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PROFESSIONAL BULLETIN

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Cover: **This month's lead article, "Sergeant Pilots—The French Solution," is the first of three articles on the training and flying careers of French Army aviators. Story begins on page 2. Depicted on the cover is a French Gazelle firing a HOT missile. Illustration by WO1 Steven Snyder.**

Aviation Branch's 6th Anniversary

On 12 April 1983, Secretary of the Army John O. Marsh Jr. approved the establishment of Aviation as a separate branch of the Army. On 6 June 1983, Army Chief of Staff General E. C. Meyer directed the Army Aviation Center at Fort Rucker, AL, as the central point for all aviation matters and issued the Aviation Branch Implementation Plan. Since this date, Army Aviation has achieved an impressive 6-year record, successfully meeting the challenges that being a full-fledged member of the combat arms team presents. In the upcoming history issue, June 1989, Dr. John W. Kitchens, the Aviation Branch historian, tells us of some of these historic challenges.

Major General Ellis D. Parker
Commander, U.S. Army Aviation Center

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Major General Ellis D. Parker
Chief, Army Aviation Branch

Military and Civilian Pilots Working Together

THE ARMY as early as 1953, saw the need to augment their instructor pilot (IP) training force with civilians. The U.S. Army Aviation Center, Ft. Rucker, AL, currently trains more than 1,700 initial entry rotary-wing students and 3,000 pilots in advanced courses each year. To accomplish this mission, 1,042 + IPs and standardization IPs teach student training at Ft. Rucker. The Aviation Center uses a unique blend of civilian contractors, Department of the Army civilians (DACs) and military personnel to make up the IP work force. The work force is 46 percent military, 42 percent civilian contractors and 12 percent DACs. The flexibility of this mixture enables Ft. Rucker to continue training aviators under the new multitrack program.

The importance and responsibilities of civilian IPs increased with the onset of multitrack. For years, students received their first exposure to primary flight training from civilian contract IPs. All of these aviation pilots are aviation veterans with the majority receiving their own initial flight training from the Aviation Center. The average contract IP's flight time exceeds 5,000 hours. Under multitrack, the civilian contractor no longer teaches primary training in the TH-55 Osage; but primary training is taught in the UH-1 Huey. Contract IPs continue to instruct instruments in the UH-1. The contractor also expanded its areas of instruction to include low-level navigation courses and advanced instruments academic, taught in the UH-1. In addition, the contractor now has the sole responsibility of teaching the rotary-wing qualification and instrument courses, instrument examiner course, U-21 Ute IP course, and also OV-1 Mohawk qualification and IP courses.

The multitrack program reemphasizes the importance of DAC augmentation. DACs work directly for the government instead of a contractor. They provide one of the most important assets to the Aviation Center's flight training program—continuity. Contractors and primary trainers may come and go; Active Duty personnel will permanently change stations, but the DAC remains. They too are veteran aviators with thousands of hours of flight experience. The majority either served or retired from active military duty. DACs retain the knowledge of how the training program can and does work. The Army all too often reinvents the wheel. The DACs institutional knowledge helps keep this to a minimum. Their constant number keeps IP turnover to a minimum and assists in the transition of new military IPs.

Throughout the scope of the Aviation Center flight training program, DACs and military IPs work hand-in-hand. They teach all tactics and night vision goggles training. The military IPs impart to the student not only flying skills, but also important knowledge of current requirements in the field. They can teach new officers what is expected of them in their new units. By allowing military IPs to rotate back to the field, units gain experienced instructors. Ft. Rucker gains a fresh perspective of unit requirements and a dynamic flow of ideas on how to improve the flight training program. Military IPs also serve as check pilots for courses taught by civilian contractors. This ensures that training is taught to standards required by the Army and also provides input directly back to the contractor.

The Aviation Center's flight training program could not exist without the excellent teamwork between civilian and military IPs. With civilian contractors starting students off on the right foot, DACs providing continuity to tactics training, and military IPs binding them together, we continue to turn out the finest helicopter pilots in the world. This winning team directly contributed to making fiscal year 1988 the safest year in the history of Army Aviation.

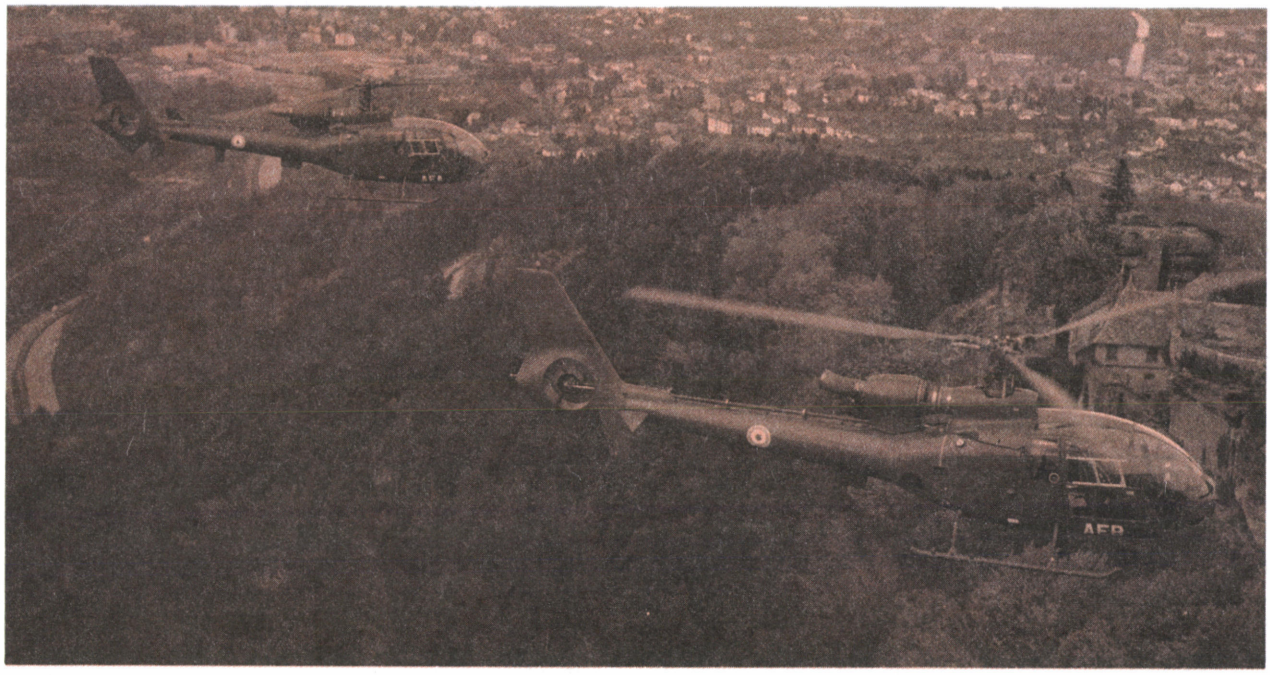
The French Army Aviator

PART 1

Sergeant Pilots

The French Solution

Lieutenant Colonel Terry L. Johnson



Editor's note: In 1986 the Army conducted a major enlisted aviator study (EAS) in response to a Vice Chief of Staff, Army tasking. The EAS conducted a close examination of British, German, Italian and French enlisted pilot programs. Although many of the Allied programs had similarities to the warrant officer flight training (WOFT) program, none of the Allied programs trained their enlisted pilots to the extent that the WOFT does.

The WOFT program trains applicants as officers first (Warrant Officer Candidate School) and then as fully instrument rated, tactically proficient, combat aviators. Warrant officer aviators perform as pilots in command, air mission commanders and combined arms officers on the battlefield. As a result of this concept and the insignificant cost savings of an enlisted aviator program, the EAS recommended the Army not adopt such a program. The Army leadership concurred with the EAS recommendation.

MONTHLY WRITING AWARD

This is the first of a series of three articles on the training and flying careers of French Army aviators. Previous articles published in the* Aviation Digest *are listed on page 9, the latest of which was written by LTC Paul Bonnet while assigned as the French Liaison Officer to the U.S. Army Aviation Center, Ft. Rucker, AL, have described French Army Aviation history, organization, mission and equipment. This series gives a glimpse behind the lines at the recruitment, initial entry and subsequent training of the French noncommissioned officer and officer aviator. The first article looks at the noncommissioned officer pilots, where they come from and their progression from flight school through a typical career. The second article will trace the officer's initial training from precommissioning to flight school and duties through the grade of captain. The last article will focus on captains, their preparation for company command and their duties in the aviation regiment.

A LOOK AT THE junior aviator's experience is a look into the heart of French Aviation. In many ways, French Army aviators themselves differ from their American counterparts mainly in language and uniform. Aviation mystique seems to know no international boundaries. Yet, whatever the parallels on an individual level, the differences in French and U.S. Army Aviation are significant. It behooves both of our armies to study those differences and to increase our common ground.

Any conflict in Europe inevitably will draw French and North Atlantic Treaty Organization (NATO) allies into the crisis. How well can we expect to work together given the language and employment barriers? Unfortunately, not very well at this point in time in Army Aviation. Not only are there language, equipment and training differences that would undermine interoperability, but there is a major gap in simply knowing and understanding each other's capabilities and procedures. Neither that gap nor the hardware differences will be reduced significantly by articles alone, but 24 hours after Warsaw Pact forces have massed on the Czechoslovakian and East German borders for an attack into NATO countries is too late

FIGURE 1: Map of France showing the basic school in Dax in the southwest of the country, and the advanced school at Le Luc in the southeast.

to start finding ways to work together.

The French have some great programs and ideas in aviation. They also have tremendous respect for and interest in U.S. Army Aviation. This series is a small tickler, some food for thought for those most liable to fight from a cockpit or anywhere else as allies.

The French Army has around 630 helicopters and the same number of commissioned officer aviators. Since not all officers are in cockpit jobs at any given time, a requirement exists for almost 1,200 additional aviators, positions filled by noncommissioned officers (NCOs). This French practice (used as well in England and Germany) is interesting from the international cooperation perspective. In any combined operation in Europe, U.S. and French flight crews and units are likely to work together (and have already). Who are these French sergeant pilots, and what can you expect of them?

To begin with, French NCO aviators are *not* warrant officers. There are some parallels, but there is no intent to compare or analyze them here. Similarly, while the French have NCOs in every branch and service, the training and career of the NCO *aviators* are unique. Comparison with our NCO corps is left to the reader.

Recruitment

To become NCOs, men, who are subject to the draft, and women, who are not, can enlist in the military and progress up the ranks, or they can enlist for special NCO training.[1] Those who meet the entrance requirements can attend the National NCO Training Academy. Academic, physical and psychological screening, and, *for the aviation candidate,* the equivalent of a Flight Aptitude Selection Test, ensure the quality of the candidates. Graduation leads to promotion to the grade of *Marechal des Logis* or sergeant.

Sergeants who choose and qualify for *flight training* are branched into the Artillery, the branch that retains responsibility for all NCO pilots.[2] The flight sergeants contract for a 10-year period upon completion of flight training. Should they wash out before graduating, their contract is voided and they serve in ground units for a minimum of 5 years. Whatever the path they have followed to NCO, the aviation candidate now begins flight training.

[1] France still has obligatory military service for men more than 18 years old. The draftee has 4 months of basic training followed by duty in a regiment for a total active service of 1 year.

[2] Aviation is not a branch in the French Army. All NCOs remain in the Artillery. Officers can be Artillery, Infantry, Armor or a limited number of other branches.

FIGURE 2: The six phases of basic flight training comprise a total of 107 flight hours, including 10.6 as passenger-trainees during navigation.

PHASE	DUAL	SOLO	PASSENGER	CHECKRIDES	TOTALS
Elementary	21		1	1	23
Stagefield	18.2	1		1.3	20.5
Autorotation	8			1	9
Navigation	15.1	3.5	10.6	2	31.2
Night Flights	7	0.3	1		8.3
Mountain	12.5	1.3		1.2	15
Totals	81.8	6.1	12.6	6.5	107

Primary Flight Training

The Basic Flight School is located in the southwest of France near the city of Dax on the site of an old seminary (figure 1). The main role of this school is initial entry flight training for both officers and NCOs. At Dax, all ground and flight instruction, except for weather (given by the only civilian instructor), is given by military instructors.

The first 4 weeks of academics cover: The theory of flight, Army Aviation organization, aerodynamics, aviation mechanics, communications, weather, navigation, aeronautical medicine and English. *French pilots are required to achieve at least a minimal level of proficiency in English, the universal language of air traffic control.*

Soldiering is an important priority, but there is only one obligatory military and physical exercise at the end of the course. To teach the effects of stress and survival techniques, the students

make a night forced march on the beaches of the nearby Atlantic Ocean. They must execute a land navigation problem at the end of the march. Physical training is done individually though they have to complete the French physical fitness test annually.[3]

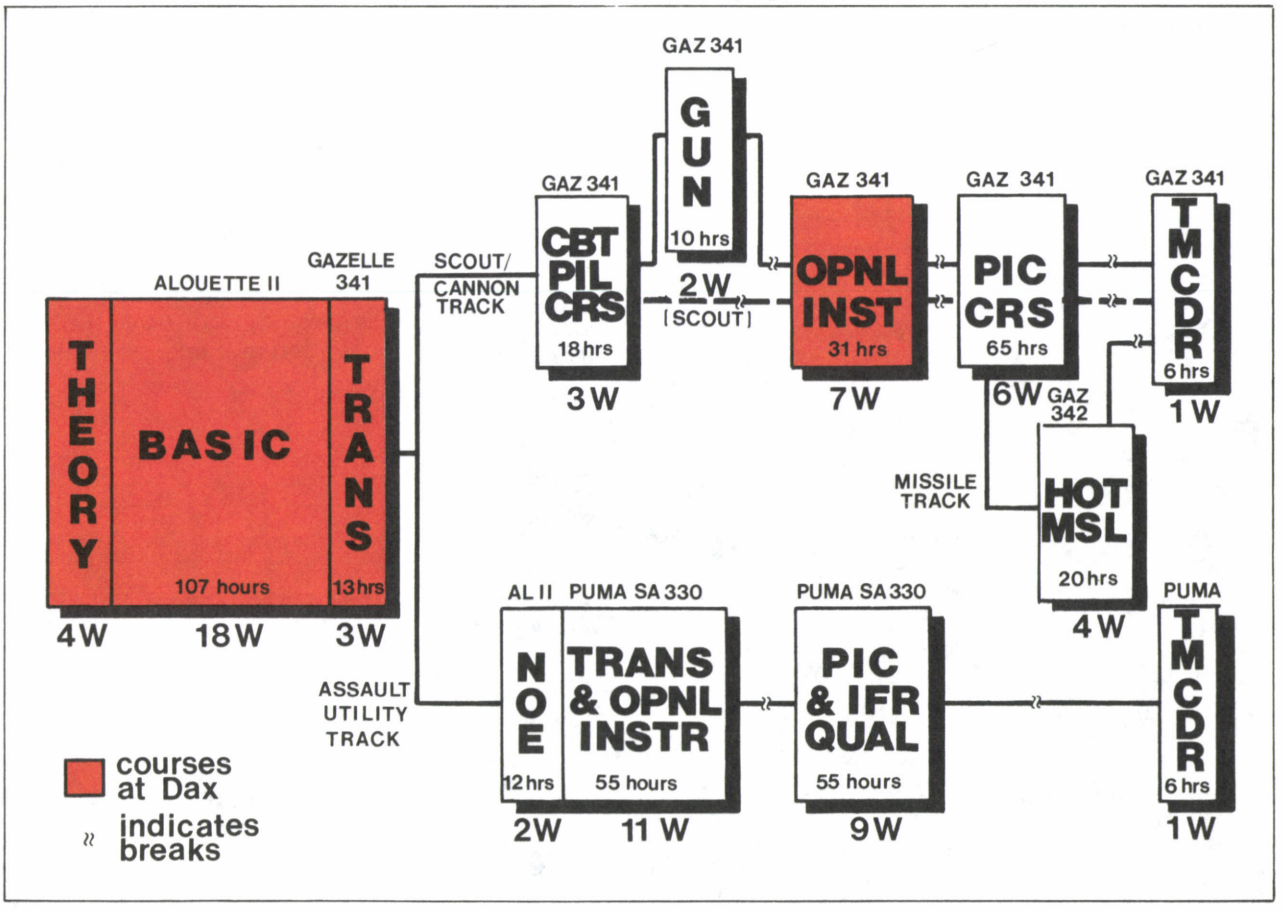
After the Theory Phase, the next 18 weeks are spent in the 6 phases of basic flight training. Training starts in the Alouette II, a venerable old turbine-powered machine that resembles the OH-13 Sioux. Figure 2 shows the phases and the number of flight hours associated with each.

The phases are not necessarily sequenced as shown in the table. Note, for example, the unique mountain training phase, conducted at Saillagouse in the French Pyrenees. Sections are cycled through the center one at a time, and base there with their instructor pilots (IPs) for 2 weeks of mountain flight instruction. For more than 10 years the West German and British armies also have used this facility for mountain flight instruction. After completion of these basic flight phases, though flight school is not yet over, the students are awarded a military helicopter pilot certificate and wings.

The final phase at Dax is a transition into the Gazelle SA-341, a machine similar in size to the OH-58 Kiowa. This phase lasts 3 weeks with 13 flight hours. At this time the officers and NCOs leave Dax. They generally report to their units for as much as 2 months to perform copilot duties while awaiting class dates for combat qualification, the second part of flight school.

[3] The test consists of an aerobic pretest on an exercycle followed by five other events. The events are the 100-meter swim with 10 meters underwater (untimed), an 8-km (5-mile) run in combat boots (50-minute maximum), a 5-meter rope climb using arms only or 7.5 meters with hands and legs (untimed), and a "Cooper Test," a 12-minute run for distance (2,800-meter or 1 3/4-mile minimum). The events are not sequential, nor necessarily on the same day.

FIGURE 3: The NCO professional development program is two-tracked and progressive, with the breaks representing time in units.



Advanced Flight Training

Combat Pilot Qualification. Based on the needs of the service, standing at Dax and the individual's preferences, NCOs are placed into one of two tracks for combat qualification at the *Ecole d'Application de l'Aviation Legere de l'Armee de Terre.* The "Advanced Combat Aviation Training Center" (not a literal translation) is located in Provence in the southwest of France at a place called *Le Cannet des Maures* near the small town of Le Luc. This school has most of the advanced training courses for officers and NCOs with the exception of IP qualification, and some instrument training, both accomplished at Dax. Figure 3 shows the entire NCO training program, and may be useful to follow the rest of the article.

The scout cannon track begins with 3 weeks and 18 flight hours in the combat pilot course. Academics and flight training focus on the threat, target recognition, tactical flight maneuvers and terrain flight. The French were pioneers in nap-of-the-earth (NOE) flight, and this course is particularly demanding. Completion marks the end of flight school in this track, and the NCOs rejoin their units for up to a year of confidence-building and flight experience.

The assault utility track begins with terrain flight and NOE qualification in the Alouette II in order to save the more expensive Puma hours. Following those 2 weeks, the NCOs begin the 11-week Puma transition and operational instrument qualification, all at Le Luc. While an older machine, the SA-330 is still a complex aircraft. It is twin-engined with retractable wheeled landing gear, and a full instrument console that includes a Doppler and automatic pilot system. This represents a big change to the students and accounts for the long transition. The Puma student is only qualified in *operational* instruments at this point. However, unlike in the Gazelle track, the Puma students stay at Le Luc without going to a unit until after operational instruments, and graduation from flight school.

Summary of Flight School

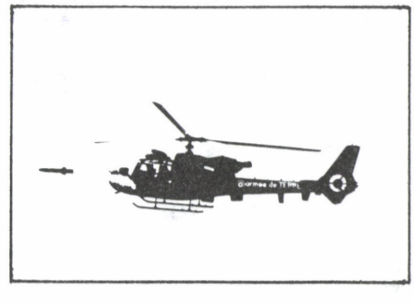
Scout/attack track students graduate with up to 7½ months in school, and 128 to 138 flight hours (not counting time flown in units while waiting for courses). Puma assault/utility track students are in school 9½ months, including operational instruments, and accumulate about 187 flight hours and 20 instrument simulator hours. None of the new pilots are night vision goggles (NVG) qualified. That, and further qualifications will come later.

First Assignment

Whether in a scout, Cannon or Puma unit, the main objective of the next 3 to 4 years is to build flight time and experience. The French officers generally agree that NCOs learn to fly and handle the aircraft well during this period, but have limited navigation and mission skills.

Pilots cannot see outside when looking through a blue-tinted visor with the amber plastic liner for instrument training.

Gazelle firing HOT missile



The NCO is supervised closely during this experience-building period by more senior NCOs, the lieutenants and unit commanders. While the NCO aviator does not receive preferential treatment over other NCOs, demonstrated skill and reputation in the small Army Aviation family does not go unnoticed. NCO aviators do perform additional duties in units, and serve in leadership positions, but their primary responsibility is to fly.

"Graduate" Flight Training

Operational instruments. After about a year in a unit, scout and Cannon pilots return to Dax for their operational instrument course. This course resembles the old U.S. Army "tactical instrument ticket" of the sixties and early seventies. The Gazelle is not fully instrumented for instrument flight rules (IFR) and the pilots are not expected to enter instrument flight intentionally. Consequently, in this track, the NCO receives 31 hours of basic instrument instruction including nondirectional beacon, ground controlled radar and frequency modulated homing approaches. Flight with an amber plastic cockpit shield limits vision outside of the aircraft for the pilot when wearing a blue-colored helmet visor in the down position. After operational instruments, NCOs in this track return to their units.

Cannon Course. Those pilots assigned to support and protection troops (Gazelle 341 with side-mounted 20 millimeter cannon) must return to Le Luc to qualify on the cannon. They study target identification; helicopter gunnery ballistics; the assembly, disassembly and functioning of the 20 millimeter cannon system; and fire 240 live rounds during the 2-week course.

Pilot in Command Course. Both Gazelle and Puma tracks have pilot in command (PC) courses. This course, which has no U.S. equivalent, is normally a prerequisite for HOT missile or IFR qualification. NCOs not only have to have a minimum of 1,000 hours, but they also have to be recommended for the training by the chain of command. Selectees return to the Advanced School at Le Luc where they are given a precourse evaluation. About 20 percent fail the in-flight and classroom evaluation and are sent back to their units to build more time and remedy their deficiencies.

Gazelle track pilots are given a grueling load of navigation missions. They are assigned as wingmen in a two-aircraft patrol in which they are required to execute the orders of the patrol leader in the other machine. Exercises proceed from simple route reconnaissance to progressively more complex missions. An IP (an officer or another NCO) acts as the copilot in the right seat, and tries to let the student run the mission as much as possible.

For many of the students, it is the first time that they have had to navigate, operate all the radios, and decide where to go with their machine all at the same time. That may be hard to understand in a 1,000-hour pilot, but remember that they are only required to *pilot* the machine during their first assignment. Classes are small—10 to 14, and grading is tough. Failures of the 6-week, 65-flight-hour course are rare, but those that do occur are for failure to master crew coordination, or terrain association and navigation.

Academics refresh the students on Army Aviation organization, other Army branches, Doppler navigation, tactics and the threat, but most of the time on the ground is spent planning the missions. In this respect, the French excel in attention to detail. The PC-candidate must largely commit the map and mission to memory. The instructors often take the map away from the student that relies too heavily on it in flight. Exercises are tailored, to the degree possible, to the student's unit.

The PC course is headed by a major, with 1 captain, 2 lieutenants—former NCOs—and 12 senior NCO IPs as instructors. Each has from 3,000 to 7,000 flight hours. They also teach the combat pilot or NOE course so all have literally memorized the 5,000-square-kilometer training area and could give their location to within 100 meters almost without looking at a map.

Puma pilots go through essentially the same PC training, oriented on the transport mission. Because of that, there is somewhat less emphasis on the painstaking navigation of the Gazelle course. Puma PC candidates only fly 55 hours in the aircraft, but they spend 9 weeks in the PC course. The extra time is devoted to completing full IFR qualification.

In terms of standardization, the French have achieved a core of proven NCO pilots in command, trained to their unit's specific mission. With 10 times the number of pilots and aircraft, and given the diversity of our missions and units, a similar program has been determined to be impractical in our Army. There is no empirical data showing a direct relationship between this course and accident or incident rate reduction, though it can be inferred to have had a positive impact, and this course is a winner, with or without the statistics.

Other graduate training includes the following:

- *Missile Course.* PCs assigned to attack helicopter troops must qualify on the HOT missile sys-

tem (similar to the TOW, but reaching its maximum range of 4,000 meters in 17 seconds). This is accomplished in a 4-week period in which they fire more than 500 simulated missiles, both in flight and on the ground, and one live HOT missile. Though the system is fired by the PC in the left seat, a certain number of non-PCs are also missile-qualified, giving units a reserve of qualified firers.

• *NVG Course.* Only about 20 percent of the French pilots are NVG trained, partly due to shortages of the goggles. Priority is to the 4th Airmobile Division of the French Rapid Deployment Force. The 20-hour qualification lasts 4 weeks. They use third generation goggles similar to the ANVIS (aviator night vision imaging system).

• *Instructor Pilot Course.* A small number of outstanding NCO pilots are selected for IP qualification. The 3-month course is at Dax and is followed by assignment as IPs in the school to build experience before being sent to be unit IPs. (Note that officers also attend this qualification course, primarily to serve in the school system as IPs.)

• *Team Commander Course.* An even smaller number of highly experienced NCOs are selected by their commanders to be "team commanders" or patrol leaders, normally a lieutenant's job. This course, taught at Le Luc, is an abbreviated version of the lieutenant's basic course. These select few NCOs command patrols of two or more aircraft in their units. Remarkably, some NCOs are able to achieve all of this in less than their initial 10-year obligation.

Career Patterns

Excepting the returns to school, NCOs move relatively infrequently. With few exceptions, they stay in the same track and spend 5 or more years in the same regiment. Overseas assignments are popular, but few in number.[4] The usual maximum overseas tour is 2 years. Retirement is possible at 15 years of service for NCOs.

Promotion. The NCO corps in Army Aviation is young, with the average age well under 30. There is fairly rapid promotion through the grade of E7 using a system

[4] The French Army has aviation units in their former colonies and possessions (overseas departments) in the South Pacific, South America and Africa. Most "overseas" assignments are in Djibouti or Chad in Africa.

A Typical Sergeant Pilot

Adjutant (E7 or sergeant first class-equivalent) Philippe Bracoud is a 32-year-old French Army aviator. He may not be strictly typical of the average NCO, but he does represent the caliber of those assigned to the Advanced Combat Aviation Training Center. Originally from Paris, he is married without children. Bracoud enlisted for aviation and the NCO Academy in 1976, graduating that same year.

Adjutant Philippe Bracoud

After flight school he was assigned to the 3d Combat Helicopter Regiment in Etain in the north of France as a Gazelle pilot. His next assignment was to Draguignan at the French Artillery School as a pilot in the School Support Troop. He is an IP with more than 3,500 flight hours. His present assignment is as an instructor in the lieutenant's course at Le Luc. Adjutant Bracoud is also fluent in English. He would like to become an officer, but if that fails, he aspires to the grade of "major," the French equivalent of sergeant major, and the highest enlisted grade in the French Army. He will be eligible to retire in 1990.

of merit and seniority similar to ours. If there is a fly in the ointment, it is the very quality of the NCO in French Army Aviation. Professionals like this peak out in responsibility and variety early. Some are content to remain at that peak, but many yearn for more challenges. Becoming officers appeals to some of this latter group, but the opportunities are limited, and the competition is fierce.

Retention. What lies beyond the initial commitment? Obviously, some of the NCOs leave the service after 10 years. This is a real problem for the French Army since the appeal of civilian employment is a strong one for a relatively young NCO. That is one of the reasons for the long initial commitment.

Incentives to stay in abound. In the French Army, pay and retirement are keyed to grade and time inservice, with supplements for flight, hazardous duty, foreign service and even for the number of children![5]

Retirement. Based on a point system, points are awarded for such things as years of overseas service, and the *number of flight hours.* Sufficient points can be accumulated to increase pay at retirement to up to a maximum of 80 percent of active duty pay. Normal age limit is 55 years old.

This article has only briefly covered the training and careers of NCO aviators. Issues such as their relations with other NCOs and the officers are interesting, but beyond the scope of the series. The French solution to providing sufficient numbers of trained aviators at the lowest cost is achieved with sergeants instead of warrant officers or more commissioned officers. There is a burden on the system to ensure quality and standardization while avoiding stagnation and complacency. Indeed, it seems to be a self-policing system, for the NCOs themselves set high standards and tolerate coasters poorly. The French sergeant pilot stems from a long tradition in the French Army dating back to World War I. They are professionals, a critical complement to the officer corps and key players on the Army Aviation team.

The next article addresses the commissioned officer's initial training and service, and the final article treats the training of company commanders. Each of these levels offers something unique, something the U.S. Army may profit from by examining more closely. For the NCOs, perhaps the PC course stands out the most. Certain aspects of the lieutenant's course and the captain's precommand course should be equally thought-provoking.

Stay tuned! Air Assault!

ABOUT THE AUTHOR

Lieutenant Colonel Terry L. Johnson is a Senior Army Aviator who was assigned as the U.S. Army Training and Doctrine Command and Ft. Rucker Liaison Officer to French Army Aviation when this series was written. He is rated in Alouette II and Gazelle helicopters and wears the French Army Aviator Wings. His previous assignments include Vietnam, Alaska and tactics instructor at the United States Military Academy. He is a graduate of the U.S. Army Command & General Staff College and has a master's degree in sociology. He is presently assigned to the 11th Aviation Brigade in Germany.

Previous *Aviation Digest* articles on French Army Aviation:

- ☐ "French Turbine Powered Helicopters," May 1959.
- ☐ "French Army Aviation," May 1960.
- ☐ "Aviation in the French Army," September 1972.
- ☐ "French Airmobility," March 1975.
- ☐ "French Army Aviation," December 1978.
- ☐ "Aviation in the French Army," August 1980.
- ☐ "From Balloon to Black Hawk," June 1981 (French expeditionary force).
- ☐ "French Army Aviation: The 4th Air Assault Division," October 1985.

[5] Like many modern countries, France's birth rate has slowed to the point that the government has had to create incentives to have children. Benefits like reduced fares and ticket prices and salary supplements are given to large families. The "ideal" is to have three children.

Mr. Edward J. Bavaro
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Soviet Air Defense

"War is a science, a series of mathematical problems, to be solved through proper integration and coordination of men and weapons in time and space."

Georgi Zhukov
(1894-1974)

THE AIRCRAFT best exemplifies the influence of science on the art of warfare. No weapon system has had such a broad and dramatic impact on military thinking. The impact of the aircraft on tactics and doctrine continues today in the form of the helicopter. Aircraft have mandated the formation of special branches of military organizations to defend against the aerial threat—requirement that is exacerbated greatly by the modern attack helicopter.

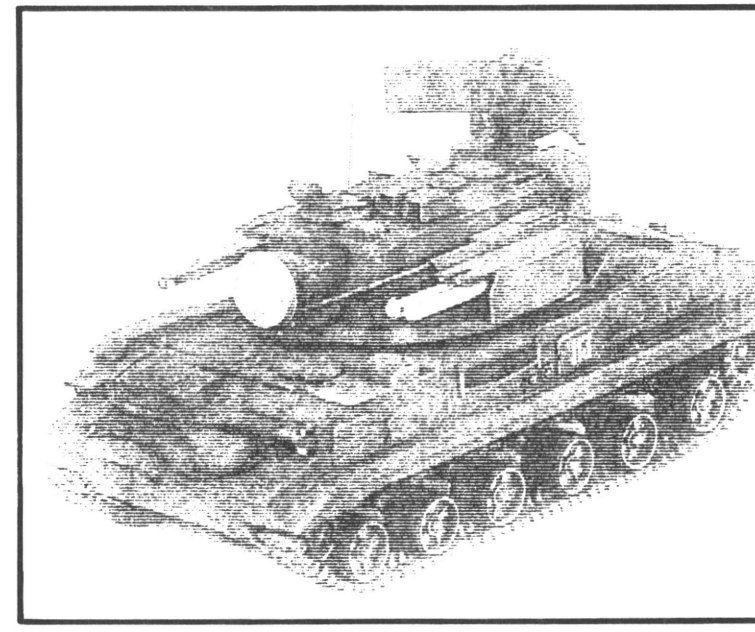
The Soviets have a great appreciation for air defense (AD) and view it as an essential segment of their combined arms force. Air Defense of Ground Forces was formed as a separate branch of the Soviet Army in the 1950s. Air Defense must protect ground forces effectively from enemy tactical air elements, both fixed-wing and rotary-wing aircraft, that will constitute the major initial obstacle to their offensive operations. Development of Soviet air defense is the product of the constant competition of offensive air weapons and tactics versus AD weapons and command control of the AD network. In World War II, Soviet air defense consisted of antiaircraft artillery and fighter aircraft, providing a combination of point and zone defense that was not especially efficient.

In the postwar period, new fast-moving jet aircraft flying at high altitude and the potential threat of nuclear attack by strategic bombers spurred Soviet developmental efforts toward more capable AD systems. The advent of the surface-to-air missile (SAM) reduced the importance of antiaircraft artillery (AAA) in the late 1950s and early 1960s. The U.S. Air Force ground support role was practically nonexistent in the postwar period, which reduced the Soviet emphasis of AAA in favor of SAM systems against high-altitude threats. Indeed, U.S. close air support (CAS) to ground forces was remote. It was so remote that, during the U.S. buildup of forces in the Republic of South Vietnam in 1965, the U.S. Air Force, lacking an adequate ground support aircraft, acquired Navy A1-Es, those marvelous Skyraiders, and pressed them into CAS roles. To support and direct the CAS aircraft, the U.S. Air Force procured O-1 Bird Dogs for their forward air

controllers. With no air threat to speak of and limited AAA threats, the A1-E, an outstanding aircraft by any yardstick, was a remarkable aircraft for ground support in terms of durability, firepower and loiter capability. The only thing lacking was a committed and rehearsed application of CAS, which required the Army and Air Force to develop that requisite partnership on the job as it were. On a high-intensity battlefield, that may have proved a much more difficult proposition.

Back in the late 1950s, the Soviets were beginning to field SAMs and more capable fighter interceptor aircraft. These increasing improvements were underscored strongly in May 1960 with the downing of the American U-2 aircraft piloted by Francis Gary Powers. Up to that time, some of our high-flying aircraft operated with a degree of imperviousness and disdain for the Soviet air defenses. Western experts had to reassess the survivability of aircraft employing high-altitude tactics against Soviet air defenses of obvious and demonstrated improvement. This reassessment led to the adoption of low-level penetration attack tactics. Low-level tactics opened the door for the reemergence of the AAA weapons, bringing them back into prominence and their ultimate partnership with the expanding array of SAM systems. The burgeoning use of helicopters in combat roles by the United States and France may have played a small part in the regeneration of AAA guns.

The Syrians and Egyptians were equipped with a good deal of Soviet hardware during the Mideast War of 1973. One piece of Soviet hardware that grabbed our attention was the ZSU-23-4 (*Z*enitnaya *S*amokhodnaya *U*stanovka—self-propelled antiaircraft (SPAA) gun), which proved to be an effective AD system against low-flying aircraft. Supposedly, it accounted for 30 of the nearly 80 aircraft the Israelis lost in the first few days of the Yom Kippur War. The ZSU-23-4 is the best AAA weapon system available today—at least until its replacement, the SPAA gun 2S6 shows up. And according to Department of Defense's 1988 issue of *Soviet Military Power,* the 2S6 is already beginning to replace the ZSU-23-4 at the regimental level of some first-line divisions. The ZSU-23-4 (with its excellent gun dish radar) consists of four 23 mm cannons) *Soviet Military Power* (describes the 2S6 as mounting twin rapid-firing 30 mm guns), which are mounted on a chassis similar to the PT-76 light tank. The system uses radar and optical sights, and an analog computer target lead. Today the ZSU-23-4 or 2S6 is found in every regimental antiaircraft battery of Soviet motorized rifle and tank regiments as a platoon containing four systems. Under the Soviet concept of tactical air defense, the combination of AAA and SAM systems is organized to assure that attacks by enemy aircraft from any direction and any altitude are repelled. Their system of tactical air defense has evolved because of the requirement to protect their mobile formations. Thus, most Soviet AD systems are vehicular-mounted, often on tracked vehicles (such as the ZSUs mentioned above) so that a *mobile* umbrella of protection exists for their fast-moving tank and motorized rifle units—a pattern demonstrated in a somewhat down-scaled fashion during the Yom Kippur War.



2S6 self-propelled antiaircraft gun (formerly M1986).

Mobility is an essential feature of Soviet AD systems. Even relatively static systems such as the old SA-2 could be packed up and relocated in a short time. The more modern tactical AD systems are all invariably highly mobile.

Four Principles of Air Defense

The Soviet Army subscribes to four principles of air defense: *mobility, mass, mix* and *integration.*

As indicated above AD *mobility* is critical to the Soviet style of combat operations. The AD units must keep up with the ground forces. Soviet tactics aim at conducting offensive combat operations at a high tempo. Once they penetrate the initial crust of main enemy defenses, the rate of advance is expected to pick up. The overall rate of advance, over time, should exceed 50 kilometers (km) per day.

Mass never has been a Soviet weakness. The Soviets employ more numbers of AD systems in a typical division than any other army in the world. Air defense systems proliferate throughout the Soviet division and are deployed down to battalion level. Besides the organic divisional AD systems, key divisions often are augmented with additional AD assets. The aggregate number of AD systems from the *front*-level SAM brigades down to the shoulder fired SA-7s at battalion level reflects the Soviet concept of *mass.*

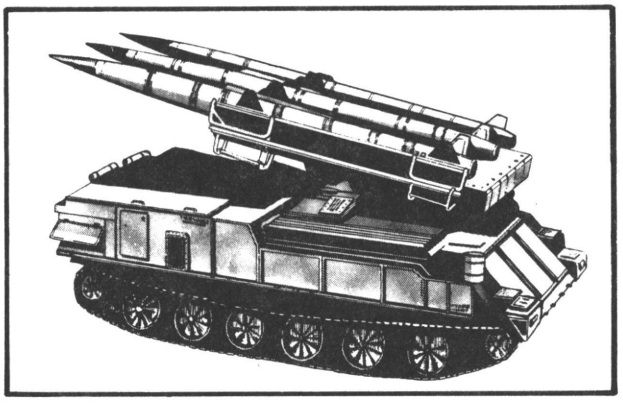
The principle of *mix* may be the best attribute of the Soviet scheme of air defense. The array of AD systems is quite diverse in terms of range, guidance, lethality and performance. The SAMs employ various guidance techniques such as infrared homing, semiactive radar homing and command guided homing; have effective ranges from 3.5 km up to 100 km; and move at speeds ranging from 400 meters per second to Mach 4. Interspersed with these missiles that extend from the *front* level down to battalion level are various AAA such as ZPU-4, S-60, ZU-23-2, ZSU-23-4 and 2S6. Add to these conventional AD weapons the possible role that artillery could play in air defense—as well as small arms and the automatic weapons, main guns and antitank guided missiles (ATGMs) on fighting vehicles, fixed-wing and rotary-wing operating air-to-air and emerging and projected weapons such as laser systems—and the *mix* could not be more thorough.

Regarding *integration,* the Soviets consider this principle absolutely vital to the effectiveness of the AD effort of protection for their maneuver elements. All AD systems are treated as an integral component of their combined arms and are well-accounted for in the planning stage of operations. **Air defense is perceived as a single system composed of a variety of parts rather than as a series of separate, distinct entities that do not relate to each other or to the conduct of the ground battle.** In their view the course and outcome of combined arms combat, as a whole, depends greatly on the effectiveness of AD combat.

An important aspect of the AD effort is the surveillance and early warning element. Great importance is placed on air defense surveillance. It is considered the key to the overall effectiveness of the AD effort. The complexity of modern air defenses and the increasing stealth of aircraft require the earliest information and warning on impending air threats.

Air defense commanders at *front* and army level are responsible for coordinating the air defense efforts with the maneuver units they support. The divisional air defense commander controls the division air defense assets and is responsible for deploying the AAA, SAMs and radars. Priority of areas to be defended will be established. Procedures for the coordination between AD and maneuver units will be arranged. At the *front* and army level, highest priority will be accorded to nuclear-capable weapons, headquarters, assembly areas, important chokepoints and logistics areas.

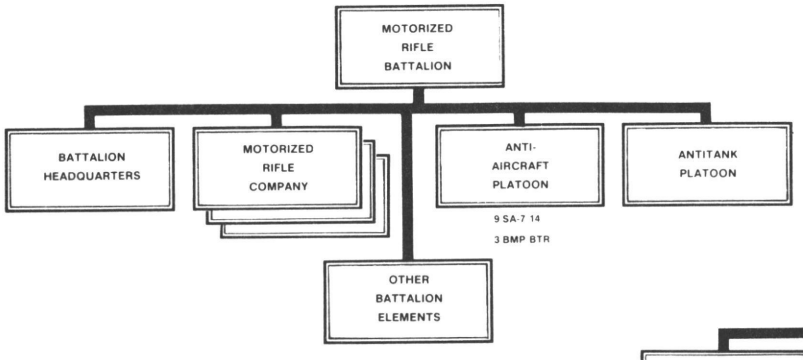
The AD commanders will locate area defense assets, accordingly, to best protect those potential targets on that priority. They generally will have centralized control of the AD assets including the SAM brigades and fighter support. Early warning information is passed from *front* level or army level AD headquarters down to division AD commanders. The Soviets use electronic and electro-optical means and visual observation to conduct air surveillance. Whenever possible, preliminary target data is passed down from higher-level radar units to AD commanders and their firing batteries. This reduces the vulnerability of forward battery radars and radar-directed guns and missile launchers to electronic countermeasure.



SA-6 Gainful missile system.

Soviet AD Systems Review

A review of the Soviet air defense systems will show how they virtually saturate the battlefield, producing a battlefield that fairly bristles with a variety and large numbers of guns and missiles.



BATTALION

The lowest level of organic AD weapons occurs at the battalion level. The antiaircraft platoons in each BMP/BTR-equipped battalion have the SA-7/14 SAM, a man-portable, shoulder-fired, low altitude infrared missile with a high-explosive warhead and passive infrared homing guidance.

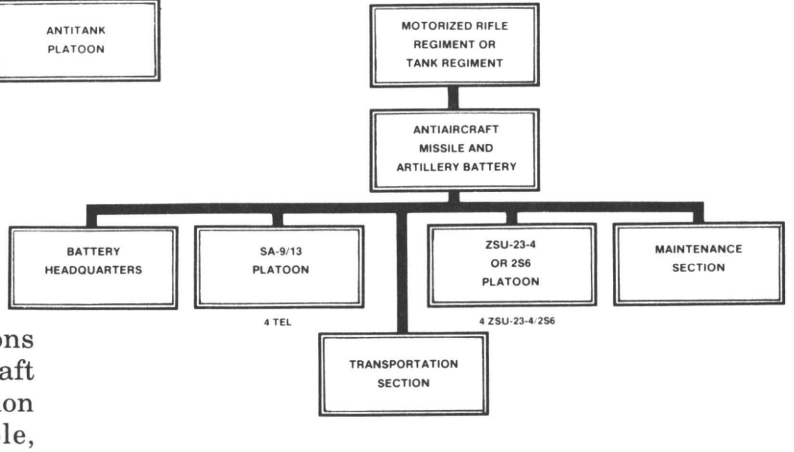
Each motorized rifle battalion has 9 SA-7/14s located in the air defense platoon. There are no organic air defense weapons currently in Soviet tank battalions. A typical Soviet motorized rifle division will have more than 120 SA-7/14s while tank divisions will have upwards of 93 units.

REGIMENT

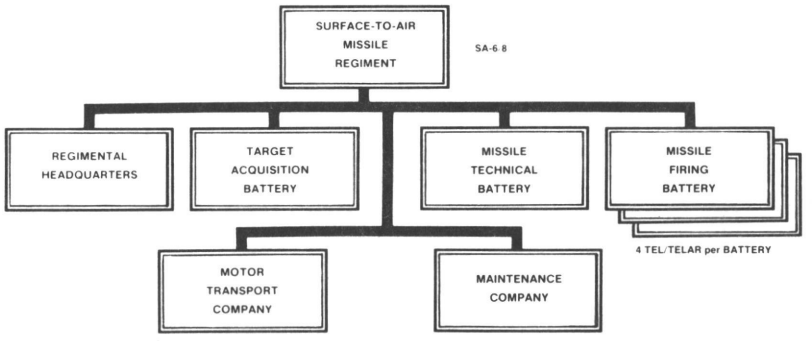
At the regimental level, there is an air defense battery that contains a platoon of four self-propelled ZSU-23-4/2S6 and a platoon of four SA-9/13 SAM TEL systems. The ZSUs normally operate in pairs, or sections, with the pairs generally in mutually supporting range of each other. A pair may be located from 150 to 250 meters apart to provide enough latitude for engaging aircraft and yet maintain their integrity as a section.

The ZSU pairs/sections are kept within 1,500 meters of each other. The SA-9 carries four cannisterized infrared SAMs, mounted on a modified *amphibious* armored reconnaissance vehicle—the BRDM-2, a wheeled vehicle.

The SA-13 carries four improved infrared SAMs, mounted on a modified MT-LB tracked *amphibious* vehicle. The SA-9/13s normally are situated between the first and second echelons of the regiments. They are employed usually as a group and, combined with the ZSUs, cover the dead space of the divisional SAMs' protective umbrella.



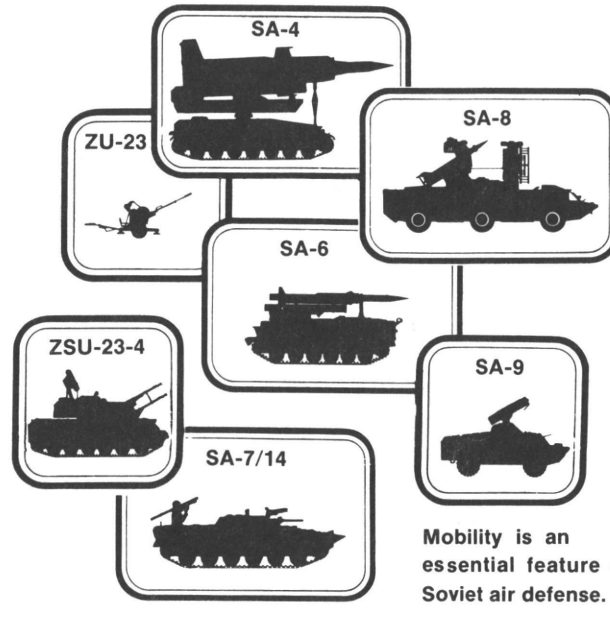
Each regimental headquarters, both motorized rifle and tank regiments, have three SA-7/14s for local air defense. Each division will have 16 ZSU-23-4/2S6 and 16 SA-9/13s.



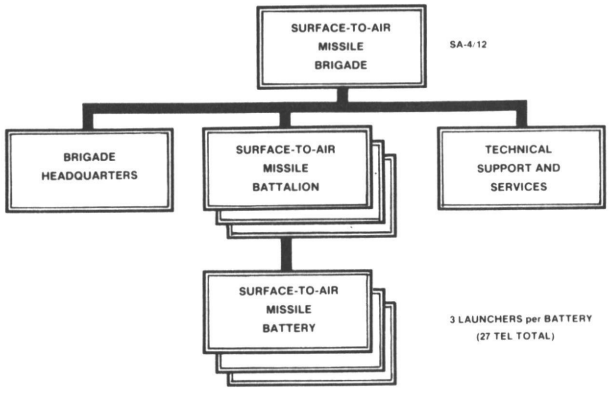
DIVISION

Each Soviet division has an air defense regiment composed of five batteries of SA-6/8s, each having 4 TEL/TELAR (*t*ransporter *e*rector *l*auncher/*t*ransporter *e*rector *l*auncher and *r*adar) as well as 21 SA-7/14s. The SA-6 is mounted on a modified PT-76 tank chassis, which is *not amphibious,* while the SA-8 is a totally self-contained SAM system (missiles and radar) mounted on a wheeled *amphibious* vehicle. The SA-6 has no onboard radar and must receive radar information from the batteries' off-line radars mounted on separate tracked vehicles. The regiments LONG TRACK surveillance radar provides early warning targeting alerts for the SA-6 TELs. Each SA-6 battery, however, has its own STRAIGHT FLUSH radar, which provides target acquisition data (shorter range than the regiments' LONG TRACK) and handles target tracking and illumination for the battery. The nonamphibious feature of the SA-6 system can be a real disadvantage in a European battlefield setting because of the many rivers that have to be negotiated.

The SA-8, on the other hand, has the advantage of being amphibious and capable of autonomous operation not requiring an umbilical connection to off-line radar and carrying a full missile reload internally; a disadvantage is the missile has only about half the range of the SA-6's Gainful missile. The SA-11 began to appear in some SAM regiments alongside the SA-6s. The tracked SA-11s may be the replacement for the SA-6; they have a little more range than the SA-6 but, more important, each SA-11 has an onboard radar that allows the SA-11 TELAR to operate autonomously if necessary. This capability will afford the SA-11 equipped batteries greater autonomy and mobility. The SAM regiment's 21 SA-7/14s provide local protection for the SAMs. Each of the five missile firing batteries has three SA-7/14 launchers for this local protection with three launchers located at the regimental headquarters and three launchers in the missile technical battery.



Mobility is an essential feature of Soviet air defense.

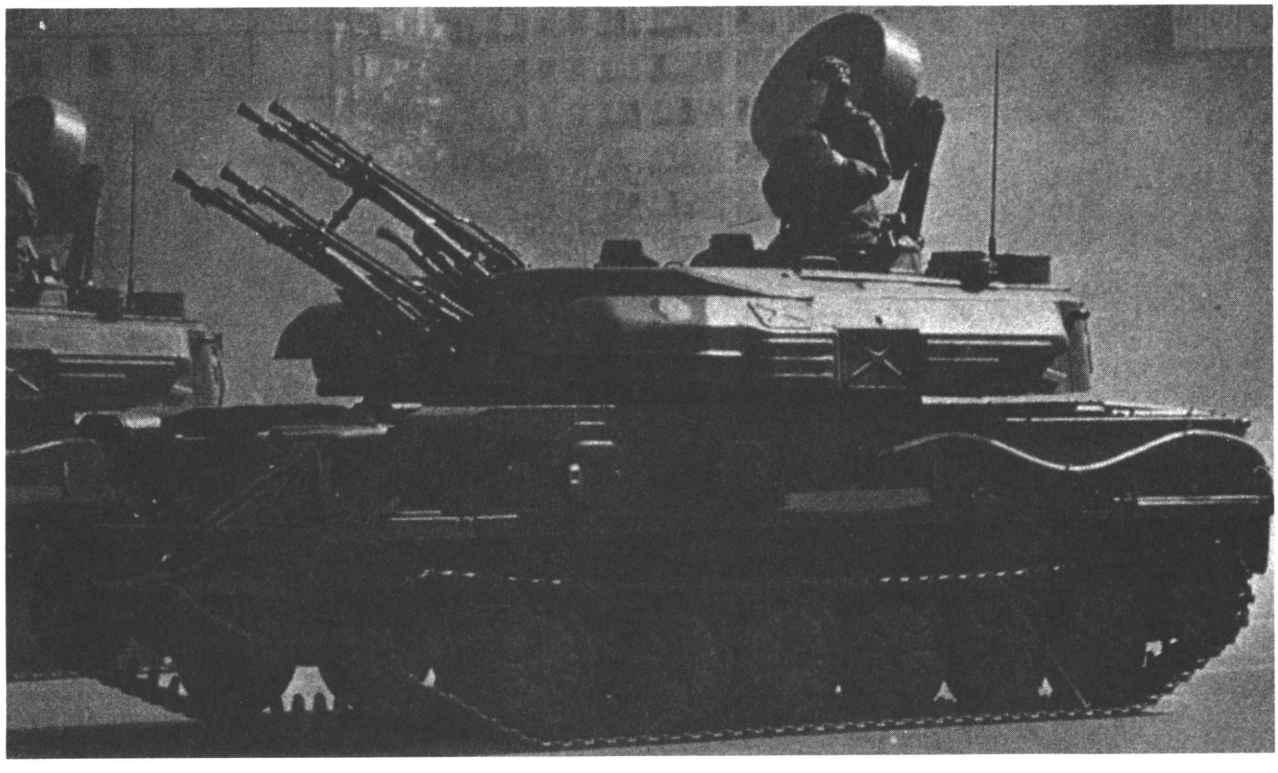


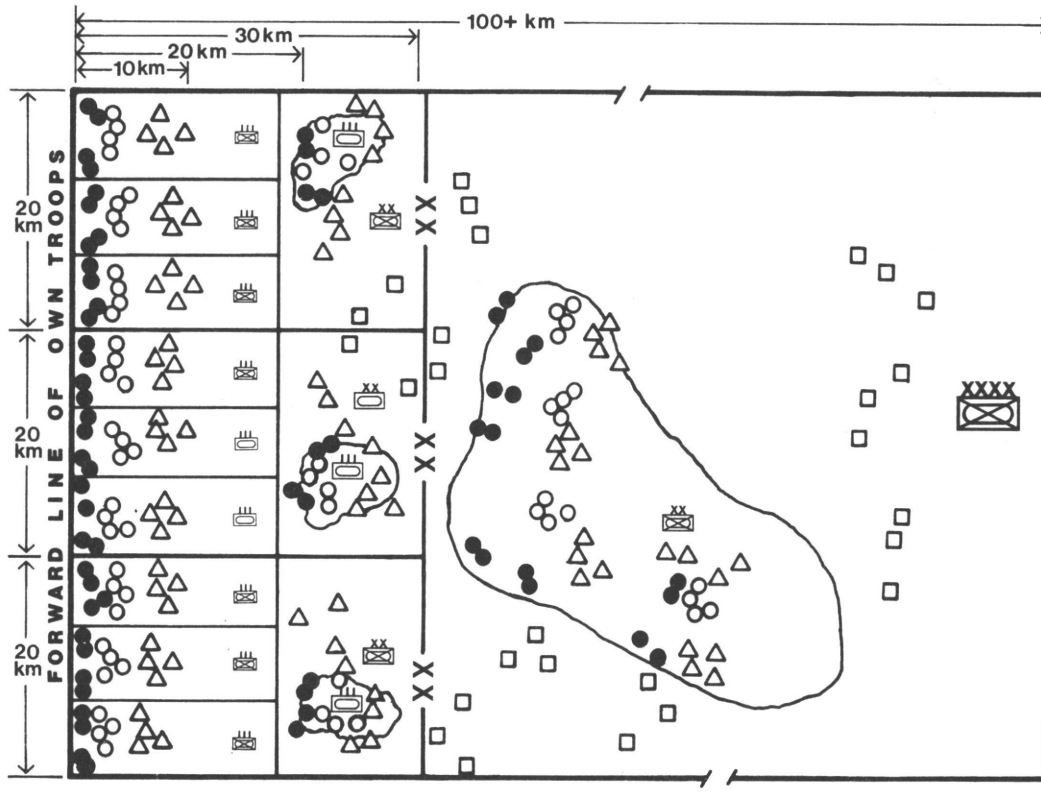
ARMY/FRONT

At each army and *front,* there is a SAM brigade containing three battalions of SA-4 or SA-12 (nine TELs per battalion). The SA-4 is a two-stage, medium- to high-altitude SAM. The SA-4 has an excellent range of between 80 to 100 km but is not effective against aircraft employing good, low-altitude flight technique. Special electronic mission aircraft operating at mission altitudes are the Army aircraft most at risk to this missile system. Missile guidance of the SA-4 is by radio-command with semiautomatic homing similar to the SA-6 except the illumination radar does not employ continuous wavemode radar.

The SA-12 is the replacement for the SA-4 SAM system. It is credited with a range of 100 km and an improved minimum engagement altitude. It may have a phased-array radar capable of handling multiple targets. Some AAA guns are often placed with these SAM batteries for local protection.

ZSU-23-4





Sample layout of the air defense assets of a Soviet combined arms army.

*Due to the vast number of SA-7/14/16 s they are not shown.

●	ZSU-23-4/2S6	64
○	SA-9/13	64
△	SA-6/8	80
□	SA-4/12	27
*	SA-7/14/16	453+
	TOTAL SYSTEMS	688+

Legend and recap of air defense assets

The Soviets have assembled an air defense system that is second to none. The basic structure, composed of a series of SAMs and AAA guns, provides excellent coverage for their ground forces. The layering of these AD assets seeks to erect successive barriers to ingressing air threats. The intent is to be able to engage these air threats early and often until they are defeated, and hopefully before they have been able to get to their objective. There are gaps in this AD umbrella—it's inevitable that there would be. You cannot cover every angle and aspect of ground forces with dedicated AD weapons. The organic AD weapons are arrayed and located to compliment each other and to optimize the overall coverage. New systems such as laser weapons, they hope, will reduce those gaps and add a different dimension to the protection effort and place stress on North Atlantic Treaty Organization (NATO) air threats, requiring them to go to further extremes to protect their aircrews and aircraft.

Apart from the organic AD weapons, the Soviets have increased the stakes air threats must contend with by applying other weapons not dedicated to air defense for use in combating aircraft. Artillery is one that can be particularly effective if the Soviets can be given

reasonable targeting information. Artillery represents a true, over-the-horizon threat to helicopters that could well frustrate and limit attacking helicopters from closing with Soviet ground force objectives. This possibility will push aircrew mission planning to even greater detail and flexibility, and will most certainly involve more coordination and cooperation from friendly elements in suppression, cover and deception.

Small arms and ATGMs are significant threats because the helicopter is, in essence, a ground combat vehicle target—like an infantry combat vehicle or tank—only with greater agility. The lethality of many of the automatic guns/cannons, main guns and ATGMs is such that attack helicopters cannot just be concerned with conventional AD weapons. The most interesting and, quite probably, the most dangerous development in the Soviet air defense effort would be the use of counterair heli-copters. Counterair helicopters, operating in the same realm as attack helicopters, can constitute the greatest impediment to NATO helicopter combat operations. When our helicopters use agility and nap-of-the-earth techniques to deny most air defense systems from achieving targeting solutions, the counterair helicopter is not similarly frustrated. It can maneuver swiftly to acquire the line-of-sight and range it needs for engagement. And if that counterair helicopter is an aircraft designed and built for the counterair role, then its superiority of performance makes that type of threat have special significance.

The air defense package that the Soviets have developed and continually perfected is no haphazard affair. It is a well-conceived defense that commands respect but, as is so often the case, does have its flaws. Capitalizing on these flaws and maximizing the opportunity they present continues to be the premise upon which NATO antiarmor helicopter operations is based.

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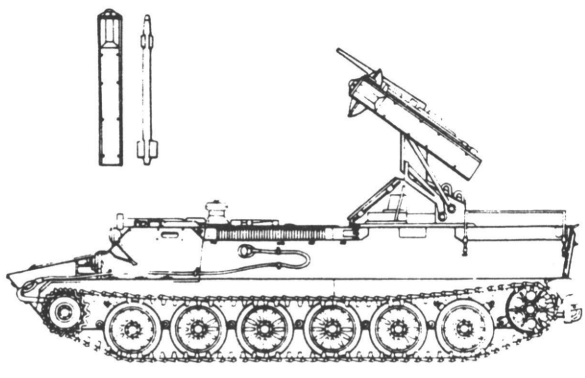
DA Field Manual 100-2-3,*The Soviet Army—Troops, Organization and Equipment.*

Weapons and Tactics of the Soviet Army, David C. Isby. DOD-*Soviet Military Power 1988.*

SA-9/13 TEL



SA-13 TEL

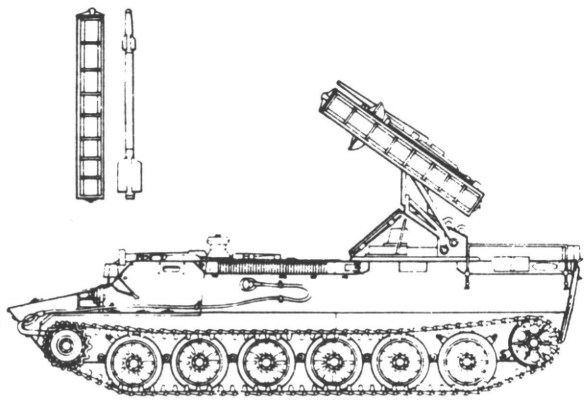
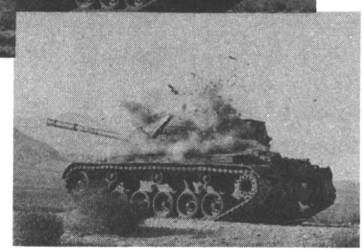


illustration by S. Zaloga, courtesy of *JANE'S DEFENCE WEEKLY*

Copperhead, a cannon launched guided projectile, closes in and scores a direct hit on an M48 tank. Fired from a conventional 155 mm artillery piece, this "bullet with a brain" homes in on reflected energy from laser-designated targets.

photos by Warren Weaver



WINNING WITH COPPERHEAD

Major Rodney O. Luce

SCENARIO: You're looking across the forward line of own troops (FLOT). On the horizon 7 kilometers (km) to your front, fire balls begin to appear. Through your binoculars, you see enemy armored vehicles burst into flame. What has happened? First-round effects such as these might well have been caused by M712 Copperhead cannon-launched, guided projectile rounds.

The Copperhead system greatly increases the Army's ability to destroy specific targets at extended ranges. Used with other munitions, Copperhead can disrupt enemy attacks at distances beyond the enemy's direct fire capabilities. It has great potential for today's battlefield.

Unfortunately, some myths cloud the employment of Copperhead munitions. Let's put these myths to rest before proceeding.

MYTH ONE:

You can't fire anything else while firing Copperhead because it ties up the communication nets and the firing battery.

Copperhead missions do not tie up the communication nets any more than conventional fire missions. Once the observer coordinates for Copperhead priority and oncall targets, he continues with regular mission processing until a target appears. Then the observer sends a "quickfire" message to get Copperhead on the way. Copperhead communications procedures follow the same process as the other priority, oncall and target-of-opportunity missions. A priority message goes to the very top of the input queue in the battery computer system. With the command, the system takes less than 45 seconds to fire the round.

Copperhead missions do not tie up the firing units. Firing Copperhead is a two-gun mission. Each mission includes rounds for two to six target elements. Since only two howitzers from a firing unit process a specific Copperhead mission, the remaining howitzers can continue to fire other missions at the same time. Each battery/platoon fire direction center (FDC), with the fire support officers (FSOs) and observers, can fire up to two priority-target and three conventional missions simultaneously.

MYTH TWO:

The forward observer's/fire support team's direction to the target must be the same as the howitzer's direction to the target to be able to designate for Copperhead.

For Copperhead to acquire enough reflected laser energy to lock onto the target, the observer-to-target direction only needs to be within 45 degrees of the howitzer's direction to the target. With the target 3,000 meters from the FLOT, an observer can be anywhere along a 5-km arc on the FLOT and still effectively engage the target with his laser.

MYTH THREE:

Copperhead requires special logistical support.

Copperhead actually conserves basic loads of ammunition. Because it's an accurate point-target weapon, Copperhead requires one-twentieth of the transportation needed for conventional artillery munitions to produce the same results. There are no special transport considerations.

MYTH FOUR:

Copperhead is dead; it has no funding.

Copperhead received $117 million in 1988 for use during the next few years. These funds are to finish production, make it more lethal and extend its range. Copperhead II is already under contract to improve the seeker and has been authorized an additional $10 million for development in 1989. Like many other systems, funding for Copperhead faced reduction during the budget cuts. All major production lines for Copperhead still are open. There are 17,300 Copperhead rounds in the Army inventory today, with 8,400 more rounds in production. Copperhead is alive and well!!

MYTH FIVE:

Copperhead command, control and communications (C^3) are too complex to make Copperhead work on the battlefield.

Copperhead fire mission planning and execution use the same field artillery used by C^3 with conventional munitions. Commander's guidance, adequate battlefield coverage and ammunition allocation for Copperhead are command decisions that are made for all types of fire missions. The commander's guidance controls Copperhead fires.

Copperhead employment and C^3 considerations should be refined within the task force/brigade fire support element to maximize its contribution to the fight and to integrate fully its effects with the maneuver commander's intent. Copperhead, used well-forward of the FLOT, particularly against enemy reconnaissance vehicles, greatly increases the lethality of our fires, and eliminates the disclosure of maneuver direct fire weapon positions. Copperhead fire planning requires far fewer planned aimpoints because of the area coverage of the weapon. Both the artillery and maneuver commanders should consider Copperhead as a decisive weapon for early use in the battle. A priority-target mission takes about 45 seconds plus time- of-flight to impact on the target. The observer requires a trigger point to have the round arrive at the aimpoint the same instant the target gets there. If the selected target moves out of sight, or out of the footprint during this time, the laser operator can shift to another target at any time up to the last 4 seconds of the mission.

The fire planning necessary for a Copperhead target is nearly the same as the planning for a conventional target. Drawing the footprint and obtaining the time-of-flight are quick, easy tasks. In the end, the three or four priority Copperhead targets greatly reduce the number of conventional missions required and blind the enemy by surgically eliminating his reconnaissance elements or high-value command and control vehicles.

Doctrine

Copperhead's strength lies in its ability to hit selected, high-value point targets far forward of the FLOT. This weapon system does not have the visible signature associated with maneuver direct fire weapons. Knowing this, Copperhead has great potential for its use during the initial phase of the battle. Commanders should consider the use of Copperhead fires, before maneuver direct fire weapons, to surgically remove those enemy vehicles that have the most influence in their plan. We want to remove reconnaissance vehicles without exposing our tanks and direct fire weapons at the start of the battle. We can do this with Copperhead at longer ranges. Then, as they appear, we should remove the vehicles and personnel that make a significant difference early in the battle. Examples are enemy reconnaissance vehicles, air defense weapons systems, maneuver command vehicles, radars and radio direction finder systems. This action will blind the enemy and cause him to deploy early, helping to expose his main thrust or plan. As a result, maneuver units should have more preparation time to defeat the enemy.

The Copperhead fire mission system

The Copperhead system is simple. One observer locates a target, calls for a Copperhead and lases the target until it disappears in flame. The basic difference between Copperhead and regular artillery mission processing is the requirement to lase the target. The strengths of the system are—

- It has a high hit probability on point targets, moving or stationary, at longer ranges than that of current direct fire weapon systems.
- It is highly lethal at all ranges.
- It can fire against an array of targets within the same target area by using several rounds.
- The lasers do not have the pronounced firing signature of the antitank guided missile.
- Target engagement with Copperhead conserves the basic loads of direct and indirect fire weapons.

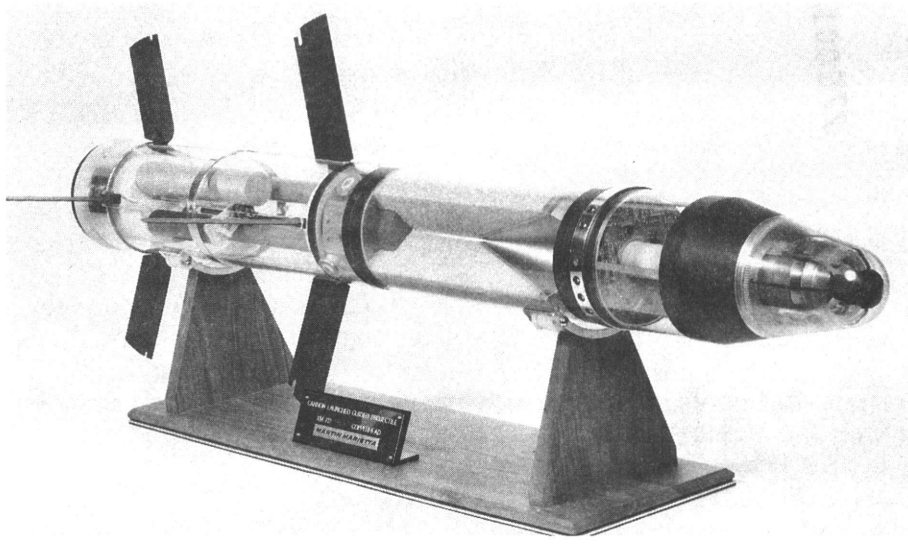
The weaknesses of the system are—

- Obscurants such as fog and clouds degrade the capability of the Copperhead to receive and track on the laser signals.
- Its responsiveness depends on the training level of the units.
- The laser designators are vulnerable to suppressive fires.
- The system depends on timely two-way communication between the observer and the FDC.
- The observer's ability to track the target limits the effectiveness of the target engagement.

These weaknesses are minimized by conducting periodic training to high performance standards.

We will now look at the technical elements of a Copperhead mission. What are some of the Copperhead lasing systems?

The ground/vehicular laser locator designator (G/VLLD) and the mast-mounted sight (MMS) systems are only a part of the family of lasers for laser-guided munitions in today's battlefield arsenal. These lasers provide the FDC extremely



A mockup of the XM-712 Copperhead cannon launched guided projectile showing the inner components.

accurate target location for both conventional and Copperhead missions. The aerial fire support officer (AFSO) with MMS in an OH-58D Kiowa helicopter can lase for both Copperhead and HELLFIRE missiles. FSOs, AFSOs and combat observation lasing teams with G/VLLD normally lase the targets for the maneuver units. Air Force pilots with a Pave Penny (laser designator weapons system) also have the capability to lase for Copperhead.

The engagement range of the lasers varies with the situation. The artillery observer can lase a stationary target at 5,000 meters. When mounted on a fire support vehicle, the forward observer (FO) can lase moving targets accurately out to 4,000 meters. For ground-mounted operations, the accuracy is beyond 3,000 meters. The AFSO can track and kill targets beyond 7,000 meters from his OH-58D. The laser produces no visible signature from the observer's position. This use of Copperhead to start the battle at these ranges greatly enhances survivability

What are the targets?

A Copperhead target is a single target defeated by one round. Since each artillery unit's basic load normally contains a limited number of Copperhead rounds, the commander's criteria should indicate the targets that influence the battle. These targets include enemy artillery command and reconnaissance vehicles, air defense weapon systems, obstacle breaching vehicles, maneuver command vehicles, radars and radar direction finder systems.

Who processes the call for fire?

Only 155 mm howitzer units can fire Copperhead rounds. The firing unit FDC receives the call for a Copperhead mission. The FDC computes and sends the firing data to the personnel on the howitzers. Normally, the FDC reports "ready" to the observer. Upon the observer's order to fire, the first howitzer fires and the FDC reports "shot" to the observer. The observer lases the last 20 seconds of the round's flight to the target. These are not complicated procedures, but frequent training is required to remain proficient and responsive.

Why do we use two howitzers for Copperhead missions?

A Copperhead round can be prepared and fired in 1 minute. With two howitzers firing a mission,

the rounds can be fired at 30-second intervals, which increases mission responsiveness.

How does Copperhead affect company/team operations?

Planning. Copperhead targets are an integral part of the company/team artillery fire plan. The FSO estimates the target locations by using the intelligence preparation of the battlefield process and the maneuver commander's guidance. A specific Copperhead target location must meet two criteria: The observer must be able to see the proposed location, and the observer must orient within 45 degrees of the firing unit's line of fire. Based on this target location, the observer will identify the trigger point. The purpose for this point is to compensate for the movement of the target vehicle while the cannon crewmen prepare and fire the round. Once the enemy vehicle reaches this point, the observer orders the round fired.

Coordination. Copperhead targets are a part of the regular fire plan. The plan goes through normal fire planning channels. The direct support artillery battalion will assign the targets from all the brigade's observers to specific firing units. Quickfire channels will be established to associate specific observers with their firing units. This procedure expedites the order to fire and provides for more responsive fires.

Execution. A preplanned oncall or priority Copperhead mission normally requires from 1 to 2 minutes from the observer's command to fire until target impact. A Copperhead target-of-opportunity mission requires more time to prepare. Copperhead missions can engage up to six target elements in the target area at the time of the mission. The FO will start the mission when enough elements appear at the trigger point to meet the commander's guidance. The FDC receives the command to fire and transmits it to the guns. For a priority mission, the guns are always laid on the firing data. The round waits on the loading tray when the gun isn't on another mission. The observer begins to lase the target after he receives the "shot" message from the FDC and counts down to 20 seconds or when he receives the "designate" command, whichever occurs first. He tracks the target until the round impacts. Unless otherwise cancelled, the howitzers will fire the subsequent rounds at 30-second intervals. The observer continues to lase and shift from one target to the next until all rounds impact.

The mission closely follows the procedures used for conventional missions. Because of the capabilities of the round, Copperhead is an ideal weapon system for outnumbered units on the battlefield.

Conclusion

Copperhead's abilities allow key target hits without exposing frontline troops. When used during the initial phase of the battle, Copperhead can surgically remove those enemy vehicles critical to the threat battle plan: the reconnaissance vehicles, obstacle breaching vehicles, ZSU-23-4 self-propelled antiaircraft vehicles, maneuver command vehicles, radars and radio direction finder systems.

Copperhead is an effective weapon. It gives the maneuver commander greater flexibility and firepower against moving targets at ranges beyond the capabilities of his direct-fire weapon systems. When integrated into the fire plan, Copperhead greatly increases the survivability of direct fire weapons during the opening moments of the main battle. It also conserves the basic load of ammunition for both the maneuver and field artillery units. In summary, commanders should plan for Copperhead's use to help win the close fight.

ABOUT THE AUTHOR

Major Rodney O. Luce is a small group instructor, Field Artillery Advanced Course, Field Artillery School, Ft. Sill, OK. He is a graduate of the Command and General Staff College, Ft. Leavenworth, KS, and holds a master's degree from Central Washington University. Major Luce has had several Lance and Cannon assignments.

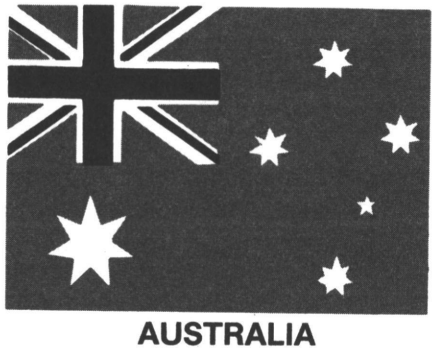
Mr. Rush Wicker

Aircraft Battle Damage Repair and Combat Maintenance Requirements Up To the Year 2005

AVIATION EQUIPMENT used to fight the battle during the year 2005 will be much more advanced than what is available today. In anticipation of fielding equipment with greater capabilities, the American, British, Canadian and Australian (ABCA) armies have developed a concept for aircraft battle damage repair (BDR) and combat maintenance requirements up to the year 2005. The concept identifies the ABCA armies' proposal for doctrine and equipment. The acceptance of the concept is beginning to generate new ideas and will contribute to achieving more effective aviation forces through standardization and interoperability programs.

The purpose for printing this concept is to provide for maintenance personnel a vision of the future as to how their replacements will perform BDR and combat maintenance in the year 2005.

General. During intense combat, the capabilities of maintenance organizations will be limited. Consequently, comprehensive and highly disciplined preventive maintenance checks and service programs are essential before, as well as after, employment. Recovery from BDR and combat maintenance application between surges or after final cessation probably will require extensive planning and dedication of maintenance resources accompanied by a reduction in operational activity rates. During the first days of combat or heavy surge conditions, maximum aircraft availability will be essential. This availability can be achieved only by reducing or deferring those maintenance actions that have minimal impact on aircraft safety and mission accomplishment. This situation will be aggravated during surge combat conditions because of the increased component failures caused by higher stress levels and equipment use rates.



AUSTRALIA

Assessment of Combat Damage. This is the process of evaluating the extent of damage sustained and determining the best possible repair procedure within the constraints imposed by time, manpower, materiel and operational requirements. Triage, a battlefield medical concept, most closely describes the battle damage assessment process. This is simply determining which aircraft can fly as is, which can be returned to full or partial mission capable conditions using quick-fix repair methods, and which cannot be repaired in time to affect the outcome of the battle. Necessity, as determined by the intensity of the combat environment, will dictate when quick-fix repair methods will be applied and which damaged aircraft will be repaired. If an aircraft cannot be repaired in sufficient time, and the battlefield situation warrants, that aircraft may become a parts source for repairing less severely damaged aircraft or it could be destroyed. The assessment of damage to each aircraft is the key to any BDR capability at all maintenance levels. Accord

ingly, assessors play a crucial role in the speed with which damaged aircraft can be regenerated for wartime flying hour requirements.

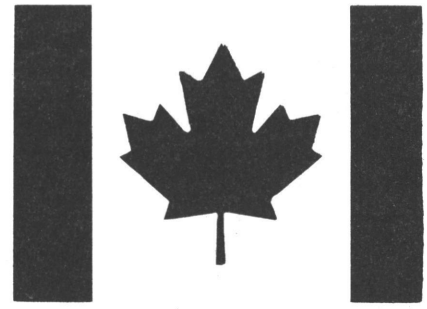
Deferment. Deferment involves scheduled and unscheduled maintenance and battle damage. Basically, except for necessary lubrication, servicing and preoperational checks, scheduled maintenance may be deferred. Unscheduled maintenance, such as the repair of systems and subsystems that have adequate redundancy or are not critical to mission accomplishment, may be deferred if safety of flight is not significantly degraded. Requirements must be examined to determine if relaxed criteria for repair and aircraft performance can be accepted. Typically, the number of broken strands that may result in replacement of a flight control cable in peacetime might be increased significantly during combat. Unacceptable leak rates of hydraulic systems and lubrication oil consumption rates for engines and gearboxes during peacetime may be fully acceptable (as opposed to component replacement) during combat. Battle damage and other operational damage will be assessed, and a determination will be made to repair or defer. Repair of damage to noncritical structures or to critical structures having adequate reserve strength may be deferred unless aerodynamic degradation is unacceptable. The impact of disrupted wiring and loss of system integration on the combat effectiveness of the total weapons system will increase as aircraft become more sophisticated and must be carefully considered by the commander when electing to defer corrective maintenance.

Repair of Battle Damage. The primary purpose of BDR is to restore sufficient strength and serviceability to the aircraft to permit it to fly additional operational missions, or to permit at least partial mission capability, in time to contribute to the outcome of the ongoing battle. A secondary objective is to enable those aircraft damaged beyond unit repair capability at the field site to make a one-time flight to a repair facility. Quick-fix BDR involves simple repair techniques that eliminate most of the material fatigue-conscious methods used in peacetime. Rapid repairs could be performed on most types of damage; however, emphasis should be placed on repair of damage expected from nonexplosive rounds where the damage is insufficient to cause loss of the aircraft, but sufficient to require corrective maintenance before another mission. These repairs would be characterized by the use of quick-fix techniques, high speed tools, off-the-shelf standard hardware items (not necessarily aircraft related) and lack of cosmetic criteria. Procedures and techniques would be developed to return the maximum number of aircraft to service in as little time as possible with the goal of completing most repairs in less than 4 hours elapsed time (U.S. R&D objective). The actual repair time will depend on the battlefield situation, but the underlying objective is to do the most complete repair possible in the time available.

GREA

Cannibalization of Critical Components. Cannibalization can provide the large volume of repair parts that will be required to support the higher flying hour rates. It is feasible, at intense wartime rates of consumption, that spares may be depleted in the first few days of the battle. In conjunction with the assessment procedure of triage discussed earlier, aircraft which cannot be repaired in the time available may be lost or abandoned. Therefore, serviceable components, including complete systems, should be removed and used to return other aircraft to a mission capable condition. When the battle has been won, those aircraft which have been extensively stripped for cannibalization can be recovered and repaired.

BDR Teams. Aircraft maintenance officers and maintenance technicians will be trained to act as "damage assessors" capable of making independent, diagnostic judgments and maintenance decisions at the remote battlefield locations where aircraft might be forced to land. The assessor will make use of appropriate symbols and descriptors to identify the type and sequence of repairs to guide maintenance personnel. Maximum use will be made of symbols and descriptors established by other Department of Defense



CANADA

agencies and the ABCA armies. This practice will ensure a high degree of exchange and use of personnel from ABCA forces, if required. Other highly experienced maintenance personnel with special training in BDR techniques will be members of BDR teams. Training will encompass a high degree of cross training, to make maximum use of the BDR kit and techniques. Teams will be kept highly mobile and self-sufficient by using the tools and supplies in the kit, and by cannibalizing other aircraft. BDR procedures will be integrated into maintenance and aircrew training programs as they are developed. Instruction should be continuously updated to ensure a smooth and effective transition to BDR techniques, if required, at the onset of hostilities.

BRITAIN

Categories of Combat Maintenance. BDR maintenance actions will be categorized into one of the following:

- Unconditional defer: continue unlimited combat operations; cosmetic repair only.
- Conditional defer:

  with mission limitations but retention of crashworthiness/survivability features.

  no mission limitations but loss of crashworthiness/survivability features.
- Repair: permit unlimited combat operations for limited amount of flight hours.
- Scrap/cannibalize: aircraft unrepairable within time and support limits.

Serviceability standards are categorized as follows:

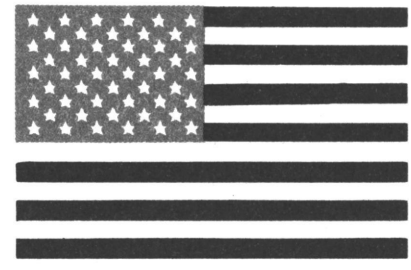
- Nonessential—defer indefinitely.
- Mission deferrable—can be deferred for a limited number of hours.
- Essential—must be performed before flight.

Given the limited aviation resources of the ABCA forces, every effort to keep aircraft in service must be made. This means that the armies must develop and implement the policies, procedures and equipment for BDR combat maintenance. The nations must work to develop quadripartite standardization agreements in the following areas:

- Inspection equipment to be used to evaluate the extent of repair based upon established serviceability criteria for maximum wear and damage.
- BDR and combat maintenance manuals.
- BDR and combat maintenance kits for use in inspection, assessment and repair of aircraft.
- Materials for use in repair of aircraft components.
- Nuclear, biological, chemical survivability built into kit and components.
- High survivability aircraft designs that provide quick repair/replacement of components.
- Standardized BDR and combat maintenance training/cross training programs.
- Personnel training to use state-of-the-art materials for the conduct of repair and maintenance operations.
- Establish priority for cannibalization of components from aircraft that are not repairable.

If this article has generated an interest and you wish to comment on the subject, please forward your comments to the following address:

Commander
U.S. Army Aviation Center
ATTN: ATZQ-CDC-C (Mr. Rush Wicker)
Ft. Rucker, AL 36362-5191



UNITED STATES

PEARL'S

Personal Equipment And Rescue/survival Lowdown

Dear PEARL'S:

I am told that individuals who operate industrial-style sewing machines must be signed off as "operator qualified." Since aviation life support equipment (ALSE) shops have these types of sewing machines, what is the Army's standpoint on this? Is there a current course Armywide? How should this type of training be recorded? My facility is located on an Air National Guard base. I use the industrial sewing machines in the parachute shop almost every day. The chief supervisor commented that all individuals who use these sewing machines must be operator qualified.

Although not an absolute requirement, I believe it would behoove us to ensure that the operator should certainly be qualified. On-the-job training is sufficient for this training. Perhaps as an operator moves from station to station, he or she could be required to demonstrate proficiency again. The only official sewing machine training course is the quartermaster parachute rigger training located at Ft. Lee, VA. Please note that Training Manual 55-1500-204-25/1, *General Aircraft Maintenance*, covers the inspection and repair criteria for restraint equipment. Course No. C3AZR-42753000 taught at Chanute Air Force Base, Chanute, IL, would be justified for the type work you would be performing.

Since I have been involved in Army Aviation, there has been much heated debate if an ALSE career military occupational specialty (MOS) is needed. Since ALSE technicians are kept in the shop and do not get out much, any information pertaining to "our" program is filtered down. Updates that we see in the* Aviation Digest *and* Flightfax *still state that studies are ongoing. One current rumor is that the study was completed and the ALSE field will not be made into a career MOS and will simply stay an additional duty. If this is so, ALSE technicians will still be kept out in left field. The amount of manhours required to work with a unit's ALSE will not afford quality time for the technician to accomplish the needed tasks in his or her primary MOS and work in the ALSE shop. If there are any current developments on the ALSE MOS, I would like to hear about them.

The latest information on the Army MOS for ALSE is that the study was completed; however, there is much "red tape" to go through to get it finally approved and established. I still feel strongly that the MOS is needed and we have much support for it, but apparently other factors must be considered before we will get the ALSE MOS. Don't think for a minute that we have forgotten the critical need for the MOS; we are well aware of the need and its importance to ALSE personnel. Keep the faith and hopefully someday we will have the ALSE MOS.

During an Aviation Resource Management Survey inspection, a comment was made about the ALSE standing operating procedure (SOP) our facility was using. The SOP was simply a rewrite of what Army Regulation (AR) 95-1 and AR 95-3 were stating, not a directive on how to run the shop from a day-to-day basis. As I was not the author of the original SOP, I was in total agreement on what the SOP should state. If any ALSE shops feel they have an outstanding SOP to cover day-to-day ALSE operations, I would like to solicit a copy they could provide me for ideas.

We are in need of a good SOP. We had a good one contained in Training Circular (TC) 1-62, *Aviation Life Support Equipment*, that we found to be the minimal desired. Should anyone have a need for a copy of this short, but sweet, SOP I am sure we can help you. Write PEARL'S and ask for the TC 1-62 SOP. Other good SOPs have been written and could be made available.

We thank SGT Douglas W. Penovich, Aviation ILARNG, IL, AUTOVON 724-9009 for the questions on ALSE.

Where to Store ALSE

What causes the scuff marks and the wear and tear on ALSE? You know what I mean—the gouged helmet, the frays and scuff marks on the vest, the dents on the flares, etc. Chief Warrant Officer Chuck Gibson has often said, "ALSE is the last thing the aircrewmember takes along with him, and the first thing that comes off before the rotor is stopped." An exact correlation exists between flight time a crewmember has logged and how much time his personal ALSE was in use. So why does the aircrewmember look so grand—sparkling sunglasses, nonregulation mustache, smile and spitshine boots, and his ALSE is looking like it barely survived a limited nuclear war? Well...enough said, right?

Out-of-sight and out-of-mind, so the saying goes. ALSE can be found in many places: under desks (covered with scuff marks); in car trunks, with a light oil coating; in bottoms of wall lockers; and other places you cannot believe. Even the so called helmet bag, generally confused with a kit bag, is a major offender. Inside the helmet bag, you will find flight publications for the entire region, a kneeboard, extra flashlight batteries and an emergency box of C rations. All of this abuse may cause the failure of ALSE, which may be needed when you least expect it. What is the solution? Why not an ALSE storage locker where ALSE can be issued on a mission basis. Then ALSE can be returned to the ALSE shop when the mission has been completed. Certainly you have ideas that we could probably use. Send them along; I am sure they would make interesting reading and who knows, they undoubtedly would be handy. By now you are probably ready to tell me to join the Air Force. No not really, the problem is not insurmountable. Remember, the Air Force has been at it much longer than we have and, yes, we are making inroads. The main thing is that we must work at it if we are to succeed. (Thanks to CWO Chuck Gibson, formerly the U.S. Army, Europe ALSE representative.)

The Importance of Aviation Life Support Equipment

The importance of trained ALSE personnel can best be brought out and is emphasized by the *Flightfax* article, "Let the System Function," Volume 15, No. 4, 15 October 1986. "Hidden" on the continuing back page is the frightening statement: "Attempts to inflate the liferaft were unsuccessful. After it was unfolded and examined, they found the **lanyard to the compressed air bottle was missing and one of the two hoses from the compressed air bottle to the raft was disconnected."** So, do we need trained ALSE personnel? I'll let you answer that question. Not only do we need trained ALSE personnel, we need proper training in the use of the equipment.

What a day! First, the aircraft goes for a swim. Was the "May Day" transmitted? Was it received? How long will the aircraft float? When will help arrive?

Yes, three aircrew personnel are alive after ditching their aircraft. But why was the liferaft put on board the aircraft in an unserviceable condition? Was it to satisfy a regulation that mandated a liferaft must be on board the aircraft because of possible imminent overwater flight, or perhaps because the regulation was misinterpreted? Perhaps the liferaft had never been inspected, because there were no trained ALSE personnel in the unit. Nobody bothered to check the serviceable tag, or perhaps didn't care enough to put the effort into taking the actions called for. Perhaps the aircraft accident investigation team report will clarify and identify the true problem. The bottom line is that the commander is responsible. We owe it to the commander to keep him in the know. So why not train for that situation? You can never get to the point where you are overtrained. The importance of trained ALSE personnel can never be underestimated.

We Care

The *we care* information format was designed and implemented by the ALSE organization with the AASF No. 1 Long Island MacArthur Airport, Ronkonkoma, NY. It is designed to provide information to aircrew personnel and aviation unit personnel. This is but one of the many things that is happening out in the "real world" of ALSE. Ask Mr. Pete Cario, aviation life support system chief, for his handouts on ALSE. He is truly dedicated to the ALSE system.

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.

AVIATION MEDICINE REPORT
Office of the Aviation Medicine Consultant

Symptoms of Simulator Sickness

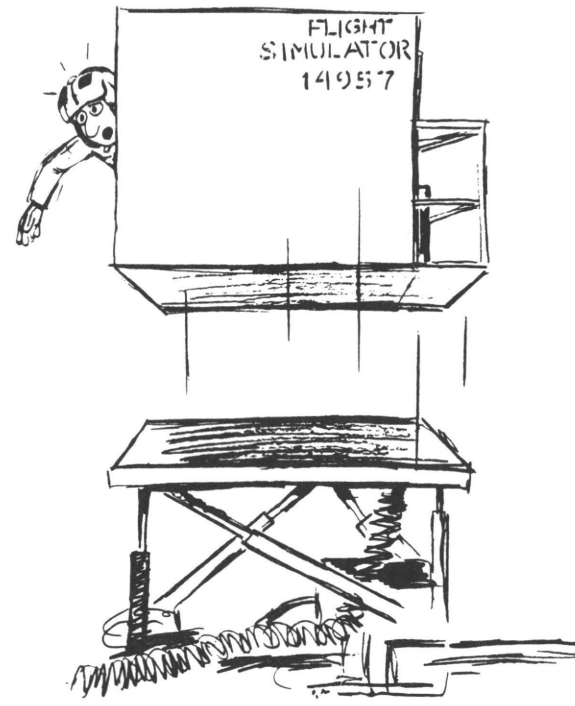
Captain James E. Hancock, M.D.
Chief, Review and Dispositions
U.S. Army Aeromedical Activity
Fort Rucker, AL

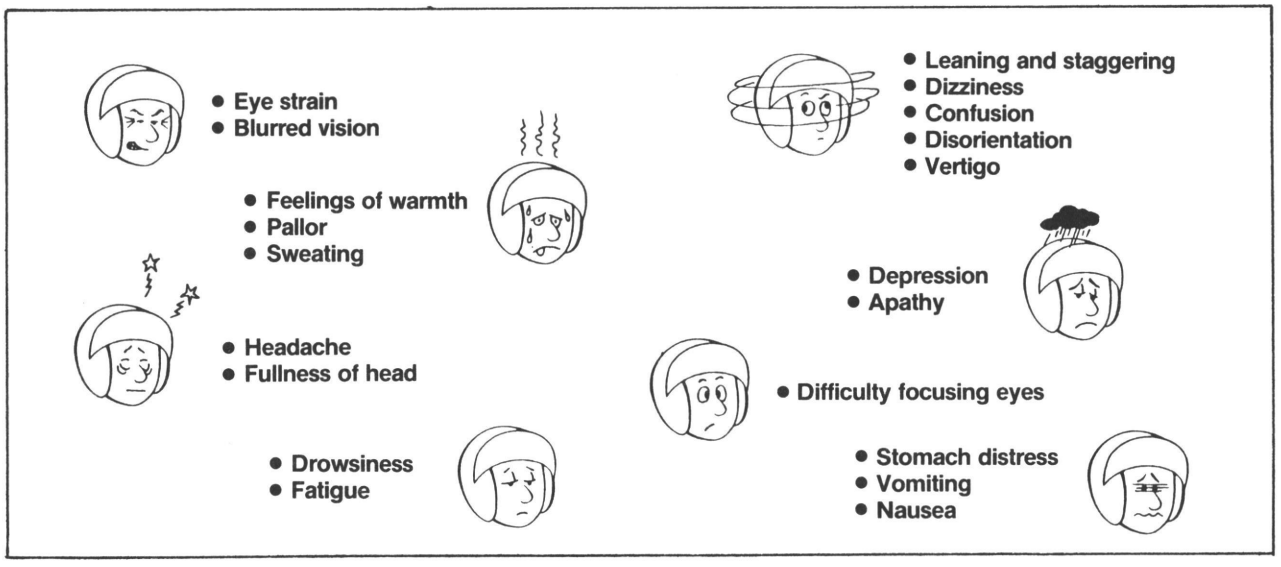
SIMULATOR SICKNESS is defined as a constellation of symptoms that result from exposure to motion or aspects of a moving environment as they pertain to the flight simulator.

This entity was first described by Havron and Butler in 1957 in U.S. Navy 2-FH-2 helicopter simulators. However, more definitive research was absent until the 1970s. Since that time all services have actively researched this problem, and the Army and Navy currently maintain a database to relate symptoms to specific equipment features.

Simulator sickness is not a small problem, especially in light of the new combat mission simulator (video coupled) systems, and has far-reaching effects. It has been estimated that 29 percent of aviators will have significant symptoms, and 1 percent will become incapacitated as a result of simulator training. Symptoms seem to manifest equally in student and rated aviators. Although most resolve their symptoms within 1 hour, 12 percent will experience problems 6 to 12 hours out. It is these symptoms that are most concerning to aviation safety.

The current most widely accepted theory regarding simulator sickness is the perceptual-conflict theory. This theory is based on the split second delay and variance between simulator flight control and actual flight. This entity should, therefore, be perceived as a normal reaction to an altered situation to which the body must adapt. The perceptual-conflict theory is supported by the fact that beginning and experienced aviators develop symptoms at similar rates. Other factors that contribute to individual susceptibility include sleep deprivation, upper respiratory tract infection, vestibular related disease, and environmental and emotional stress. Susceptibility also seems to be related directly to the duration of the simulator flight.





The symptoms of simulator sickness are broad and varied. These symptoms can be divided into three groups: visual, vestibular and vagal. A list of the common symptoms are blurred vision, dizziness, confusion, pallor, drowsiness, sweating, headache, fatigue, stomach distress, nausea and vomiting. Other residual symptoms that may occur hours after simulation include sudden compelling flashback, disorientation, spinning sensation, visual illusion and lost equilibrium. As mentioned above, these symptoms are highly individualized. Because these symptoms can cause serious performance degradation and limit training effectiveness, early detection is most important.

The Army has established several guidelines to reduce the problem with simulator sickness, and early detection and reporting of symptoms are necessary. If symptoms develop, that person should be removed immediately from the simulator, and should not return for 12 hours. When starting training, pilots should be allowed a period of adaptation beginning with short flights with gentle maneuvers. Simulator flight should not exceed 2 hours. Because of the incidence of residual symptoms, aviators should refrain from actual flight for a minimum of 6, preferably 12, hours after simulator training. All aviators should maintain optimum health and fitness to reduce individual susceptibility. During simulator flight, when possible, abrupt maneuvers and visual freeze or slew should be avoided.

Treatment of simulator sickness is mainly preventative. Pilot education is important. The acute treatment is largely symptomatic, and pharmacologic therapy can be useful. Chronic therapy should not include drug therapy, but should rely on physiologic adaptation. Keep in mind this is a normal response.

In summary, simulator sickness is a form of motion sickness unique to the flight simulator that has far-reaching aeromedical and aviation concerns. With the rapidly advancing technology of today's aircraft, increasing simulator training will be required to master flying duties. During a time of budget constraint, the simulator will become an increasing part of flight training. It is the responsibility of all aviators to participate in educational efforts to ensure the optimum gain from the simulator experience, as well as maintain aviation safety.

The Aviation Medicine Report is a monthly 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, Ft. Rucker, AL 36362-5333.

Airborne Air Traffic Control

First Lieutenant Marybel Huston Johnson
2d Platoon, B Company
1/58th Aviation Regiment
Fort Bragg, NC

JUNE 1985 was part of one of the hottest summers of my life. I was attending airborne school at Ft. Benning, GA. I did more pushups those 3 weeks than I could ever do again. Completing airborne school was a rite of passage, a challenge to overcome. I never dreamed I was learning a skill that would later become a major part of my job.

Upon my commission, I attended flight school at Ft. Rucker, AL. I always wanted to be an aviator. I looked forward to using my newly acquired skills in an aviation unit, leading other aviators.

After completing flight school, I was supposed to be assigned to an aviation unit at Ft. Bragg, NC. However, when I reported to the officer management section, the Armor Branch major across the desk from me said, "You'll be going to the 58th ATC Battalion."

ATC? I quessed he meant air traffic control, but I wasn't 100 percent sure. "Certainly there's been a mistake. I'm an aviator. Within the last year, I've been trained to fly. I don't know anything about ATC," I told him. But there had been no mistake. I reported to my new battalion and was assigned as platoon leader for the 1st Platoon, B Company, 1/58th Aviation Regiment (ATC), Ft. Bragg, and my adventure began.

The 1st Platoon is an airborne platoon. Our mission is to support the 82d Airborne Division, Ft. Bragg, in airfield seizures and other emergency deployments. We accomplished our mission with the help of a couple of PRC-77s, AN/TRN 30 V1 beacons and an AN/TSQ 97 portable control tower. With all equipment and personnel airborne-qualified, we were fully capable of supporting any size assault element. We had assumed the pathfinder's mission and could be deployed anytime, anywhere.

When I was assigned to the platoon, I hadn't jumped since attending airborne school 3 years earlier. My initial jump was scheduled for 0130 hours. Our "night" jumps at airborne school were anytime after sunset. I was nervous about jumping. I didn't feel confident that jump refresher had "refreshed" me. We practiced parachute landing falls, but the whole airborne sequence from initial manifest to descent and assembly could really only be "refreshed" through experience.

We began initial manifest at 1900 hours. My soldiers made sure my equipment was properly rigged and that I was squared away. I was manifested second on the left door. The number one jumper in front of me was Staff Sergeant (SSG) Martin who was a master blaster.

I was given a band that my soldiers had inscribed with numerous phrases and drawings designed to warn other parachutists of my inexperience and impending danger. After prejump training, we moved to Pope Air Force Base, NC. We practiced actions on the aircraft in a C-130 Hercules mockup and then were issued parachutes. By this time, I was really excited. My adrenalin was pumping and I was ready. The hour-long wait while wearing parachutes seemed like only moments. I must have asked SSG Martin a thousand questions and rehearsed the rules of the air numerous times before we boarded the plane. While an Air Force aircraft took us on nap-of-the-earth flight to the drop zone, most of the other soldiers slept. I was too anxious. I rehearsed over and over in my head what I was supposed to do. During the plane ride I thought back to June 1985 when I never expected to jump again. Here I was 20 minutes until the green light, waiting to step out into complete darkness, combat equipped. I realized then that I was more than an aviator: I was an airborne soldier.

The 1st Platoon is the only tactical airborne platoon in the Army. It is made up of 12 of the most motivated and dedicated soldiers in the Army. Many have served in the 82d Airborne Division as infantrymen during previous assignments. In addition, they have all completed the ATC course at Ft. Rucker. These professional soldiers can accomplish any mission as evidenced by their service in Grenada, South America and within the continental United States, supporting the 82d Airborne Division. Twice their accomplishments have been recognized by being named U.S. Army Forces Command Platoon of the Year.

As the airborne platoon leader, my first priority is to my platoon. My second priority is flying, although I maintain the same minimums and proficiency as platoon leaders in aviation units.

As a 2LT in an aviation unit, I would more than likely be a platoon member with no real function or responsibility. As an ATC platoon leader, I am holding a captain's position and leading soldiers. When I was commissioned, I knew that I would not be just an aviator. I was aware that my responsibilities would encompass many administrative duties. However, I never realized the opportunities available to aviators unrelated to performing pilot duties. Being in ATC has enabled me to wear many hats: tactical platoon leader, airborne liaison officer and pilot. Initially, I felt that I needed to be in an aviation unit. However, now that I have worked airborne tactical ATC, I know the challenge and excitement of working with outstanding soldiers.

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

U.S. Army Class A Aviation Flight Mishaps

	Number	Flying Hours	Rate	Army Fatalities	Total Cost (in millions)
FY 88 (through 29 February)	8	663,590	1.21	10	$17.4
FY 89 (through 28 February)	12	602,194*	2.22	11	$31.8

*estimated

VIEWS FROM READERS

Editor:

In the November 1988 issue of *Aviation Digest* in "Views From Readers," CPT John H. Gerken, New York Army National Guard, wrote to you concerning the "DUSTOFF" call sign used by aeromedical evacuation units in Vietnam. You indicated that you would query the reading audience for replies.

A book entitled *DUST OFF: Army Aeromedical Evacuation in Vietnam,* published by the Center of Military History, U.S. Army, Washington, DC, in 1982 and authored by then CPT Peter G. Dorland and James Nanney may well provide the necessary information. The commander of the 57th Medical Detachment at the time was MAJ Lloyd E. Spencer. MAJ Spencer chose the "call word" DUSTOFF from a Navy Signal Operations Instructions book. According to the authors, the Navy controlled call words for operations in RVN at the time.

The following paragraphs are quoted from the book stating how the call word DUSTOFF was adopted:

> "For the past year the 57th had worked without a tactical call sign, simply using ' Army ' and the tail number of the aircraft. For example, if a pilot were flying a helicopter with the serial number 62-12345, his call sign would be 'Army 12345.' The 57th communicated internally on any vacant frequency it could find. Major Spencer decided that this slapdash system had to go. In Saigon he visited Navy Support Activity, which controlled all the call words in South Vietnam. He received a Signal Operations Instructions book that listed all the unused call words. Most, like 'Bandit,' were more suitable for assault units than for medical evacuation units. But one entry, 'Dust Off,' epitomized the 57th's medical evacuation missions. Since the countryside then was dry and dusty, helicopter pickups in the fields often blew dust, dirt, blankets, and shelter halves all over the men on the ground. By adopting 'Dust Off,' Spencer found for Army aeromedical evacuation in Vietnam a name that lasted the rest of the war."

When the second aeromedical evacuation unit arrived in RVN, it too chose the DUSTOFF call sign because their mission was the same. The 82d Medical Detachment was that unit.

I hope this is of some assistance in resolving how the DUSTOFF call sign became a legend.

MAJ Danny E. Lacy
U.S. Army Aeromedical Research Laboratory Liaison Office
St. Louis, MO

Editor:

I am writing to ask for your assistance. On 16 September 1988, the 7th Battalion, 158th Aviation Regiment (C) became a newly constituted aviation unit. Viewing the accomplishments of the 158th Aviation Battalion while it was in Vietnam, its legacy at Ft. Campbell, KY, and the historical significance of unit identities, we are continuing the names of both "The Ghost Riders" and "The Lancers."

However, we need help. The Institute of Heraldry, 101st Airborne Museum or the National Archives and Records do not have a copy of either company's patch or motto. If any of your readers who were past members of either The Ghost Riders or The Lancers have either a sew-on patch or a picture of the logo could contact me, I will ensure they get their patches returned.

This will help us be as accurate as possible continuing the memory of these impressive units.

CW4 Thomas J. Hill
7/158th Avn Regt
Bldg 3680
Scott AFB, IL 62225-8700

Editor:

I am writing in response to your query of the first use of the call sign DUSTOFF. I am a radio

telephone operator currently assigned to the 57th Medical Detachment (RG) at Ft. Bragg, NC. After researching our historical records, I found CPT Gerkin's statement that DUSTOFF originated in Vietnam with the 57th Medical Detachment to be true. In an article in *Family Weekly,* 23 October 1966, Major Lloyd E. Spencer, an aerovac founding officer, explained how the callsign DUSTOFF originated:

> "About 3 years ago the Navy was providing code words for the Vietnam theater. I went through a meager list and figured DUSTOFF was a natural code designation for aerovac. Later we got orders to change the code name, but nobody paid any attention to the new word—ground troops or aviators. DUSTOFF had come to mean something special. To ground troops, it meant somebody would help their wounded, whatever the risk, and to us—well it was ours, and we had reason to be proud of it."

Wounded were evacuated by air in Korea. In November 1950, the U.S. Army 2d Helicopter Detachment arrived in Korea to be used for medical evacuation. By 1953, the helicopter evacuation units had been reorganized as the U.S. Army 1st Helicopter Ambulance Company. Between 1 January 1951 and 27 July 1953, helicopter detachments had evacuated 21,212 patients. However, the callsign DUSTOFF did not originate until the Vietnam conflict with the 57th Medical Detachment (RG). DUSTOFF!

SPC Mark McCann
57th Medical Detachment (RG)
Ft. Bragg, NC

Editor:

Statement of the problem: Army Aviation versus being a soldier first.

Explanation: There is a known fact in Army Aviation that crewmembers are always expected to be soldiers first. My question is, "Am I a professional soldier or a professional aviation mechanic?"

Let me explain myself. I am a flight engineer with the 271st Aviation Company. I went through basic training to become a soldier. I completed advanced individual training to become a helicopter mechanic. When I am required to train as a soldier, time is taken from the aircraft, which often reduces the unit's mission effectiveness.

I will not sacrifice the condition of my aircraft or perform less than thorough, detailed maintenance on it. Would you ask an 11B to repair this $8 million aircraft? Yet you ask me to do the job and meet 11B standards. Why is it then that my salary is the same as his when I am performing both jobs? Should I get more or should he get less?

This is not a financial issue, though. The issue is quality, professional work. The CH-47 Chinook aircraft that I work on tell the story themselves. From the new CH-47Ds that I crewed at Ft. Campbell, KY, to the CH-47s at Camp Humphreys, Korea, they say the same thing. That is "help." Although normally all are in a flyable status, most have minor discrepancies, are dirty and are in need of personalized care. Once the helicopter is flyable, the crewmember can continue to train at being a soldier. This means that the small discrepancies on the aircraft are not attended to, small discrepancies that could lead to severe mishaps. I read numerous reports that blame poor maintenance for extensive aircraft damage and fatalities. Why? Perhaps poor training, possibly improper parts or equipment, but more likely lack of attention to detail that possibly results from work overload, stress and insufficient time to ensure maintenance is performed properly and by the book.

What the Army assigns me I will complete to the best of my abilities. However, I WILL NOT allow ANYTHING to jeopardize the safety of the aircraft or its occupants. I am Army Aviation.

My suggested solution to the problem: The U.S. Army is entering a new decade. Army Aviation must move out of the 1970s and attack the 1990s head on. Army Aviation appears to be a miniaturized version of the U.S. Air Force only acting within the confines of the Army structure. The difference is that the Air Force does not attempt to play soldier as well as mechanic. I believe that Army Aviation should be more removed from the Army's present structure.

We flight engineers and crewchiefs keep Army helicopters flyable and in the best condition we can under the circumstances in which we are forced to work. Let us do our jobs the way they should be done.

These are viewpoints of a simple flight engineer who takes his job very seriously. May you think of these words if you ever get the opportunity to fly in an Army aircraft. Although these viewpoints are derived from the flight crews that fly in the CH-47 Chinook helicopter, I believe the contents of this letter reflect the attitudes of all Army flight crew personnel.

SPC Terry Tyner
Flight Engineer
271st Avn Co
APO San Francisco

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

Touchdown Emergency Procedure Evaluation

Mr. William A. Rowe
Technical Support Branch
Directorate of Evaluation and Standardization
U.S. Army Aviation Center
Fort Rucker, AL

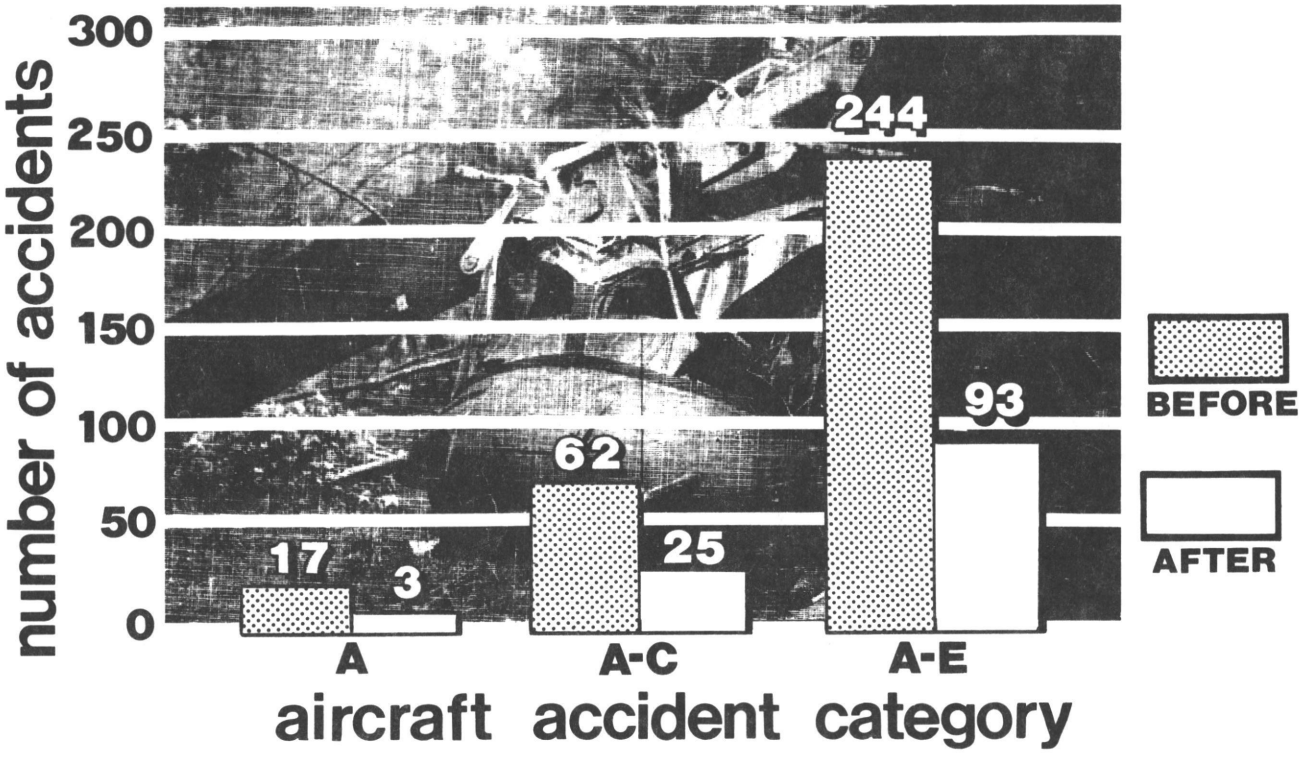
QUESTION: What do the following maneuvers have in common?

- Hydraulic system malfunction.
- Standard autorotation.
- Low level autorotation.
- Low level, low airspeed autorotation.
- Low level, high speed autorotation.
- Antitorque malfunctions.
- Autorotation with 180-degree turn.

ANSWER: As all of you Army rotary wing aviators know, they are flight maneuvers subject to prevailing restrictions on touchdown emergency procedure training. Unless you've had a recent local transition, have been to an Army training post for schooling or have had an actual emergency, you haven't been authorized to perform these maneuvers in more than 5 years.

The Department of the Army imposed the prohibition on touchdown emergency procedure training in April 1983. The action was taken in response to the high costs and safety risks associated with practicing the maneuvers. The prohibition has since been labeled the moratorium on touchdown emergency procedures or "the moratorium," for short. Not long after the moratorium was imposed, concern began to develop over its long-term effects.

The Directorate of Evaluation and Standardization, Technical Support Branch, has been monitoring the moratorium's impact for the last 4 years. We've reported our findings on an annual basis through formal reports addressing flight performance and logistical and safety data relating to UH-1 Huey, OH-58 Kiowa and AH-1 Cobra aviators. We also provided a status report in the *Aviation Digest* following the second year of our study. What follows is a summary of the most recent report of our evaluation.



Findings

On the average, aviators continue to need verbal or physical assistance to complete the prohibited maneuvers within acceptable standards. Safety data, however, revealed that there have been fewer mishaps (where pilot error on the emergency touchdown maneuver was cited as a contributing factor) since the moratorium was imposed than occurred during the same length of time before its implementation. No Class A through C emergency autorotation mishaps involving pilot error occurred during fiscal year 1988. The figure above demonstrates the positive impact the moratorium has had on Army Aviation's accident record.

Cost avoidance for Class A through E mishaps in the 59 months since the moratorium (compared to the 59 months before) is $12.2 million.

Conclusion

Data that cover 14 years and 609 checkrides provide an undeniably strong indication that the moratorium is good policy. Our findings portray performance that is low, but stable over a period of time. The safety record reflects levels of performance that continue to permit aviators to bring their troubled aircraft safely to the ground.

Although all indicators point to the many benefits of the current policy, we intend to continue monitoring the effects of the moratorium. The investment on our part is minimal compared to the importance of maintaining the highest possible standards of safety. We want to be certain that no negative trends appear as the bulk of those aviators schooled under the old policy leave the Army. We'll keep you posted.

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 Ft. Rucker Hotline, AUTOVON 558-6487 or Commercial 205-255-6487 and leave a message.

The Warrant Officer Training System

Captain Robert Sewall
Captain Sewall was attending AWOAC 88-4, U.S. Army Aviation Center, Fort Rucker, AL, when he wrote this article.

THIS SYNOPSIS of the warrant officer training system (WOTS) incorporates recent revisions and primarily emphasizes the senior and master levels of education.

A brief review will show how the present WOTS came about. In 1984, the Chief of Staff, Army (CSA) approved the initiation of the Total Warrant Officer Study. This was a comprehensive analysis of the Army's current warrant officer (WO) corps. Upon completion in August 1985, the results were submitted to the CSA. One recommendation subsequently approved was the restructuring of the warrant officer training system to align it with the newly approved total warrant officer management system. The key features of this new management system are to manage WOs by years of WO service and use them in positions calling for progressive levels of expertise. Initially, WO1s and CW2s serve in WO positions (entry level), then in senior WO positions as CW3s and CW4s, and then a select few will serve in master WO (MWO) positions as MW4s, and maybe eventually as CW5s, pending legislative outcome. The WOTS is a derivative of the new management system.

The WOTS prepares warrant officers for future duties and is comprised of the following three phases:

- Phase 1: Entry Level (0 to 8 years' WO service).
  —Warrant Officer Candidate School (WOCS).
- Phase 2: Senior Level (8 to 20 years' WO service).
  —Senior Warrant Officer Training Course (SWOTC).
- Phase 3: Master Level (20 years until retirement).
  —Master Warrant Officer Training Course (MWOTC).

In addition, functional area training may occur throughout a WO's career to provide skill refinement, specific job proficiency, equipment update or specialty development.

Here is a closer look at each phase. Phase 1 begins upon selection as a warrant officer candidate (WOC). Currently, the WOCS is 6 weeks in length and is conducted at Ft. Rucker, AL. Following completion of the WOCS, all aviation designated WOCs attend about 38 weeks of initial entry rotary wing (IERW) flight training, also at Ft. Rucker. Upon graduating from IERW, WOCs are appointed WO1 in the U.S. Army Reserve and receive their aviator designation (wings). They incur a 5-year duty obligation. The first 8 years (phase 1) are spent in aviation assignments, with limited functional area training.

Phase 2 builds on phase 1. Between the 8th and 10th year of WO service, all WOs with the rank of CW2 (promotable) or higher will be enrolled automatically in the SWOTC. Actual schooling will occur in conjunction with permanent change of station moves. The first SWOTC was conducted during 1st quarter, fiscal year 1989 and replaced the old Warrant Officer Advanced Course (WOAC). The purpose of the SWOTC is threefold. First, it provides senior WOs with a general knowledge of the role Army plays in relation to its missions and functions. Second, it provides knowledge of units/staff functions and procedures. Third, it provides a general knowledge of combined arms operations.

Specific improvements of the SWOTC over the old WOAC include 75 hours of communicative skills versus 59; 28 hours of intelligence/threat versus 18; and microcomputer training conducted

beginning day 4 versus day 45. The course itself is 11.5 weeks in length and is conducted at Ft. Rucker. Listed below are the academic subjects and hours per subject for the ASWOTC:

ACADEMIC SUBJECTS	HOURS OF INSTRUCTION
Aeromedical Subjects	5
Air Defense	17
Aviation Tactical Operations	54
Safety/Accident Prevention	12
Combat Operations	42
Communicative Skills	75
General Subjects	34
Intelligence/Threat	28
Leadership	39
Maintenance and Supply	27
Microcomputer	45
Military Justice	6
Nuclear, Biological, Chemical Operation	14
Personnel	17
	415
Physical Fitness Training	37
Total hours	452

Phase 3 is the master level of WO education. The MWOTC is designed to be the highest level of professional education available to WOs. The goal of the training is to qualify senior MWOs designated to become MW4s upon graduation from the MWOTC for expected roles as technical integrators, trainers, managers and developers in the most demanding assignments within their own career fields. The MWOTC consists of a nonresident and a resident phase:

• Nonresident Phase—This phase is a do-ahead correspondence course that prepares students for the resident phase. Areas of training include:

ACADEMIC SUBJECTS	HOURS OF INSTRUCTION
Communicative Arts	10
Development of Staffs	7
Staff Skills/Roles/ Relationships	10
Military Decisionmaking	12
Quantitative Skills	12
Personnel Service Support	2
Staff Leadership/ Management	4
Training Management	7
Budget	6
Tactical Sustainment	12
Reserve Components/ Mobilization	7
Force Integration	8
Comprehensive Examination	3
Total hours	100

• Resident Phase—This phase of training initially validates the nonresident phase. It concentrates on accomplishing a change in frame of reference from technical skill application to systems integration. This phase is designed to maximize WOs' skills with the goal that each WO becomes a master systems integrator of technical skills and tactical expertise. Areas of instruction include:

ACADEMIC SUBJECTS	HOURS OF INSTRUCTION
Staff Skills	100
Training Management	46
Budget	20
Mobilization	96
Combined Arms Doctrine	4
Functional Area Assessment/Total Army Analysis	2
Current Threat and Counterterrorism	4
Manpower and Personnel Integration	2
Physical Fitness and Total Well-Being	2
Special Leadership Issues	2
Computer Systems	10
Total hours	288

The resident phase of instruction has incorporated the use of small group instruction, creating a more personal teaching environment. This phase is 8 weeks in length and is conducted at Ft. Rucker.

In summary, the WOTS has evolved into a viable system that specifically outlines all levels of professional military education for WOs. Throughout each phase, WOs gain valuable experience and knowledge from classroom instruction and the collective expertise of classmates. This knowledge, coupled with the dedicated service of our warrant officers, significantly enhances the combat effectiveness of the Army.

CORRECTION: In the Feburary issue Aviation Personnel Notes, page 41, the Selective Reenlistment Bonus zones should have been:

A = initial term soldiers not more than 6 years of total active service.

B = midterm soldiers with a minimum of 6 but less than 10 years of service.

C = all soldiers with no more than 10 through 14 years of service.

CW4 Charles T. Robbins
Western Army National Guard Aviation Training Site
Silver Bell Army Heliport
Marana, AZ

Britain, Italy and Canada will receive the EH-101 in the 1990s.

A VISIT TO FARNBOROUGH

PART 2

The Farnborough International Airshow, held in September during even numbered years, is a comprehensive trade show and flying display for commercial and military aircraft and related ground systems and services. Part 1 in the March 1989 issue of the *Aviation Digest* discussed some of the military fixed-wing aircraft at the show and the Soviets' visit. Part 2 discusses some of the rotary-wing programs in progress, and a few of the antiarmor and antiaircraft weapons represented directly or indirectly at the show.

MOST OF THE major multinational helicopter programs entering operational service in the 1990s still do not have flying prototypes. One major exception is the EH-101 program represented at Farnborough by the Westland Helicopters prototype. Most other programs lack, or have lacked, agreement on mission requirements, political commitment, or both. Successful ongoing programs such as AH-64 Apache, UH-60 Black Hawk and Westland Lynx seek to upgrade aircraft capabilities and expand sales.

In 1986 Sikorsky bought part of Westland Helicopters, which gave Westland operating capital to continue until the EH-101 begins full production. And perhaps, just as important, the transaction gave Westland a license to produce Black Hawks and market them in Europe and the Middle East. Recently a contract was completed to sell 80 Westland Black Hawks (WS-70) to Saudia Arabia. Two Black Hawks flew at Farnborough, one of which was equipped with the Westland developed aircraft stores support system armament pylons to enhance the Black Hawk as a combat helicopter.

Westland has invested heavily in rotor blade technology using advanced design and composite materials. One result, which became known as the British experimental rotor program rotor blade, was used on a Westland Lynx in 1986 to set the helicopter world speed record of 249 miles per hour (216 knots).

The two latest versions of the Lynx are the Mark 8 for naval use and the Mark 9 "Battlefield Lynx" for the Royal Army. Both variants will enter service in 1990 and will have the advanced blades. The Army's Lynx Mk.9 will be equipped to fire TOW missiles and will have a wheeled landing gear instead of the skids as used on earlier Army versions.

The EH-101, which Westland is developing with Agusta of Italy,

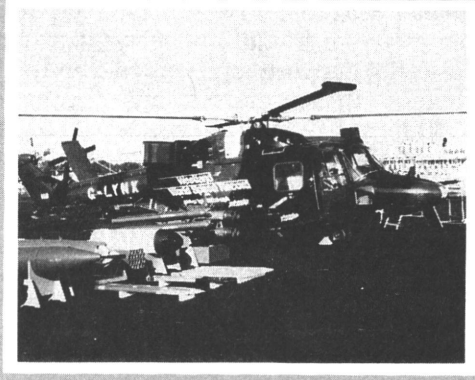
is a transport helicopter being configured in three versions: utility, naval and commercial. Three engines power five advanced design rotor blades for a design cruise speed of 160 knots. The helicopter will carry 30 fully equipped troops into battle areas, and will replace the Sea King, H-3 and S-61 size helicopters. The Royal Air Force has a requirement for 25 aircraft; the Royal Navy, 50; and the Italians, 40. A big boost came for the program when Canada ordered 50. The U.S. Navy is also a potential customer. First production EH-101s will be delivered in 1994.

The British Army, as part of its Northern Army Group of North Atlantic Treaty Organization (NATO) commitment, will create the 24th Airmobile Brigade to be composed of 25 EH-101s and 16 Lynx Mk.9 helicopters. This unit is intended to be held as a reserve unit for rapid antiarmor deployment as needed.

A little smaller than the EH-101 is the NH-90, being developed in utility transport and naval versions. Its size and missions will compare to utility and naval versions of the Black Hawk, but will use newer technology. Present plans call for a NATO requirement of 400 utility and 200 naval aircraft with deliveries starting in the late 1990s. This program is sometimes referred to as the "NATO helicopter of the 1990s" and was started originally by Italy, Germany, France, Netherlands and the United Kingdom. The United Kingdom pulled out after Westland became linked to Sikorsky and the Black Hawk. The NH-90 full-scale development decision is expected in 1989. No prototype exists at this writing.

Two European programs exist to develop antiarmor battlefield helicopters, the Franco-German PAH-2/HAC/HAP program and the LAH program of Italy, Spain, the United Kingdom and the Netherlands. The former program appears more cohesive than the latter.

ABOVE: A Westland/Sikorsky WS-70 is fitted with armament pylons.



RIGHT: The record setting Lynx, now in Mk.9 standard.

RIGHT: The Lynx Mk.8 naval version did flybys at 160 knots.

The Franco-German Eurocopter (Aerospatiale-MBB) program went through a period in which

divergent military requirements almost killed the program; however, a realization that neither country could develop an adequate program alone has been the cement to bind their efforts.

As presently envisioned, there will be three similar versions, all with tandem seating, twin 1,200 shaft horsepower engines, four rotor blades and wheeled gear. Germany will receive 212 PAH-2s for the antiarmor role. France will receive 140 HACs for the antiarmor role, and 75 HAPs for armed escort of friendly helicopters and fire support, and will be equipped with antiaircraft missiles, 30 mm cannon and will be able to fight at night. The antiarmor helicopters will be equipped initially with the HOT-2 missile then the advanced ATGW-3 antiarmor missile when it is available. Prototypes should fly by the end of 1989 and deliveries starting in 1997.

The LAH program, known as Tonal, is an outgrowth of the Agusta A129 Mangusta helicopter. One of four potential designs had yet to be selected as of Farnborough '88. In the United Kingdom there is fear that the Tonal will not be able to meet the threat of the 1990s. There is movement to quit the LAH program and purchase off-the-shelf Apaches or become a codeveloper of the advanced Apache. There is concern that the Netherlands may also bail out of LAH for the Apache or the PAH-2/HAC/HAP program. Italy's concern of probable loss of LAH partners resulted in an Italian offer to the United States to consider a joint LAH/LHX program.

The light helicopter experimental (LHX) program remains a big unknown. News reports occurring during the time of the Farnborough Airshow suggest that the United States might be interested in joint LHX development with as yet undetermined European partners. The A129, however, is not considered an adequate airframe for LHX.

The Apache, firmly established as the world's leading antiarmor helicopter, led off the daily flight demonstrations with a series of rolls, half cuban-eights and hammerheads intended to emphasize the helicopter's air-to-air agility. Several European countries are considering taking part in Apache purchases or codevelopment of advanced Apache, which

GLASNOST
and Foreign Military Sales

Glasnost hit Farnborough in a big way with the arrival of two MiG-29 Fulcrum air-superiority fighters from their base in East Germany. For the first time ever, advanced fighter aircraft from the West flew daily flight demonstrations in the same airshow with the airplane that would be their most likely adversary. During past years, the Soviets studied flight demonstrations performed at Farnborough and designed a flight routine very similar to what was performed by the Western fighters, and added their now famous "tailslide."

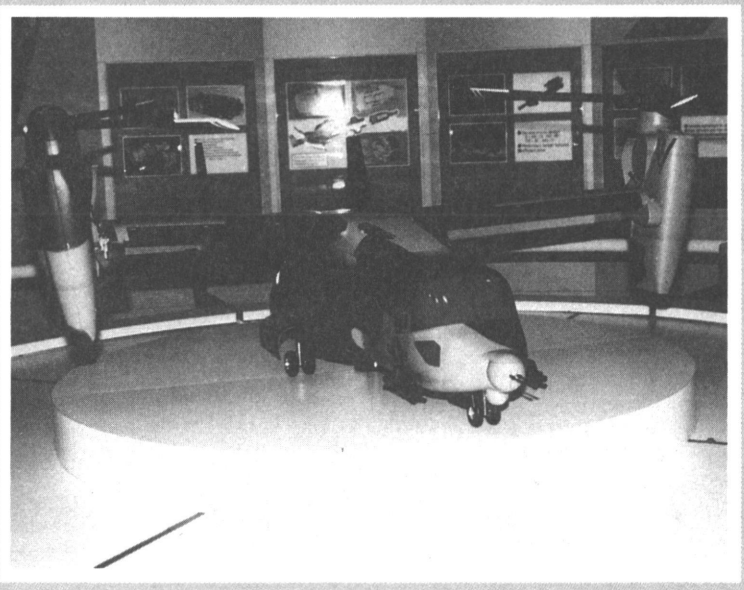
In an effort to put their best foot forward for the airshow, the Soviets, which included Rotislav Belyakov, chief designer at the Mikoyan design bureau, and several test pilots, were presented at newsbriefings and discussed their aircraft and plans for future airshows. The person who actually flew most of the flight displays was Anatole Kvotchur, chief test pilot for the Mikoyan design bureau. The stated reason to display the MiG at all was to show the West that the Soviets can produce advanced technology aircraft. And their reason to debut the aircraft at Farnborough was their belief that Farnborough is the world's most prestigious military show. Another consideration for their openness could be that this is a critical time for the Soviet leader, Mikhail Gorbachev's, dual policies of "Perestroika" (political and economic reform) and "Glasnost" (openness). He is using every opportunity to overcome the inertia of the Soviet system. Russia's lag behind the West economically and technologically is

will upgrade the air-to-air combat role.

With the U.S. Army apparently now out of the Bell/Boeing V-22 Osprey program, the U.S. Navy is looking for foreign military sales of the aircraft to reduce unit costs. A commercial Osprey has been touted as the aircraft of the future for European commuter airlines. V-22 models of various sizes appeared throughout the Farnborough exhibition halls by various subcontractors.

The market for helicopter mission equipment shows great growth by improving present day antiarmor systems, and adding new systems for both antiarmor and antiaircraft. A few are mentioned here.

Euromissile, a company set up by Aerospatiale and Messerschmitt-Bolkow-Blohm continues to market their HOT antiarmor

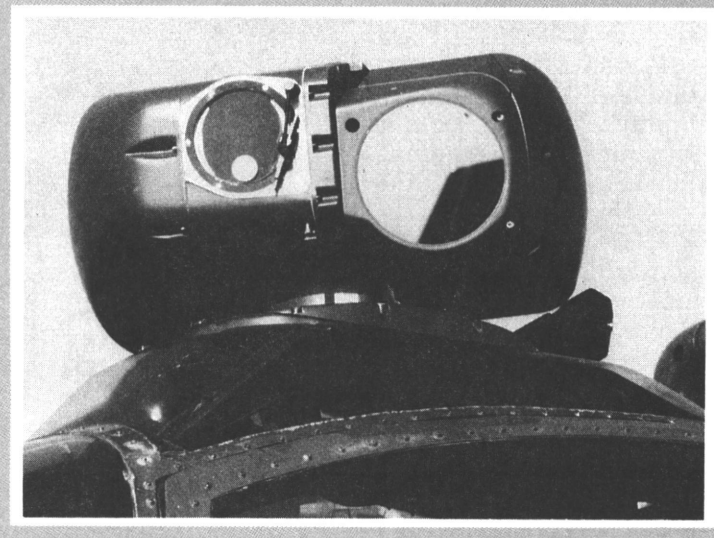


The Navy is trying to interest foreign purchases of the V-22 Osprey.

increasing, and reforms intended to produce better conditions for the Soviet people have not been going as hoped. Gorbachev has been accepting much of the blame, but the real cause might be a bureaucracy indentured to a system of inefficient resource allocation. With that in mind, all aspects of the Soviet society, including the military, are being told to tighten their belts now in hopes of effecting the reform goals. Faced with a reduction of allocated resources the military may be looking to provide some of their own funds in order to continue spending at its previous high levels.

Even though the market for total numbers of military aircraft is shrinking, within the next decade many countries will be looking to replace the thousands of Northrop F-5s, Dassault Mirage 3/5s and similar aircraft heavily exported in the last 15 years. This may be a chance for the Soviets to solve some of their problems at home and continue to influence people abroad. One strong point for the Soviets is their ability to produce large numbers of military equipment. At $22 million per copy, the Fulcrum is a very competitive commodity in near term sales. One obstacle that the Soviets will have to overcome is their reputation for poor service once a product has been delivered, but if Gorbachev's reforms start to achieve success this reputation might change.

The Soviets indicated that they will be showing military aircraft at the Paris Airshow in 1989 and at Farnborough again in 1990. Which aircraft wasn't made clear, but for export potential and airshow excitement, the Fulcrum will be a hard act to follow. No matter what happens to Glasnost, Farnborough '88 will go down in history as the Year of the MiG.



The Viviane sight (right) will give the French Army's Gazelles (above) day/night missile firing capability.

A Visit to Farnborough

missile. By description, operation and capabilities, it is very similar to the TOW missile. The latest version of the HOT-2 is reported to have an antireactive-armor capability by an additional extended explosive device similar to the TOW-2A.

"Viviane" is a new roof mounted stabilized day and night sight marketed for the HOT-2 and soon will be retrofitted to the French Army's fleet of SA.342 Gazelles. The sight contains an infrared (IR) camera for use at night and it also contains a laser rangefinder.

The ATGW-3 third generation antiarmor/antihelicopter missile is under development by a trilateral effort between Britain, France and Germany. It will replace MILAN and HOT systems, and will be the primary armament of the German PAH-2 and French HAC helicopters. The ATGW-3 will be a beam guided missile with a range of about 5 kilometers (km).

"Helitow" is a system devised by the SAAB instrument company combining its helios observation system with the Emerson Electric TOW system. Helitow was displayed on a Swedish Army MBB Bo.105CBS and a Bell 406 combat scout destined for Saudia Arabia.

HELLFIRE, in use on the Apache for antiarmor, is being promoted as an antiaircraft weapon using a fragmentation warhead.

A probable future missile to be used in the antiarmor role is the LTV designed hypervelocity missile (HVM), which is being developed in separate versions for the Air Force and the Army. Both use their very high speed, about 5,000 feet per second, to drive a penetrator rod through armor. They are expected to be more effective against advanced armor materials and shapes than "chemical" warheads. After a target is acquired, it is tracked by a forward looking infrared (FLIR) sensor. After the HVM is launched, it receives guidance instructions by laser pulses, which control the firing of a series of tiny control rockets arranged radially around the missile.

Twelve of the smaller Air Force missiles, which appear similar to 2.75-inch rockets, will be carried in a pod. The larger Army missile is 112 inches long and weighs 170 pounds, and individually will be tube contained and launched from ground vehicles or from helicopters.

A futuristic-looking missile is the Shorts "Starstreak," which

ABOVE: A Bell 406 combat scout with helitow system is bound for Saudia Arabia.

LEFT: The SAAB designed Helios sight, part of the helitow system, is on a Swedish Army Bo.105CBS.

was displayed in the static display area as an option for Apache use. Its velocity is described as being several times the speed of sound. It has three warhead darts, which are individually guided to the target by internal guidance systems. The type of guidance system has not been revealed except to disclose that it is not an IR seeker. Shorts presently has a contract to develop a ground based system. The first test firing of the missile is due in 1991. Development continues with McDonnell Douglas.

A more conventional antiarmor retrofit option for helicopters is the gun rocket control system (GRCS) for sale by Les Forges de Zeebrugge (FZ) of Belgium. The system is equivalent roughly to what the U.S. Army knows as the Hydra-70 rocket system; 2.75-inch rockets with remote set fuzes are programed to create a "wall in space" by rockets with multiple submunition warheads. FZ produces the complete system. Also being produced are flechette warheads, which when used with the GRCS provide an option for air-to-air engagements.

In a future AirLand Battle where there are aircraft, there will be ground based systems to shoot them down. Farnborough had no shortage of systems available for this purpose.

The Oerlikon-Buhrle armament company in Switzerland and Martin-Marietta in the United States developed the air defense artillery threat simulators (ADATS) antiaircraft/antiarmor missile system. Acquisition of targets can be by radar, TV, FLIR or optically; and much of this technology came from the Martin-Marietta designed target acquisition designation sight/pilot's night vision sensor system for the Apache. Mounted on a ground vehicle, eight tube-launched missiles have a range of 8 km.

Both Canada and the United States have selected the ADATS system for their NATO-based forces. Canada will mount its ADATS on the M113A2. The United States will mount its ADATS on the M3 Bradley infantry fighting vehicle.

Euromissile is marketing its latest version of the Roland air defense system, the Roland 3. West Germany is acquiring the system, mounted on 8 by 8 all-terrain vehicles, which will be used for the defense of U.S. and German Air Force bases in Germany. Up to six Roland firing stations can be networked with each other to provide an integrated defense system. More than six firing stations will use a fire control center that can tie in to

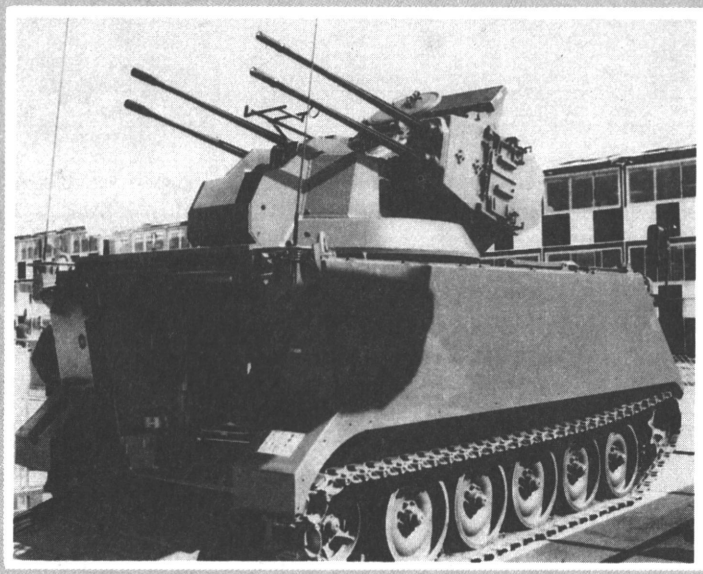
other air defense assets. Individual firing stations can provide target cuing to man carried antiair missiles(ManPortable Air Defense (System)).

An increasing trend in air defense is the growth of hybrid systems. A contractor might use any of a variety of existing weapons along with any of a variety of existing sensors to create a new system. One example shown on the radar and equipment terrace at Farnborough was the "Crossbow" equipped with Bofors RBS-70 missiles, Hydra-70 rockets and a .50-caliber machinegun—all integrated into the LTV designed retractable pedestal mounted on a high mobility, multipurpose wheeled vehicle. The pedestal with customer selected weapons is designed to fit on any adequate vehicle or ship.

Two new pure gun antiaircraft systems on display were the Italian Oto-Melara Otomatic 76/62 gun for medium weight vehicles and the Sidam 4 x 25 for light vehicles, shown with four 25 mm Oerlikon cannon on an M113A2.

One final example shows the diversity of a system. Electronic Serge Dassault of France will sell Egypt the Sinai-23, mobile, short-range air defense system. On an M113A2 supplied by Oto-Melara is a turret with six Sakr-Eye (SAM-7 Strella with a French IR seeker) missiles plus two ZU-23 cannons, plus a French-designed search radar.

Crossbow is a modular weapons pedestal, here on a HMMWV.



The Oto-Melara Sidam-25 antiaircraft system.

Farnborough '88 turned out to be the biggest show yet with the most companies represented and the most people attending. The use of multinational cooperative efforts on a wide variety of aircraft and weapons systems is now well established. The apparent decision by the Soviets to take part in military sales "Western style" will increase competition in an already crowded market. Finally, Farnborough '88 came at a time when many programs, including some directly affecting Army Aviation, are at critical decision points; yet looking at the possibilities, a glimpse of the future can be seen.

The new systems training plan superseded the old individual and collective training plan that was used to develop systems policy and procedures. Among other improvements, this new plan makes it easier for proponent schools to obtain necessary information from supporting schools, and provides the philosophy and rational for proposed training

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FOR YEARS WE have talked about "Icy Tee Pees" when, in reality, we were referring to ICTPs.

Many people will applaud the departure of the former individual and collective training plan (ICTP) for developing systems policy and procedures. They will point out that the information within the plan was not always current and, therefore, not usable; or there were too many requests for the same information in different formats; e.g., new equipment training plans (NETPs); materiel development program reviews (MDPRs); modernization resource information submissions (MRISs), etc. Some individuals have felt the ICTP was not really used as a management tool, and publishing it was simply fulfilling a requirement imposed by U.S. Army Training and Doctrine Command (TRADOC) Regulation (Reg) 351-9, *Systems Training Development.*

The ICTP, like all documents, is subject to revision periodically. As Army doctrine and training techniques and procedures are revised because of evolutionary changes in equipment and material, the supporting training documents also must be revised to reflect these changes, otherwise they become obsolete. Because of these and other reasons the ICTP has been redesignated and is now called "systems training plan" (STRAP).

The STRAP has been redesigned for use as a source of feeder information for NETP, MDPR, MRIS and other documents. The new design makes the STRAP's use as a management tool easier. It also improves the capability of proponent schools to obtain needed information from supporting

schools in a timely manner by using annex A to the STRAP.

Some improvements of the STRAP include the revised milestones for STRAP submission, changes in staffing procedures with a shorter timeframe and more integrating center involvement. Manpower and Personnel Integration (MANPRINT) requirements also have been included plus the "umbrella STRAP" concept for entire families of vehicles, weapon systems or devices. This concept is similar to the umbrella STRAP used with the battlefield deception family of deception devices. With new reorganization, TRADOC Reg 351-9 is much more concise and regulatory. The "how to do it" information has been deleted. This latter information will be included in the new STRAP "Handbook for New Systems Training Development."

THIS STRAP HANDBOOK will not reiterate the contents of Army Regulation (AR) 70-2, *Production Management;* AR 71-9, *Materiel Objectives and Requirements;* or TRADOC/Army Materiel Command Pamphlet 70-2, *Materiel Acquisition Handbook.* It will provide necessary information and sufficient background data to make its use easier, with separate chapters on topics and subjects such as resourcing and MANPRINT that require indepth analysis. These chapters were distributed to the field as interim policy letters during February through June 1987. The contractor will use them as source material to publish the handbook. The handbook also provides the "how to do it" information not contained in TRADOC Reg 351-9. Questions to be asked and answered at each phase of the life cycle system management model (LCSMM) are emphasized. Also included is a series of events within the context of the LCSMM that the training developer must *perform and accomplish.* The portion covered by MANPRINT elaborates on these events.

The systems training plan format is relatively short. It contains only eight paragraphs in the basic document plus six additional supporting annexes. A brief summary follows:

System description

The STRAP begins with a short narrative description of the system. Detailed specifications are not required—just a basic understanding of what the system looks like, who will use it, and how it will be used and whether it replaced another system. Also, if the system is multipurpose, that information is included as well.

Training concept

The training concept explains how to train personnel to operate, maintain and manage the system. It provides general information, including the philosophy and rationale for the proposed training. It should include long-range training plans for both Active and Reserve Components.

Training constraints

This paragraph describes, in narrative form, the training constraints that were identified by the system MANPRINT management plan. These constraints help to support rationale for the proposed training concepts.

New equipment training strategy

New equipment training (NET) strategy explains how we transfer initial knowledge of the system from the materiel developer to the trainer and to the eventual receiving unit. It provides feeder information to the NETP developed by the U.S Army Materiel Command. After the Materiel Command or program/project manager develops the NETP, it is attached to the latest version of the system training plan.

Training device strategy

The training device strategy discusses what type training devices are planned for both institutional and unit training. A training device analysis is required, including how embedded training will be accomplished.

Training Test Support Package

The development and coordination required of the training test support package are described. The training developer provides this information containing the program of instruction; instructor requirements; training documents, such as lesson plans; personnel selection criteria; training aids or simulators; and any other training data collection requirements. This package is used in outline form during special task force meetings and is required in detail about 6 months before any test start date. This package also is used to train the troops who will conduct the test and for collecting data for training requirements.

Significant training issues at risk

The next to last paragraph will be in narrative form. Vital training issues requiring resolution before system development or fielding are discussed in this paragraph. During the early states of system development, the STRAP may not identify issues at risk; however, as the new system continues to develop and problems arise, the new system training developer must keep management informed so the required decisions can be made. Identification of issues at risk are especially vital before major decision points to ensure that the training subsystem is ready to progress to the next phase of development or fielding. When these issues are identified, they must be clearly explained. This paragraph should conclude with either a recommendation for resolution of the problem or a suggestion to delay any decisions until the problem is resolved.

Postfielding evaluation summary

The STRAP format concludes with a postfielding evaluation summary emphasizing the importance of TRADOC schools' receiving feedback from the using units in the field. This feedback ensures the products that the schools produce and the soldiers they train meet the unit's requirements. This feedback helps the schools to adjust their training and products if deficiencies exist. It also provides lessons learned data that can impact on the next generation of equipment or product improvements. The new system training developer must create a plan to evaluate the training subsystem. The STRAP describes the plan and discusses what will be evaluated, who will conduct the evaluation, how and when. It also explains how the evaluation results will be analyzed and staffed, presenting this information in narrative form.

IN SUPPORT OF the basic systems training plan format are several annexes that supplement and refine information and data contained in the STRAP. A brief summary of each annex follows:

Institutional training

Institutional training requirements are presented and discussed in annex A. The proponent school gathers and assembles this information with input from supporting schools. The information received is categorized according to the school from which it was acquired, military occupational specialty (MOS) affected and other appropriate specialized information. The training support required data show any effort and support needed for institutional training; e.g., ranges, ammunition, facilities and audiovisual. The resource entry data indicate which documentation resources are to be made available to support the training, such as MRIS, TRADOC review of manpower, program development incremental package and unfinanced requirements. However, the actual resources are shown at annex C. Annex A presents an overview of institutional training, and is a management tool used to track the training subsystem progress for institutional training.

Unit training

The training concept for unit training, discussed previously; is converted into a strategy in annex B. This strategy includes both individual sustainment training and collective tasks for crew or unit use to maintain performance standards. The first paragraph of the unit/sustainment training strategy pertains to individual training. It explains how individual skills will be sustained to maintain acceptable performance standards. It also identifies those products that are required to sustain individual skills, when those products are required, which resource documents to use and who the responsible agencies are. Detailed milestone

scheduling information is located at annex D. The second paragraph discusses the collective training strategy, including the doctrine and tactics training required to employ the system. The collective training strategy also explains types of collective training, including exercises, simulations, embedded training and crew drills by which crew/unit members will be trained. This paragraph also identifies the products and support required to support collective training.

The last paragraph in this annex discusses any and all unique requirements a unit must be aware of, to prepare for fielding and employment of the system.

Resource summary

Annex C covers resources, resource feeder data/information and the resources summary. The resource feeder data summary is designed as a management tool for use in monitoring the planning, programing and execution of system resources. The STRAP by itself is not a resourcing document; however, it generates source data for resourcing documents such as MRIS, Army extension training information system and training requirements analysis system. It addresses TRADOC's resource requirements to analyze, design, develop, implement and evaluate training according to the systems approach to training. It also considers management functions, training and training products. It provides source data for NETPs. The feeder data summary plans for personnel, facilities, structures, operating costs, travel, studies, contractual support and other TRADOC costs associated with the training subsystem. Additional guidance provided for the manpower staffing standard system and MRIS documents is also helpful to formulate input to the feeder data summary plan. The information/data obtained is displayed on the resource summary document that is organized by the proponent school and each supporting school. The resource summary portion of annex C contains detailed information and data in the following format: personnel (civilian and military); civilian pay; travel/per diem costs; contractor support required; facilities needed; and equipment, ammunition and printing requirements. While compiling these data, consideration is given to the information/data requirements of 29 additional planning documents.

Milestone summary charts

Annex D is the milestone schedule for developing systems. It contains those elements and products (e.g., facilities, ranges, training devices, etc.) of the training subsystem. The New Systems Training Office (NSTO) must plan and closely monitor the training subsystem to ensure TRADOC is ready to train personnel and provide the training materials required to support system fielding. NSTO action officers use the milestone charts and "map" to guide the training development of their system(s). TRADOC Form 569R, "System Milestone Schedule," is used for the milestone schedule and is comprised of an "a" or "b" sheet. The a sheet contains general system management information. The b sheet is prepared for each training element or product to be developed. The proponent school compiles and maintains a b sheet for each element and product containing information for its own school as well as supporting school. Individual detailed legends are keyed to each element and product, which explain the meaning and significance of each milestone entry. Proponent or supporting schools may use additional b sheets for any elements unique to their system, with a supporting legend.

The number of elements, and the composition and quantity of supporting legends, vary according to the various systems and subsystems being developed. Some of the more common elements and legends are:

Element: Individual Training

Legend

- Initial individual training plan (ITP) completed and submitted.
- Analysis completed.
- Annotated task list completed and submitted.
- Course revision plan completed and submitted.
- Training program worksheet (TWP) completed and submitted.
- ITP completed and submitted.
- Program of instruction completed and submitted.
- Resident course start date.

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Element: Training Device

Legend

- Front end analysis reviewed/high risk, hard to train tasks identified.
- Device concept validated.
- Need for training device identified in operation and organization or training device needs statement.
- Requirements and training device strategy incorporated into STRAP.
- Analytical justification by cost and training effectiveness analysis as input to cost and effectiveness analysis completed.
- Training device requirement/commercial training device requirement or appendix to required operational capability developed.
- Device effectiveness validated.
- MOS specific milestones/requirements for devices developed and incorporated in integrated training support.

Element: Army correspondence course program with six supporting legends.

Element: Armywide training literature program with eight supporting legends.

Element: Soldier's training products (soldier's manuals, training guides, MOS, job books) with five supporting legends.

Element: Skill qualification test with six supporting legends.

Element: Department of the Army audiovisual production program with six supporting legends.

Element: Facilities, ranges and real property with eight supporting legends.

Element: Training amunition with nine supporting legends.

Element: NET products with four supporting legends.

Element: Collective training and Army Training and Evaluation Program with seven supporting legends.

Element: Cost and effectiveness analysis with five supporting legends.

See TRADOC Regulation 351-9 for complete listing of elements and supporting legends.

Coordination and references

The last two annexes pertain to coordination and references. The coordination annex provides a summary of the agencies to whom the STRAP has been staffed. The summary includes the names of the agencies, number of comments each agency provided and the number of comments accepted. For those comments not accepted, the rationale for nonacceptance must be stated. The annex is a listing of appropriate references.

FOR THE MOST part, ICTPs have served us well for several years. They have provided TRADOC training developers with a systematic approach to plan and manage the training subsystems of a great number of developing materiel systems. The ICTPs have incorporated a workable strategy for training from initial qualification through sustainment training; and to maintain proficiencies, both in institutions and in units, at all skill levels and for all affected MOSs/specialty codes. With the improvements afforded by the new STRAP, future training and equipment should be even better.

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USAASO SEZ

U.S. Army Aeronautical Services Office

Global Positioning System Navigation of the Future

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THE U.S. ARMY Aeronautical Services Office, Cameron Station, Alexandria, VA, is the Army's focal point for the global positioning system (GPS) instrument procedures. The GPS is a space-based navigation system that has the capability of providing highly accurate three-dimensional position, velocity and time to an infinite number of airborne and ground-equipped users anywhere on or near the earth. The system consists of the following three elements:

- The *space* segment will transmit satellite position coordinates and timing information.
- The *control* segment tracks the satellites and uploads correct position and precision clock information.
- The *user* segment processes the position and time data from four satellites to compute precise position and velocity.

The U.S. Army is planning to use one-channel sets to pinpoint artillery pieces and provide precise targeting information for close air support. The aircraft fleet will be equipped with either the five-channel high dynamic/fast acquisition set or the two-channel medium dynamic set. The advantage of the multichannel receivers is that they simultaneously receive more than one visible satellite and obtain quicker fixes. The single-channel receivers collect the data from the satellites in serial fashion.

The GPS will not be affected by adverse weather conditions. It has the capability of being accurate to within 15 meters. The benefits derived from satellite information processing will enhance aerial navigation (en route, terminal, approach and departure), weapons delivery, ground navigation and surveying.

The use of a passive system also will be a valuable asset in the tactical realm. No longer will we require a ground-based navigational aid for flights in adverse weather, thus reducing the risk of compromising the airfield or heliport location. With time, position and velocity information available, multiship rendezvous are enhanced.

With the assistance of the Department of Defense (DOD) Position/Navigation Executive Council, tentative agreement has been reached with the Federal Aviation Administration (FAA) to accept DOD/GPS only flight operations in the National Airspace System (NAS).

The Assistant Secretary of Defense (ASD) (command, control, communications and intelligence) has tasked DOD to explore the use of GPS to emulate the NAS as it exists today, with the intention of decommissioning DOD ground-based VOR (very high frequency omnidirectional range), DME (distance measuring equipment), TACAN (tactical air navigation), Omega and Loran-C. The ASD tasked the U.S. Air Force to develop a GPS avionics performance standard for all DOD platforms and a test plan for the integration of GPS in the NAS. A working group that consists of the three services, FAA and the GPS Joint Program Office was formed. Our task was to develop the test plan and matrices to evaluate GPS performance and accuracy. The first draft of the baseline guide should be distributed for service coordination during the third quarter of fiscal year 1989. Presently, we are coordinating with the laser tracking facility and airfield commander at Laguna Army Airfield, Yuma Proving Ground, AZ, GPS test site so that the test procedures can be developed and implemented. The test plan will be implemented in two phases.

Phase one will consist of gathering statistical data to support the use of GPS to emulate existing en route and terminal procedures.

Phase two will be to develop GPS unique procedures using the data gathered during phase one, and then flying them in controlled conditions and at selected sites in the NAS.

For additional information, please contact Mr. Walter W. Perron, AUTOVON 284-7773, or Commercial 202-274-7773.