example of an expected production of six An-225s is now the world's largest and heaviest aircraft. Its length is 84 meters (275 feet) and the wingspan is 88.4 meters (290 feet). Design gross weight is 1,322,000 pounds. The airplane is offered for lease to almost any country or major company to transport large commercial cargo loads. The An-225 can carry about twice the load as a C-5B Galaxy.

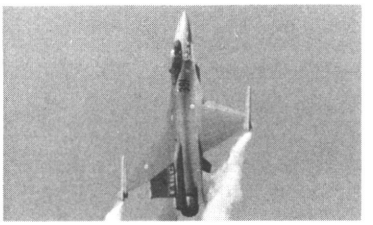
Two Soviet helicopters were on display at the Paris Airshow. An Mi-17 (NATO codenamed Hip-K) was shown in the static display area. A Hungarian company

Hungary outfitted this Mil Mi-17 Hip for the medical role with complete operating facilities.

From Shenyeng, China, the F-811 uses design features of the MiGs -19, - 21 and -23.



A model of the German Pah-2 antitank helicopter to be in service by the late 1990s.



A Turkish-built F-16C for the Turkish Air Force demonstrates high maneuverability with the latest engine upgrade.

The Aerospatiale Panther combat helicopter demonstrates loops and rolls to emphasize its air-to-air combat capabilities.

The French Orchidee battlefield surveillance system, intended as an extension of the airborne warning and control system, has a Doppler radar extended under the Puma's fuselage to pick up troops and vehicles 100 kilometers behind enemy lines.

A mockup of the NH-90 tactical transport, this helicopter is expected to enter service in several European countries by the mid-1990s.

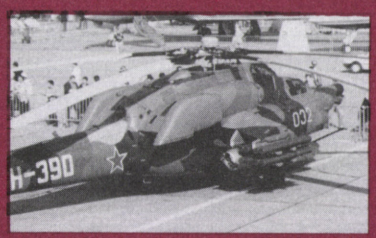
equipped the Mi-17 with medical supplies to include an operating table for one patient.

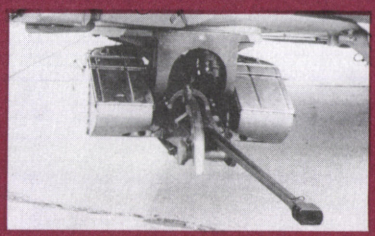
A highly secret helicopter, the Mi-28 (NATO codenamed Havoc), was available for inspection (see page 63). During the show, the Soviets gave a press conference to answer questions about all their aircraft. At other times, Mark V. Vineberg, deputy chief designer for the Mil design bureau, was at the Mi-28 and readily answered questions about the helicopter.

The Havoc flew twice at Paris: once when it was first assembled after being unloaded from an An-22, and again during the first weekend of the show. According to *Aviation Week and Space Technology,* 26 June 1989, page 45, a slight mechanical problem developed during this second flight. Even though the problem was fixed, it resulted in a decision not to fly it again. During the public demonstration, banks up to 90 degrees were achieved and, according to the Mil chief designer, the aircraft is capable of rolls.

One more Soviet helicopter worth mentioning is the Mi-38. A transport helicopter still in the design stage, it is intended to replace the Mi-8/-17 Hip series and is scheduled to perform its first flight in 1992 or 1993. A small model of this was displayed in the Soviet Pavilion. It appeared similar to the Eurocopter EH.101 now being developed in England and Italy. The Mi-38 will be powered by two 3,200 shaft horsepower (shp) engines, carry 30 troops, weigh 32,000 pounds and cruise at 160 knots.

Most of the Soviet aircraft shown at Paris had features that appeared to be influenced by, and with some improvements on, Western designs. If the Soviet policy of Glasnost continues, resulting in increased competition and cooperation, we may see United States, Soviet and European designs merge even closer. Already, Mikoyan (Soviet Union) and Dassault (France) have considered a joint executive jet project. It is possible that Sukhoi (Soviet Union) and Grumman (United States) might cooperate with a supersonic business jet. Marat N. Tishchenko, Mil design bureau chief, suggested a Mil-Sikorsky project for a 100-passenger commercial helicopter by the year 2000. If, however, the many political and economic changes currently going on in the Soviet Union take a turn for the worse, then the 1989 Paris Airshow may prove to have been just a small window of opportunity to see some of the Soviet's latest aircraft.





The Mi-28 Havoc, a highly secret helicopter, will have a 30 mm cannon and a prominent nose radome for controlling antiarmor and antihelicopter missiles.

Havoc Revealed

Even though the outside visibility was good, sitting in the pilot's seat of the Mi-28 Havoc felt like sitting in a tank. The inch-thick glass forming the pilot's and gunner's cockpits can withstand direct hits from 7.62 mm rounds and larger calibers depending on the deflection angle. Developed with lessons from Afghanistan freshly in mind, aircraft and crew survivability were of paramount concerns.

On 10 November 1982, the first Mi-28 flew. This particular helicopter at the Paris Airshow was the third of three prototypes. Although preproduction aircraft have been produced, full production of a service standard model is scheduled to start in 1990 or 1991.

Very similar to the Apache in design, the Havoc is intended to operate primarily in the antiarmor role with a secondary role of antihelicopter. A design requirement was a 60-degree per second turn rate, which it exceeds. It also is capable of flight from plus three units of acceleration (gravity (G)) to minus one-half G.

Two Isotov Tv3-117 engines, 2,200 shp each, power the five-bladed rotor system. The rotor hub is titanium with elastomeric bearings for blade movement. The composite blades have filament-wound glass fiber spars, Kevlar skin and Nomex honeycomb interiors. A titanium abrasion strip is on the leading edge. The blades have no finite time life (according to *Show Daily,* McGraw-Hill, Paris, 1989, 13 June 1989, page 16). The blade airfoil is unsymmetrical, and there did not appear to be any spanwise blade twist. The tips of the blades are slightly swept, with each tip having a small pitot tube as part of the omnidirectional airspeed system. The dome on top of the rotor hub contains controls for the blade anti-ice system. The AH-64 Apache-style tail rotor blades also are of composite material and are offset at a 35-degree angle. The Havoc has conventional flight controls and hydraulics.

Empty weight of the Havoc is 15,400 pounds, mission takeoff weight is 22,900 pounds and maximum takeoff weight is 25,350 pounds. Maximum speed is 162 knots and cruise speed is 142 knots.

The prominent "thimble nose" on the Havoc contains the radar for guiding the "beam riding" antiarmor missiles. Up to 16 At-6 Spiral missiles are carried, and with an estimated range of 6,000 meters in 11 seconds, the At-6 would probably have an additional antihelicopter role. The helicopter also carries conventional unguided rockets in pods under the wings.

The turret-mounted 30 mm cannon appeared to be the same gun as is on the Russian infantry combat vehicle-2. Two ammunition boxes, each containing up to 150 rounds, are mounted either side of the gun. The ammunition boxes move with the gun, which can traverse 110 degrees either side of centerline, elevate to plus 13 degrees and depress to minus 45 degrees from horizontal. Either crewmember can aim the gun using a helmet sight system or the front seat gunner's optical sighting system, which incorporates a laser rangefinder.

Two panels, one on either side of the nose, blank off areas for the yet to be perfected forward looking

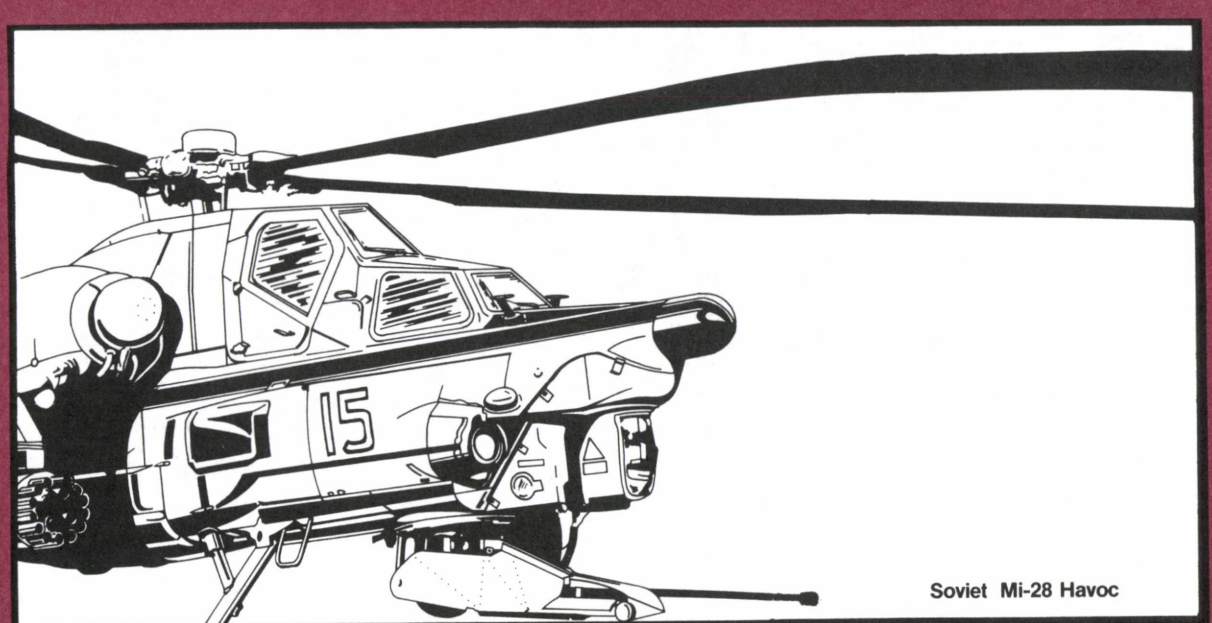
infrared (FLIR) night sighting system. Export versions of the Havoc might not have the FLIR option available.

The landing gear is designed to prevent crew injury from a 15-meter-per-second drop. A negative pressure fuel system is intended to prevent leaks from damaged fuel cells. Large composite ducts on the Havoc displayed deflect the engine exhausts downward while mixing in cooling ambient air. Other exhaust configurations have been tested.

The pilot is in the rear cockpit, which is completely separate from the nonrated enlisted gunner's cockpit. Only the pilot has flight controls, but both crewmembers wear parachutes.

At the front of each seat is an orange handle. When the handle is pulled several things happen: the pilot's (right side) and gunner's (left side) doors are released and fall off; the wing stores are jettisoned; and inflatable rubber balloon devices, located outside and below the crew exits, are inflated and provide a stepoff point for the crew to jump from the aircraft. According to Mr. Vineberg, this escape system has been successfully used in the past. Obviously, it would best be used at higher altitudes than many combat situations would allow, but it might provide some air-to-air combat survival potential that Western designs do not have. Separate red and white handles inside the windows appeared to be emergency releases for the pilot's left and gunner's right windows.

Most of the pilot's cockpit instrumentation appeared conventional; however, there were no markings that would indicate limitations. Some of the engine monitor instruments were of the vertical-tape style. The cyclic appeared very basic with a few add-on switches and what could have been a manual release grip for the wing stores. The collective was a lever with a handhold, but without throttle controls. The large tail rotor pedals had toe straps. Most of the electrical switches were on the right side console, and a large head-up display was mounted on top of the instrument panel. Overall, the cockpit interior appeared to be less sophisticated than Western standards with the exception of the crew seats, which were form fitting and nicely padded. This observer was not allowed into the front seat. Considering that this particular helicopter was a prototype and still undergoing development, the final configuration might be different on production aircraft.



Soviet Mi-28 Havoc

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U.S. Army Aeronautical Services Office

DA Regional Representatives

Mr. John McKeeman
U.S. Army Aeronautical Services Office
Cameron Station, Alexandria, VA

WE RECENTLY moved our Eastern/New England Department of the Army Regional Representatives (DARR) office from New York to Boston for better service to our Army customers. The Eastern/New England DARR is Lieutenant Colonel John W. Taylor, AUTOVON 478-4447 or Commercial 617-273-7155.

The DARRs serve an important function for Army personnel who work in aviation-related areas: air traffic control; range operations; and facilities that use airspace, such as depots and research and development activities. Part 3, Chapter 6 of Army Regulation (AR) 95-2, *Aviation Air Traffic Control, Airspace, Airfields, Flight Activities, and Navigational Aids,* explains DARR functions. The DARR offices can help answer aviation-related questions.

Each DARR office is located at a different Federal Aviation Administration (FAA) regional headquarters across the United States. In addition, the DARR office in Europe serves the same purpose. This office is better known as the U.S. Army Aeronautical Services Detachment-Europe. AR 95-2 and the Flight Information Bulletin, Technical Bulletin AVN 1-series, include phone numbers and locations for these DARR offices.

Because of their location in the FAA regional headquarters, the DARRs can solve problems at the regional level. The DARR can help with problems dealing with violations of flying regulations; interpretations of FAA rules or regulations; and coordination of aviation activities requiring regional approval, such as paradrops or night vision goggles training. DARRs have instant access to the resident experts on all these subject matters.

Airspace is important. The FAA is responsible for the management of the nation's airspace, a resource that is becoming scarce as more users want their fair share. The Army uses airspace for air traffic control (ATC) purposes, such as control zones, as well as special use airspace (SUA) for conducting activities that may be hazardous or incompatible with nonparticipants. Hazardous activities include firing artillery, firing aircraft weapons, detonating old munitions, test firing production munitions and conducting tests of new weapons systems. Most of our hazardous activities are conducted in SUA restricted areas. When we use these areas, other users are denied access to that airspace, much to their discontent. This is when the DARRs help, handling airspace matters for the Army user and serving as the initial point of contact (POC) for obtaining, modifying or returning airspace in coordination with the FAA.

Our DARR ATC noncommissioned officers (NCOs) have considerable experience in their field and can help both fixed-base facilities and tactical ATC units. Capabilities of the DARR NCO include interpreting the *ATC Procedures Handbook*, reviewing and updating facility letters of agreement and appointing control tower examiners.

The DARR offices also work closely with the Aeronautical Information Division. DARRs can help the user request, develop and update instrument approach procedures. They can also update information currently in the Department of Defense Flight Information Publication (FLIP). DARR personnel validate facility information currently in the FLIP products. They ensure that FLIP account holders understand how to verify information for products, as well as how to obtain products to support unit missions.

POC is Mr. John McKeeman, AUTOVON 284-7796 or Commercial 202-274-7796.

USAASO invites your questions and comments and may be contacted at AUTOVON 284-7773.

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The Tchepone Navy

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82d Aviation Brigade Deploys to Honduras

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Eagles, Wings and Other Things

CW4 Harry W. Sweezey

November/December

Brother Solider, I Trust You With My Life

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