Special Focus: C4I and Electronic Warfare

SPECIAL FOCUS: C4I AND ELECTRONIC WARFARE

ARMY AVIATION

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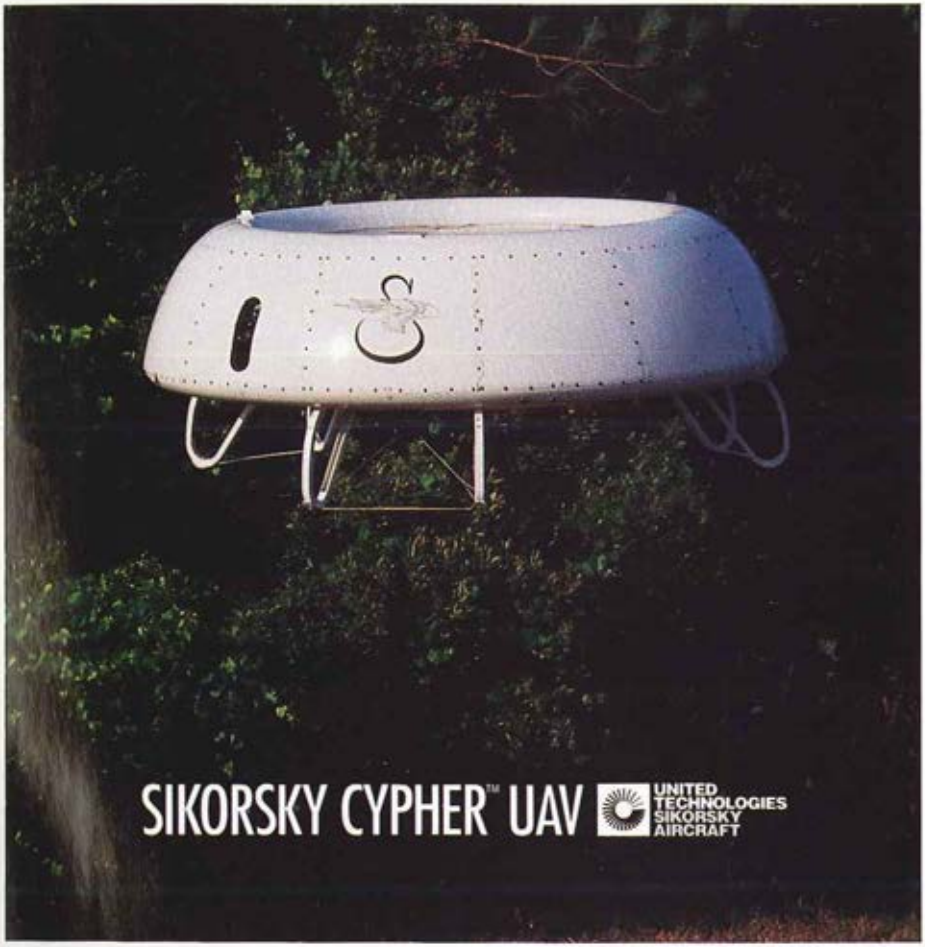

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FORTHCOMING ISSUES

February 1994 — Maintenance and Logistics.

March-April 1994 — Annual Convention Issue.

Briefings

Simula Inc.'s Advanced Composites Division has announced the signing of a new contract with the U.S. Army Applied Technology Directorate to develop a full scale model of the company's crash worthy thermoplastic subfloor structure for helicopter applications, valued at approximately $500,000. Simula will conduct all the testing of the subfloor structure components and will receive support in the analysis of the test data from Bell Helicopter Textron and Grumman Aircraft.

Mr. David V. Gaggin, Director of CECOM's **Command, Control, and Systems Integration Directorate (C2SID)**, has left the Army to take the position of President, **Chelton Systems**, a subsidiary of Chelton Limited and the FR Group. Mr. Gaggin was the Director of AVRADA from 1985 to 1992 and before that held numerous avionics engineering and management positions with Boeing Helicopters from 1968 to 1985. **Mr. Bruce Miller** is the new C2SID Director. He was previously Director of Advanced Systems Directorate, CECOM RDEC, Ft. Monmouth, NJ.

One soldier and two civilians have been credited for saving taxpayers about $13.8M by extinguishing a generator fire in an AH-64 Apache at Hanchey Army Airfield, Ft. Rucker, AL. **SGT Michael L. Taylor, Clarence G. Washington,** and **John W. Alford** suppressed an electrical fire which could have resulted in catastrophe at the Hanchey flight line. MG John D. Robinson, CG, USAAVNC and Ft. Rucker, and Aviation Branch Chief, presented the Meritorious Service Medal to SGT Taylor, and the Commander's Award for Public Service to Washington and Alford, both employees with DynCorp.

The **1994 Army Aviation Electronics Symposium**, sponsored by the AAAA's Monmouth Chapter, will be held 15-18 August 1994. This biennial event will be conducted at Gibbs Hall, Ft. Monmouth, NJ, in conjunction with the Chapter's Annual Sports Day. The theme for the symposium will be "Digitizing Tomorrow's Battlefield", and papers are expected on all the major thrusts in the C⁴I arena that have developed under the new emphasis placed on digitization by the Department of the Army and the Office of the Secretary of Defense. For more information, contact COL Theodore T. Sendak, Ret., at (908) 544-8220.

Transmission and sharing of digital targeting data has been achieved by an airborne AH-64D Longbow Apache, being developed for production by **McDonnell Douglas Helicopter Systems**. The Longbow transmitted to a mobile ground station using an Improved Data Modem (IDM), an integral part of the aircraft's avionics suite.

VOLUME 43 ARMY AVIATION NUMBER 1

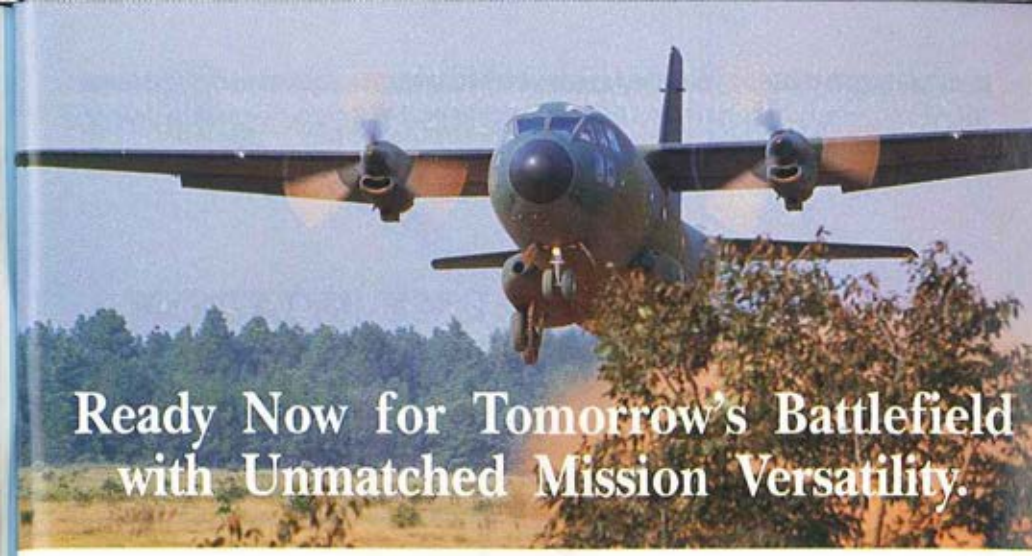
FEATURE ARTICLES

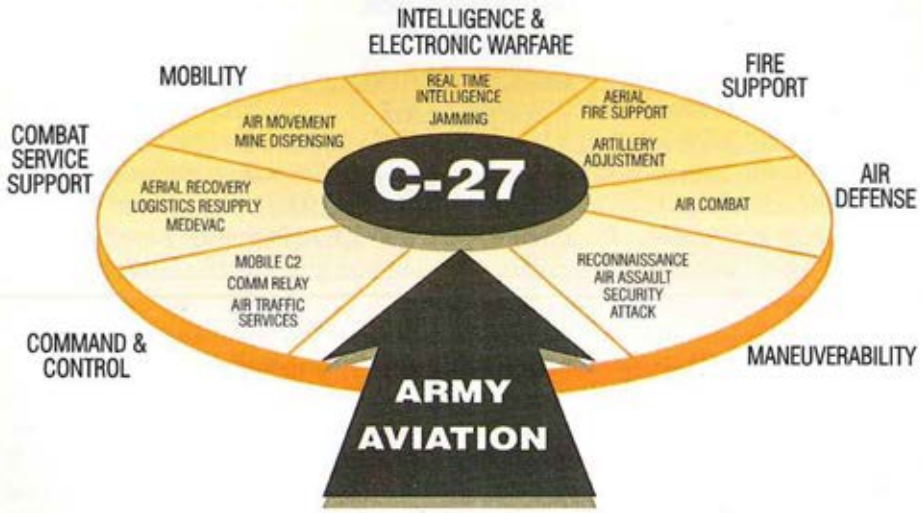
SPECIAL FOCUS: C4I AND EW

DEPARTMENTS

FRONT COVER

Paid advertisement: Sikorsky Aircraft. *The Sikorsky CYPHER™ Unmanned Aerial Vehicle (UAV) is being developed to meet U.S. military needs for ground and naval surveillance, communications relay, and countermeasures missions. The vertical takeoff or landing air vehicle, with a three hour endurance, will transmit data to control stations on land, aboard ship, or in the air.*





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THE FUTURE OF ARMY AVIATION IN EUROPE

Regional contingencies, ARI, multinational corps, and simulations in USAREUR.

The Cold War is over, the Soviet Empire has crumbled, the Army is downsizing, and dollars for defense are becoming scarce. These phrases have become truisms; their acceptance, however, doesn't mean that our challenges have ended. America's Army — particularly our Army in Europe — is very much "still in the business", but the nature of the business has fundamentally changed.

The absence of the Soviet threat has not resulted in European tranquility, but widespread instability. There is a strong correlation between the post-World War I borders of Europe and the lines of struggle being waged on the Eurasian landmass today. The existence of a bipolar superpower structure served as an appetite suppressant to the often conflicting aspirations of the various ethnic, religious, and nationalist groups. Factional conflict was essentially "put on hold" during most of the cold war. With that stable structure now gone, many groups have found an increased freedom of maneuver to pursue their ambitions.

One result of this phenomenon has been increased conflict. In fact, ethnic and cultural conflict, resurgent nationalism, and attendant humanitarian problems are rapidly becoming the dominant themes of 21st Century European security. Actual or threatened use of arms has again become a diplomatic measure of choice among many nations in our region.

The U.S. Army, Europe, has changed to meet the new environment. We are not positioned at the Fulda Gap,

USAREUR'S POST-DESERT STORM DEPLOYMENTS: HIGHLIGHTS

Figure 1

looking East to meet a multi echeloned armored threat — and haven't been for four years. USAREUR remains a key player in NATO, still contributing to security and stability, but in a far different manner than in the Cold War days. USAREUR is an essential element of the force projection Army. A widened focus; deployment out of the central European region; new missions; structural changes that include participation in multinational formations; and training innovations have all contributed to a new USAREUR, one in which Army Aviation plays a key role.

USAREUR's focus has dramatically changed — from a forward-deployed force that would fight from established battle positions in the central German plains to a forward-stationed force that can be called upon to deploy on a no-notice basis anywhere in a 100 country area on three continents. Recent deployments highlight that change in focus. Over the past three years since Operations DESERT SHIELD and DESERT STORM, 20,000 USAREUR soldiers have conducted 40 deployments to 27 different countries in Asia, Africa, and Europe, in both the CENTCOM and EUCOM Areas of Responsibility. Highlighted in Figure 1, above, those deployments were operational missions, not training exercises. By comparison, in the 44 year period between 1946-1989, roughly 12,000 USAR-

EUR soldiers deployed on 29 operations. Today, nearly 500 USAREUR soldiers are deployed in eight countries where we don't usually station forces. In the past three years, we have nearly doubled the pace of deployments of the entire Cold War era.

Not only the number of deployments, but the type of missions USAREUR soldiers and units are performing have changed. The bulk of the 40 deployments since DESERT STORM have been nation assistance, humanitarian assistance, and peacekeeping operations. Forward-stationed aviation assets have been essential to many of those missions, particularly because of their ability to self-deploy rapidly to potential crisis areas.

For example, during Operation PROVIDE COMFORT I in northern Iraq and Turkey, Company E, 502d Aviation Regiment deployed from Aviano Air Base in Italy to Incirlik, Turkey, 1,800 miles away. The first four CH-47Ds arrived 96 hours after initial mission notification. Even before the unit closed, it began to conduct missions in support of the Combined Task Force, resupplying the maneuver units providing security for the relief operation as well as delivering aid to the Kurdish refugees. By the end of the operation, the unit performed over 2,200 flight hours, transported more than three million pounds of cargo, and carried more than 6,000 passengers. By self-deploying, E/502d's nine CH-47Ds were able to respond quickly to conduct those missions. A similar deployment from CONUS would have required strategic lift assets to get to the Area Of Responsibility (AOR). Once there, those nine aircraft would then have required reassembly. A minimum of 32 hours per aircraft, with a four-man crew doing the work, more than a thousand manhours would have been expended before the unit would have been operationally ready.

The 6th Squadron, 6th Cavalry conducted the first AH-64 strategic self-deployment as a maneuver element of Joint Task Force-Bravo (JTF-B) during Operation PROVIDE COMFORT. Over a four day period, 18 Apaches and two Black Hawks transited six countries and covered 3,000 miles. Illustrated in Figure 2, the self-deployment from Illesheim to Incirlik demonstrated the utility of forward presence aviation elements in a force projection Army response to regional crises.

Also as part of Operation PROVIDE COMFORT, six UH-60s from the 159th MEDEVAC Company deployed to Incirlik and performed casualty evacuation operations of coalition troops and refugees. Thirty UH-60s from 11th Aviation Brigade units also deployed. In all, more than 70 aircraft from USAREUR deployed as part of Operation

6-6 CAV DEPLOYMENT TO OPERATION PROVIDE COMFORT

- 3,000 MILES, 6 COUNTRIES
- 4 DAYS TO CLOSE:
  - 18 X AH-64
  - 2 X UH60
- DEMONSTRATED SELF-DEPLOYMENT CAPABILITY OF AH-64

Figure 2

PROVIDE COMFORT. Six UH-60s from the 12th Aviation Brigade (and four MH-60s from the United States European Command) continue to provide support there today.

More recently, as part of Operation RESTORE HOPE in Somalia, the 159th MEDEVAC Company again deployed, with 15 UH-60 air ambulances self-deploying within 72 hours of notification to Livorno, Italy for loading onto ships. D Company, 502d Aviation also self-deployed to Livorno, beginning movement within 24 hours of notification. Seventy-two hours after notification, 16 CH-47s were at the port, ready to be loaded. A lift platoon from C Company, 7-158 Aviation Battalion, two platoons from A Company, 7-227 Aviation, an AVIM from 7-159 Aviation, and ATC elements from B Company, 3-58th Aviation also contributed to Task Force (TF) 5-158, deploying by USAF aircraft from Ramstein directly to Mogadishu. In Somalia, TF 5-158 supported the 10th Mountain Division as it provided security for relief operations. Today, USAREUR still has one C-12 and its crew in Somalia.

The point: forward-stationed aviation units have demonstrated a unique capability to respond quickly to regional contingencies.

While the types of missions being performed have changed, readiness requirements have not. Deployment timelines such as those mentioned for Operations PROVIDE COM-

FORT and RESTORE HOPE are not uncommon in today's USAREUR. Army Aviation in Europe must be more versatile, deployable, and at a higher state of readiness than ever before.

Concurrent with the increased intensity of operational deployments, USAREUR continues to reshape its force for the future. The drawdown in now roughly three-fourths complete. There is a significant change in the aviation community as USAREUR goes from 15 attack helicopters battalions in 1989, the start of the drawdown, to four in FY96, the projected end of the transition.

The real issue, though, is much greater than just "drawdown". The residual force is not simply a smaller version of the old Cold War USAREUR; it is a much different force, modernized for the future, built for a new set of missions.

For example, USAREUR will be the first MACOM to implement the Aviation Restructure Initiative (ARI). Through the ARI, at the same time we conduct the drawdown, we will improve the force, fixing Army of Excellence aviation personnel shortfalls — particularly in maintenance and headquarters robustness for 24 hour operations — while modernizing the fleet. Under this plan, all corps and divisional UH-60s will be consolidated in the General Support Aviation Battalions and all UH-1s in the corps will be replaced by UH-60s. The two Assault Companies assigned to the corps Command Aviation Battalion for command and control enable USAREUR to commit two 15 aircraft companies to out-of-sector missions without degrading the residual maintenance and logistic capabilities of the corps or the divisional units.

There will be a single AC Attack Regiment consisting of two attack battalions in the Corps Aviation Brigade. The division's aviation brigade will be resourced for one attack battalion. Those units will be organized into pure-fleeted AH-64 companies. Within each company, three AH-64s will perform scout roles, while the remaining five AH-64s will continue to perform the attack role. A total of 36 AH-64s in USAREUR will transition to perform scout missions.

As a result of the ARI and drawdown, USAREUR will zero out its fleet of AH-1s and reduce the theater's fleet of UH-1s from 78 to 24 by the end of FY 96. During the same period, USAREUR will add to its fleet of 32 armed OH-58D Kiowa Warriors, subject to funding constraints.

Several challenges have already emerged as we begin to implement ARI in Europe. These challenges range from doctrinal and force design issues to leader development

and training. ARI will change the way we do business. Removing the utility aircraft from the attack battalions and AVIM units and consolidating them in the General Support Aviation Battalion and corps Command Aviation Battalion will heighten the requirement for exceptional planning and supervision by brigade staffs. Otherwise, we could generate a condition in which those units compete with the General Support Aviation Battalion's operational missions for utility aircraft to support contact maintenance and recovery missions.

Additionally, some units in the endstate USAREUR will be separated by a significant distance from their AVIM and utility helicopter support. Further, we must work through the issue of modularity, in both tools and skills, in the GS Battalion, in order to be able to task organize forces for deployment in the increasing probability the entire brigade is not deployed.

As aviators transition from one aircraft to another or, as in the case of future AH-64 scout pilots, from one mission to another, maintaining currency will be a significant challenge. During the transition to ARI, a small number of aircraft will be required to fly a greater number of hours, increasing the maintenance challenge.

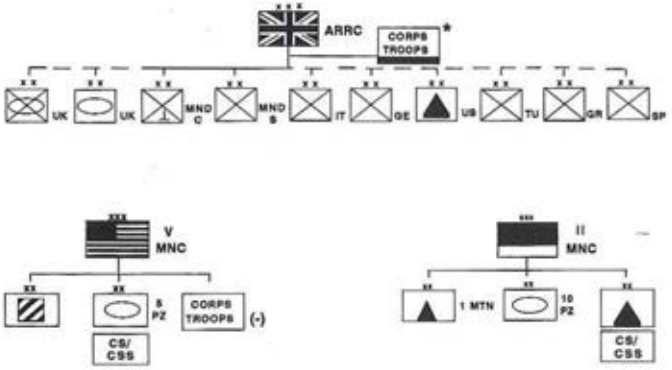
The first real test of ARI's Attack Helicopter Battalion force structure will occur during the 11th Aviation Brigade's External Evaluation (EXEVAL) in late 1994. We must be prepared to analyze the results of that training event, quickly resolve any readiness shortfalls, and provide feedback for any required adjustments to the structure.

Clearly, the challenges of implementing ARI are significant; but the payoff in terms of increased capability will be even greater.

USAREUR's structural changes extend to the multinational environment. Since October of 1992, three multinational headquarters have been established in which U.S. forces stationed in Europe have a role: the Allied Rapid Reaction Corps (ARRC), the II (GE-U.S.) Korps, and V (U.S.-GE) Corps. Of those, only one — V Corps — is commanded by a U.S. general officer.

The ARRC serves as NATO's corps-sized unit designed for rapid deployment throughout the Allied Command Europe area. Ten division equivalents, located in six different countries, have been identified for commitment to the ARRC. The ARRC may command up to four divisions from this pool of ten division equivalents. The U.S. has identified one division from USAREUR, the 1st Armored Division, for possible employment with the ARRC. In addition to the 1AD with its organic aviation assets, the U.S. may provide an additional tailored avia-

U.S. INVOLVEMENT IN MULTINATIONAL CORPS



*** MAY INCLUDE US TAILORED AVIATION PACKAGE**

Figure 3

tion package to support the ARRC. There is, therefore, a requirement not only for 1AD's aviation brigade, but also the corps aviation brigade to be prepared to deploy as a tailored package of the ARRC. Contributing to the ARRC's ability to integrate our aviation assets, synchronize the battlefield operating systems, and exploit our aviation doctrine, the ARRC has a U.S. BG as its G2/3 and a U.S. LTC aviation officer on the staff.

II (GE-U.S.) Korps and V (U.S.-GE) Corps contribute to NATO's main defense forces in the central region. While V Corps' multinationality represents little change for the corps and division aviation brigades, that of II Korps poses a challenge similar to the ARRC's; how to ensure optimum utilization of U.S. aviation capabilities by an allied headquarters.

Our structural changes have brought significant training challenges. With the establishment of multinational formations comes the requirement for commonality of tactics, techniques, and procedures, as well as common understanding to doctrine. In exercises from the platoon and company to Echelons Above Corps, we have made tremendous progress. For example, in a recent combined exercise at the company/troop level, the U.S. 3-1 Aviation and the British 6/54 Attack Squadron, stationed in Detmold, Germany, the units' leadership to-

gether compared METLs, determined training objectives, and conducted joint mission planning for a deliberate attack on an enemy position. The planned operation was executed as a combined task force employing six AH-64s, three OH-58s, three Lynx, and three Gazelles. The AAR process was used and resulted in modifications to both units' Total Training Package (TTP). Those kinds of gains are made only as a result of routine, daily interaction.

From 26 August through September 1993, USAREUR's V Corps conducted Exercise STEADFAST II at the Grafenwoehr Training Area, marking the first time German, French, British, and U.S. forces have trained together in a live-fire situation. Combining U.S., German, and French MLRS platoons, British Tornadoes, and U.S. F-16s and AH-64 Apaches, the V Corps commander was able to test his ability to integrate and synchronize the effects of all the players in the Corps deep attack. Using a concept called "sensor-to-shooter", intelligence information on deep targets was passed to an impressive array of delivery means — including long-range fires, rotary and fixed wing aircraft, for engagement. This provided a unique opportunity for allied forces to train together in executing deep operations.

At the staff level, we are making equally significant progress. Multinational corps commanders approve their divisions' METLs, plan and conduct combined training. We are now planning for V (US-GE) Corps' Battle Command Training Program, in which both of the corps' divisions — 3 ID and 5 Panzer Division — will participate. Use of aviation in the Warfighter CPX — in SEAD and deep attack, possibly even in a division's close battle — will drive commonality of procedures. We will work through issues of command and control forward of a foreign division, overcome differences in communications and enable all units in the corps to exploit our aviation capabilities.

Next, in an initiative known as Synthetic Theater of War-Europe (STOW-E), we will be able to link virtual and constructive simulations with live maneuver through the instrumentation system at CMTC during REFORGER 94. From the pilot in the Combat Mission Simulator at Ft. Rucker, AL through the battalion task force at CMTC, the brigade staff in BBS and the higher level headquarters, actions will be linked and all players will see the same battlefield. In the REFORGER exercise, for example, we will be able to synchronize the planning and execution of a mission conducted by an attack helicopter battalion in a joint and combined environment.

USAREUR is also pioneering

training innovations at the individual and crew levels, both to increase proficiency and reduce O&S costs. We are working closely with the Aviation Center to devise a series of gunnery tables designed for the Combat Mission Simulator, in which we can vary the types of engagements, change the threat ADA capabilities, and change the conditions under which the pilot must perform tasks. We want to grade performance automatically and be able to provide a printout After Action Review — all similar to the COFT for Bradley and Abrams — that will assess abilities, identify weaknesses and define minimum proficiency levels, or "gates" that must be met prior to entering the cockpit.

Finally, we are also working with the Aviation Center to develop an objective standardized gunnery training program, to include door gunnery, that is both quantifiable and sufficiently challenging. It will measure total crew performance — again, similar in concept to Abrams or Bradley tables.

We have already made great strides in these areas. We have an interim CMS training matrix and after action templates modeled after Table VIII score sheets; and we know we can automate that capability in the CMS in the short-term future. In crew qualification, we have abandoned cannon suppression standards and have adopted target hit standards for both cannon qualification and door gunnery, with impressive results. One brigade recently achieved a 74% Table VIII cannon qualification rate, bettering the previous record by 20%. The first unit firing our door gunnery program attained a first run qualification rate higher than 90%. In short, USAREUR is training its "Top Guns" to truly be above the best.

In the first decade of Aviation's life as a branch of our Army, never has it faced such great change. Yet from my perspective, the future of Army Aviation — and USAREUR's aviation — is bright! We have new missions, new organizations, and tough, realistic training in the multinational environment of the future. We have leaders and aviators who are technically competent, willing to accept challenges, and willing to chart the course into the 21st Century. Europe, now more than ever before, is a great place for those kinds of professionals. Deploying, maintaining training skills and readiness, reshaping the force, implementing ARI, living and working daily in a multinational environment — these are a few of the challenges we will meet over the next crucial decade. Army Aviation and USAREUR aviation are up to the challenges — together.

★★

GEN Maddox is the Commander-in-Chief, U.S. Army Europe, and Commanding General, Seventh U.S. Army.

C4I: BREAKING THE OLD PARADIGMS

The Branch Chief reviews the tactical advantages provided by the impact of the information age.

What is next? Americans in service uniforms and of all ranks are thinking and asking the question. We have shifted our military focus and our structure to accommodate the shifting world order. But when will the changes stop or subside? They won't. To underscore the significance, the Army Chief of Staff said that our evolution in the Army is a journey and not a destination. We should not expect (nor desire) a waning in the evolution of our military forces. The real question of "What is next?" is rooted in the larger scope of the evolution of civilization and warfare.

Futurists Alvin and Heidi Toffler have analyzed civilization and warfare evolution and have postulated that we are on the brink of a new stage in history: the Age of Information and Technology Insertion. This era of technology and information will be marked with the ability to instantaneously transmit mass quantities of information ... at anytime, anywhere in the world.

We will soon experience a level of interactivity not seen since the invention of the telephone. Multimedia communication — image, sound, and text combined — can happen in the blink of an eye. Many organizations are beginning to harness this technology today.

In the past, organizations have failed to capitalize on innovative technologies. Failure to seize the initiative and break old paradigms was precisely illustrated in Switzerland not too many years ago. The Swiss master watchmakers scoffed at new technologies in favor of their 17-jewel

craftsmanship. They passed on the opportunity to develop Quartz technology. The Quartz watch is the most accurate watch available today. It also weighs less, costs less to produce, and is more durable. The Swiss were afraid to break the old paradigms and invest in new technology. They were too concerned with the continued refinement of main springs and gears instead of stepping back and looking at innovative technologies to redesign their masterpiece. Quartz watches, of course, are today's standard.

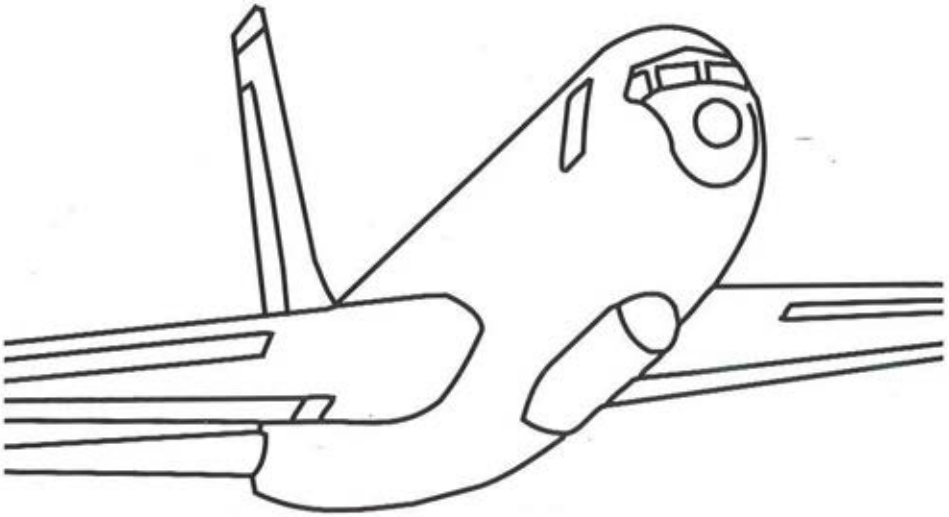
We are approaching a similar crossroad in our military today. What was acceptable yesterday is not necessarily acceptable or best today. The paradigms — the examples of what worked yesterday — may be obsolete in the technically sophisticated world of today. In the third wave of the evolution of civilization and warfare, the Army must ride the wave of information technology, or else it will wallow in the shallows with the other organizations apprehensive about breaking their comfortable paradigms.

The Army is moving to break the paradigms in Command, Control, Communication, Computers, and Intelligence (C^4I). Computers play such an integral part of command and control, communications and intelligence, that many have dropped the "computers", leaving the traditional C^3I. It is generally accepted that computers have permeated throughout the other components of C^3I. Evidence of the Army's automation efforts is apparent in the Army Tactical Command and Control System (ATCCS).

"Command" is an art learned by the commander, and "control" is the staff use of systems to execute the commander's intent. In the C^2 area of ATCCS, the Army's efforts to support the commander with better C^2 capability lies in the Maneuver Control System (MCS). The MCS is the focal automation system for the commander. The system integrates the necessary information from the other battlefield functional area automation systems. This system will network all the C^3I devices in the Tactical Operations Center (TOC).

The aviation equipment requirement designed to improve aviation C^2 capabilities is the Aviation Mission Planning System (AMPS). The AMPS is a computer that will significantly increase the aviation unit's ability to quickly and accurately plan aviation missions. In a similar manner as other computers, the AMPS will receive and efficiently process inputs and provide outputs. Inputs include weather data from the Integrated Meteorological System (IMETS), friendly and enemy locations (MCS interface), aircraft type, Signal Operating Instructions (SOI) data, map data, and Air Tasking Order (ATO) data. Out-

Joint STARS...



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puts from the AMPS include flight plans, communications cards, terrain-based threat ranges, strip maps (including GPS waypoints), performance planning cards, weight and balance, and a data cartridge. We are rapidly pulling away from the days of writing with grease pencils on acetate under the dim glow of a red lens flashlight.

In the communications area, the Army is integrating digital links to expand its use of the electromagnetic spectrum. ATCCS will be built around three communications conduits: single channel radios such as SINCGARS, data devices such as the Enhanced Position Locating Reporting System (EPLRS), and a highly mobile phone system called Mobile Subscriber Equipment (MSE). The frequency hopping SINCGARS is our radio common link to the combined arms team (digital and analogue). The air defense plans to use EPLRS to pass a near real time air picture and assist in combat identification. The MSE provides that mobile and static phone service down to battalion level, both digital and voice.

For years, Army Aviation missions have been limited by long range communication shortfalls. The aviation requirements for better communications are HAVE QUICK II, high frequency Nap-of-the-Earth Communications (NOE COMM), and the Improved Data Modem (IDM).

The HAVE QUICK II UHF radio will facilitate joint services communication. It frequency hops to reduce its susceptibility to jamming and interference. This radio will be used extensively for digital target handover between Air Force CAS, Kiowa Warrior, Longbow, and Comanche. It is also the link to off-board sensor information such as J-STARS. Conversely, aviation assets may return information, filling voids these sensors cannot always detect.

The HF NOE COMM radio will permit uninterrupted NOE communications. With built-in Automatic Link Establishment, HF radios will be used for long distance paths, such as from the Aviation TOC to the aircraft operating in the most forward areas. This radio will have a built in modem for digital communications, which will adjust its speed to accommodate interference and path loss. Reliability of digital communications with this radio will be 90% which represents a quantum improvement over the intermittent HF radios of the past.

The IDM is a joint services modem, processor, and message set device for the interchange of target and situation report information. This modem can be linked to any combination of four line-of-sight radios simultaneously. It is the standard modem which Army Aviation

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At pilot option, a specific inbound or outbound course from any waypoint may be entered. The appropriate course deviation is then displayed on a pilot selectable Track Angle Error graphic providing a visual representation of desired course intercept.

It includes both standard C/A code positioning and P/Y code through incorporation of the PPS-SM, when valid Keys loaded and Y code satellites operational.

The Navigator provides selectable MGRS, Lat/Lon, UTM and UPS coordinate systems with 123 worldwide Datums; user units (nautical miles, kilometers, statute miles, etc.); a quick access search of the 20 nearest airports, VORs, NDBs, intersections, and user waypoints; it can automatically sequence through 20 flight plans with up to 20 waypoints each; plan vertical descents or climbs; display minimum safe altitudes; calculate winds aloft; and provide E-6B calculation functions.

Coupled with an optional Air Data Computer, the TNL 2100SM Navigator can display true air speed, density altitude, pressure altitude, and winds aloft.

The Navigator incorporates a Jeppesen NavData* card—a complete database of worldwide aeronautical information including military and public use airports, VORs, intersections, NDBs, airspace boundaries, MEAs, and more.

The TNL 2100SM comes complete with a Night Vision Goggle (NVG) compatible display. It is in operational use now by U.S. and allied military forces worldwide.

*NavData Card is a trademark of Jeppesen, Inc.

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will use to receive, store, and transmit field artillery calls for fire, aviation C^2 reports, Air Force CAS, and internal target exchange.

In the information war, aviation contributions to battlefield intelligence will exponentially increase. Our targeting (enhanced by the accuracy of GPS) and survivability systems will significantly assist in illuminating the entire battlefield. Detection systems such as J-STARS will detect moving targets throughout the battlefield; however, terrain may partially shield enemy movement. J-STARS cannot see on the opposite side of a mountain. The combined arms team will realize the contribution of Army Aviation at this point. The Apache will supplement the other intelligence systems in illuminating the area of operations. Additionally, unmanned aerial systems will assist in expanding the three dimensional battlespace by conducting intelligence and electronic warfare. U.S. forces will know where the enemy is ... and where he is not. We will have unprecedented situational awareness.

The Longbow Apache (LBA) will be configured with complementary systems that will detect and target threats. The LBA will have the millimeter wave radar that will detect, classify, and prioritize threats. Those target files will then be available through digital message to our combined arms and joint partners. Additionally, the aircraft will be equipped with a programmable Aircraft Survivability Equipment (ASE) Suite. The equipment will detect radio frequency, Infrared, and Electro-optical emissions. The ASE suites will cue the aircraft's targeting systems for engagement. Our aircraft equipped with their sophisticated array of sensors and detectors will fill the gap in near real time intelligence for the combined arms team.

The era of technology and information is upon us. Our Army is taking bold steps to harness the latest technologies in order to provide its soldiers with unprecedented situational awareness. We are pursuing the ability to thoroughly plan missions in a fraction of the time it takes today. We will know the location of all friendly assets and have a level of interactivity not experienced on any battlefield today. The innovations in C^4I will keep Army Aviation on the crest of the information wave and ultimately give commanders decision information that allows them to act faster than the enemy can respond. This tactical advantage will institutionalize information as the battlefield resource of the next generation of aviation warriors who maneuver in the third dimension of the ground regime.

★★

MG Robinson is Chief, Aviation Branch and Commanding General, U.S. Army Aviation Center (USAAVNC) and Ft. Rucker, AL and Commandant, U.S. Army Aviation Logistics School.

BY LTG PETER A. KIND with
MAJ(P) MARK S. BOWMAN

COMMUNICATIONS SUPPORT IN THE NEW WORLD DISORDER

In the October issue of ARMY AVIATION Magazine, MG Robinson covered the communications systems that will be used to support Aviation in an article entitled: "Digitization of the Battlefield: Aviation Applications". The following article completes the picture by covering the future direction of communications support on the battlefields of tomorrow.

Greater efficiency and C² on the move are requirements for future success.

With victory declared over the cold war, some refer to a new world order. What order? It's a new world disorder with fundamental questions like: Who are our enemies and how do we identify them early? Answers unknown ... it's a totally contingency-based world. No one knows where the next war will take place, but one thing for sure — it will be a "come as you are" war. Couple that with the fact that as each day passes, we have a smaller number of service members and greater competition for limited amounts of money, training facilities, and forward deployed bases. In addition, we must capitalize on the lessons learned from Operation DESERT STORM.

Under these constraints, there is only one option. Do it smarter and with the flexibility to make sure that we can respond to everything from DESERT STORM operations to disaster response operations like Hurricane Andrew. Smarter means getting the maximum efficiency out of our resources and flexibility means the capability of C^2 on the move.

Our strategy and doctrine have

changed. Now the strategy is based upon world-wide power projection of a CONUS-based force that can respond to all ends of the threat spectrum from fighting wars to humanitarian assistance. Our doctrine is to employ our smaller more lethal force over greater distances more rapidly and with greater agility than ever before.

Because of the monumental changes that have taken place throughout the world over the past five years, a great deal of effort has been devoted to analyzing the way that the Army will modernize and accomplish its mission. Resulting from this analysis, five pillars for modernization were established by the Chief of Staff of the Army: project and sustain the force, protect the force, win the information war, use precision strikes, and dominate maneuver. This is a major change from five years ago. Who would have included "win the information war" in such an important list then?

The power projection strategy and associated doctrine has significant implications on C4I. Connectivity requirements are clearly global with an increased role for CONUS, greater communications range, greater reliance on automation, command and control capabilities on the move, a seamless architecture, and total situational awareness. Each of these is important and warrants discussion.

Global connectivity means two way communications from the theater tactical level to the sustaining base (CONUS). It includes reserve, active, joint, allied, and commercial connectivity and applies to command and control as well as automation.

Global connectivity is no small task considering the different families and generations of equipment. These differences are found between allies, between components, between services, on installations or power projection platforms, and even within units. So as part of the Army's goals and objectives, we are upgrading both the communications equipment in individual units and at installations to meet the power projection requirements. The upgrades, which include voice and data switching, cable systems, and enhancing interface capabilities, are part of a planned migration to commercial standards and technology.

To get the true global connectivity, satellites provide part of the solution. They afford us the opportunity to use split based operations allowing the deployed users to input data and make queries, while the processing is done in CONUS. But the satellites are already a scarce and over-committed asset and we continue to place an even greater demand on these assets.

New government owned satellites are extremely expensive and take

years to deploy. We need increased satellite efficiency now, from the satellites currently in service. This challenge leads to more challenges such as avoiding information overload — sending so much data that we clog the transmission pipes, ensuring cryptographic compatibility, message storage and retrieval techniques and solving the multilevel security problem.

We are meeting these challenges with technological solutions. Examples are: improved antenna design, the use of the Extremely High Frequency (EHF) spectrum, and the use of data compression techniques that will allow us to transmit more data over existing links. We are also transitioning to Demand Assigned Multiple Access (DAMA) on our satellite networks. DAMA means that we can support multiple nets on the same channel instead of having just one net per channel. The benefits of DAMA can account for a 20 fold increase in usage.

Expanded use of commercial satellites is also planned. This is not a new concept. We have done it for years with the Leased Satellite (LEASAT) Program. But in the Post Cold War era, with a changed threat, current fiscal constraints, and increased information needs of the warfighter, this concept has renewed appeal and OSD policy support. Applications include general purpose communications support to strategic users as well as the warfighters, meeting day-to-day and contingency surge capability requirements.

"We need increased satellite efficiency now, from the satellites currently in service. This challenge leads to challenges such as avoiding information overload ..."

Satellites will be integrated onto the area communications networks from Echelons Above Corps (EAC) through divisional units. This translates to range extension. Using this capability, we can make a call from any power projection platform, route it over satellite to the deployed area of operations, interface it with the tactical area communications network and terminate it at a tactical user's phone, radio, or computer terminal. Further, our satellite assets allow us to make hundreds of calls simultaneously that ride the same satellite communications link.

Our area communications capabilities (Tri-Service Tactical Communications (TRI-TAC) with Digital Group Multiplex (DGM) transmission equipment for EAC and Mobile

Subscriber Equipment (MSE) for Echelons, Corps, and Below (ECB)) were proven in DESERT STORM. There are challenges here too, but they are not surprises. In order to get these systems to the field as early as possible, we knowingly accepted them with things that we know would have to be fixed ("warts") following deployment.

We are fixing the MSE "warts" today and we have planned enhancements such as an Integrated System Control (ISYSCON) and packet switching technology. These enhancements will allow us to make more efficient use of our switching assets and interface the Defense Data Network (DDN) into our tactical networks. We are also positioning ourselves to exploit the numerous technological advantages of commercial switching for both strategic and tactical use. By using commercial standards and equipments, we will be capable of rapidly integrating new technologies as they are developed.

Support to many users as described translates not only to efficiency, but also to vulnerability. Satellites links can be jammed. To combat this vulnerability, we are taking steps to improve our anti-jam capability. Today we have anti-jam capabilities, but when we employ them, we are constrained by technology to limit the number of users and the data rates at which we can communicate. We have ongoing programs that will allow us to increase our data rates from the current low rates to medium and eventually high data rates.

Even with an anti-jam capability, our communications systems networked with our area communications networks give only part of the answer. Although we can talk to our forces anywhere in the world, when our forces deploy, much of our communications capability is packed up and shipped with or following them. So how do we continue communicating while enroute to the area of operations? The requirement is for continuous communications with our forces as they deploy. We need C^2 on the move.

Today, more than ever, the warfighter needs continuous C^2 system support enroute to the area of operation and upon entry. To provide this support, C^2 vehicles must keep pace with the maneuver forces both physically and electronically. The Combined Arms Center (CAC), Ft. Leavenworth, KS, conducted a study on this and concluded that to effectively support the warfighter, there are three vehicles required; the Airborne Command and Control Vehicle (ABC^2), Command and Control Vehicle (C^2V), and the commanders vehicle. But there are some issues here too.

We need to be more efficient in our C^2 Vehicle requirements and we plan to do that by combining func-

tions. The vehicles must have the range capabilities to reach net members, provide a "common picture" of the battlefield, and contain facilities to support a "small battle staff". We need to provide fused, real time data, and have it available when the CINC or Joint Task Force warrior needs it.

We need to give the warrior a total situational awareness that is available on demand. The warrior needs the capability to pull information that he needs, and should not have information constantly pushed to him. Then when the warrior gets the information, he has got to be able to move it down to and between his components.

"We need to give the warrior a total situational awareness that is available on demand. The warrior needs the capability to pull information that he needs..."

The C^2 Vehicle communications system requirements are for Tactical Satellite (TACSAT), Single Channel Ground to Airborne Radio System (SINCGARS), High Frequency (HF), Army Tactical Command and Control System (ATCCS) compatibility, wireless Command Post (CP) connectivity, and facsimile. These are not new requirements, but we need to add to them. There are a number of issues being worked with these requirements. They are bandwidth and frequency availability, cosite interference, antenna limitations, and reliability. Objectively, we want to pursue a single multiple frequency and multiple mode radio to replace all those currently found in C^2 vehicles.

Other issues that we are working on are in the area of combat identification and fratricide reduction. To accomplish this, there are several ongoing actions. Future buys of SINCGARS will have Global Positioning System (GPS) capabilities. We bought 1800 Enhanced Position Locating and Report System (EPLRS) for high rate data distribution. We also bought 500 Single channel tactical satellite terminals for Corps and Division Commanders nets. There are also R&D efforts ongoing to provide a common battlefield picture, automated information exchange using ATCCS, and other enhancements to C^2 systems such as voice initiation and recognition and hands-off operation.

Automation has become a critical part of all of our C^2 modernization. Today we employ automated network management, switching, transmission equipment, and inter-

faces between different systems. Complementing automation, we are transitioning our networks from an analog/digital mix to strictly digital. This transition is an effort called "Digitizing the Battlefield". Automated digital networks, through the use of universally accepted standards and protocols, will allow us to make the interfaces between systems and networks transparent to the user. Thus, we will have a seamless architecture that is more flexible and reliable, and a key link in our migration to commercial standards and technology.

So as you can see, there is a lot going on, but it is all part of a strategy. The modernization described above is part of the Army's Enterprise Strategy, a strategy by which we will exploit technology, both current and future, to advance the total Army C^4I capabilities. The Enterprise Strategy ensures that the Army has the ability to effectively command and control its forces in the Post Cold War era. Its increased communications efficiency and C^2 on the move provide the warrior what is needed to win the information war and if called upon, to dominate land warfare.

★★

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BY ROBERT F. GIORDANO

COMMUNICATION-ELECTRONICS: AT THE CORE OF ARMY OPERATIONS

The CECOM RDEC support for the user community.

Anyone who has used a cordless telephone, "nuked" his coffee in a microwave oven, enjoyed music on a CD player, seen a movie on a VCR, or even driven an automobile built since the mid-80s has exploited the explosion in electronics development. Electronic microprocessors are everywhere, and capabilities leapfrog from one generation to another, seemingly at the microsecond rate that these devices perform their functions.

Capitalizing on this rapid evolution, the Army's strategy not only embraces the capabilities of current commercial technology, but tracks the focus of commercial development, seeking to minimize development time for future fieldings, while reducing the cost of military acquisition.

Electronics systems are the neural networks on the Army Battlefield, providing the critical command, control, and communications capabilities, the diversity of sensors for intelligence gathering, analysis and targeting functions, and the multiplicity of electronic warfare subtleties essential to the modern fighting Army on the move.

Electronics are now embedded in every strategy, every maneuver, and every tactical intelligence system and becoming, more and more, an imperative precursor to commanders' decisions and the battlefield dynamics relating to fielding forces and weaponry. This requires that the Army's electronics be sustained at the most advanced edges of technology to exploit new potentials and capitalize on the technical opportunities in planning the next generation systems.

The U.S. Army Communications-Electronics Command (CECOM) Research, Development, and Engineering Center (RDEC), located at Ft. Monmouth, NJ, provides the Army with this depth of electronics know-how applied to evolution of new and innovative systems to maintain the Army's fighting capabilities at the world-class level.

CECOM RDEC is the Army Materiel Command's (AMC) Center for Research, Development, and Engineering in Command and Control, Communications, Computers, and Intelligence (C^4I); Electronic Warfare; Night Vision and Electro-Optics; and Avionics. Our multi-faceted mission focuses on providing support to the Program Executive Officers and Project Managers; developing and acquiring superior technologies; developing, acquiring, testing and evaluating non-major systems; and sustaining and enhancing systems and equipment.

The RDEC is organized into five Research and Development Directorates, partitioning the complex of technologies, professional expertise and applications into the following logical, synergistic groups:

Intelligence and Electronic Warfare Directorate — Signals Warfare, Fixed Wing Signal Intelligence, Tactical Systems, Communication Countermeasures, Intelligence Data Fusion, Meteorological Systems.

Night Vision and Electronic Sensors Directorate — Radar, Combat Identification, Image Intensification and Infrared Devices, Aided Target Recognition, Lasers and Applications, and Electronic Survivability Equipment.

Command, Control, and System Integration Directorate (C^2SID) — C^2 System Concepts and Development, Airborne Engineering, Integrated Technology Platforms and Prototyping, Decision Aids.

Space and Terrestrial Communications Directorate — Strategic and Tactical Satellite Communication Terminals and Control Systems, Combat Net Radios, Aviation Communications, Information Security.

Software Engineering — Software Technology, Intraoperability Assessment, and Software Support to the Army in the field.

This RDEC structure fosters exploitation of ground, airborne, and space-based electronics in the collective thrust for battlefield advantage. It is essential to understand, however, that though these activities are focused in their specialty spheres, there are dominating themes that govern their directions and collective efforts. These themes reflect RDEC's vision of the Army in the next decade ... its professional perspective on the Army of tomorrow from the viewpoint of

functional field strategies, technical opportunities, integrated system operations, and greater coherence and real-time operating efficiencies via the digital technologies. This vision sees a Digitized Battlefield embracing an integrated "System-of-Systems" architecture which links the multiplicity of independent battlefield electronic systems with compatible interfaces and common protocols to permit full horizontal and vertical highways for information exchange.

This digitized/integrated battlefield effort is coordinated and synchronized by an RDEC Special Projects Office working with Program Executive Officers, Program Managers, the TRADOC Battle Labs and Schools, and the RDEC Directorates; a Digitized Brigade is targeted for FY96 and a Digitized Division for FY98.

First concentration is on converting existing and emerging new equipment (typically designed for one force element and one purpose) to work compatibly and flexibly across the board with other systems — a major interface challenge demanding establishment of an acceptable set of common protocols and common message sets for the envisaged System-of-Systems.

Concurrently, the process of converting the mix of analog/digitized systems into the all-digitized architecture and the follow-up test bed evaluations are formidable tasks

that will also require close user-developer coordination to resolve all technical and operational issues. Studies have confirmed that the technologies and the capabilities are available to do the job in the structured, coordinated program now in force.

The ultimate goal of the digitization and integration concept is to provide the highest quality support to the U.S. Army forces which would provide the ultimate capability to:

- Own the Night
- Own the Spectrum
- and Know the Enemy in a near-real-time environment featuring Global, Seamless Communications supported and sustained by intensive Software Development as a force multiplier.

Inherent in this vision is the rapid and automatic access of both the tactical and strategic commanders of the battleforce to a common pool of data that will provide a common picture of the battlefield tailored to their needs. This data includes the many decision aids used at multiple echelons throughout the fighting zone — fire planning modules, terrain evaluation modules, intelligence modules, weather modules, etc. Aside from the military merits to the user of finger-tip access to such decision aids are the reduced costs of operations inherent in the automated, integrated system procedure, commonality and consistency in execution, ease of training (information flow is transparent to the user), and other relevant aspects.

These great advanced forecasts for military electronics, exemplified by both Operation DESERT STORM and CNN's tracking of it, offer both an opportunity and a challenge to the Army and particularly to CECOM. It will be feasible to harness much commercial development energy for military applications to enable the vision to throw off the "business as usual" paradigms which have slowed development and fielding of technology in the past. The CECOM RDEC is eager to confront the challenge and "reinvent Government" with the user community to accomplish this task.

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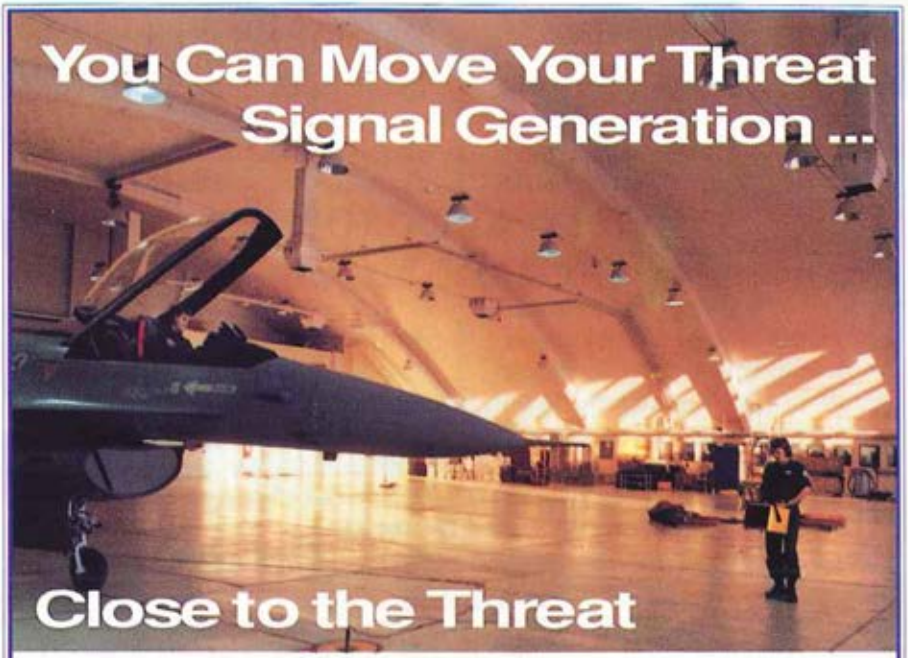

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BY JOHN T. RESPASS and
COL THEODORE T. SENDAK, RET.

ARMY AVIATION C^2 ON THE MOVE

How Army Aviation proves to be a tremendous combat multiplier on the digitized battlefield.

The commander's attempts to consistently control the chaos of battle better than his opponents in order to achieve victory have been and are today unanswered challenges. The Roman legions used "standards" to mark the location of the commander, who personally led his forces. They used runners and signals to pass messages, orders, and intelligence throughout the command.

That relatively inefficient mode of operation did not change significantly up through the American Civil War. Armies still blundered into enemy forces, orders were still misinterpreted by the receiver, reconnaissance reports never made it to headquarters or, if they did, the reports were not disseminated in time to affect the outcome of the battle, unit cohesion was lost in the fog of war, and support was not provided at the critical time and place to assure success.

The industrial revolution brought new technologies to the problems of command and control with the balloon, telegraph, telephone and the handling of information in seconds that once could take days to transmit and receive. But even with all of this, a review of recent training and combat after action reports will not lead anyone to believe that technology has solved the multifaceted problems of command and control ... especially "on the move"!

Commanding armed forces is normally accomplished by providing a concept, guidance, resource alloca-

tion, and leader presence. Control, on the other hand, is typically a staff function done by generating plans that follow the commanders' concept, providing resource allocations defined in those plans, and ensuring continuous situational updates to the commander based on reliable and adequate resources and communications links.

Successful command and control on the battlefield is, thus, a prisoner to a unit's ability to communicate (which has to include situational awareness, navigation, target identification and handoff, and combat identification, as subsets). Standard operating procedures and individual initiative (within the commander's intent) are still very important, but the matrix of combat and combat service support assets available to the modern warfighter makes near instantaneous communications and very accurate navigation mandatory. In battle, as in all attempts to control chaos, communications are the most relied upon means to manage, given good plans and training are in place.

Today, the factors that affect different techniques of command and control include the intensity of conflict, the pace of the operation, the operational environment, the enemy's ability to disrupt or monitor, and the equipment available to the friendly forces. With this in mind, there are still some command and control basics that have not changed since before Vietnam.

The TOC, considered to be the hub of command and control, has only one thing in common throughout the Army: no two are alike. Each is based on the ingenuity and ability of the commander and operations personnel to work the supply systems and "borrow" equipment. In peace time, an innovative TOC set-up reflects well on the command. But in times of mobilization, most units need their assigned equipment doing the intended jobs. Thus, shortages in communications equipment, misused shelters and vans, excess equipment that cannot necessarily be shipped or properly maintained, non-standard items that cannot be supported, and equipment not designed for the environment in the theater of operations are all problems we have faced in every conflict.

Although the Army today utilizes a good portion of the spectrum with FM, VHF, UHF, and HF radios, voice communication over these radios is slow and inefficient. There are never enough radios or frequencies to cover the needs of the commanders and their staffs. TOCS are located, not by the best tactical position, but by where they can get the best communications with higher, adjacent, and subor-

dinate elements. Even with good communication links, commanders must still pull officers and NCOs from their normal duties to be liaison officers and runners, assuring critical communications are completed. Secure radio equipment is bulky, heavy, unreliable, and in short supply. Many messages that should be transmitted secure are often not sent, not timely, or simply transmitted in the clear during the heat of battle.

Since ranges of radios depend on frequency, terrain, weather, maintenance personnel's ability to tune and adjust, and the users ability to operate the system, it is little wonder that tactical communications are generally poor. So poor in fact that during Operation DESERT STORM, commanders used vehicles and OH-58C aircraft like kernels of corn sprinkled across the desert to provide communications relay and navigational way points. So poor that during exercises like TEAM SPIRIT in Korea, division commanders would put helicopters and communications vehicles dangerously close to front line engagements (had there been a real battle) so that staffs could get the information they needed to resource the front line units, and commanders could respond to and direct subordinate units.

"Secure radio equipment is bulky, heavy, unreliable, and in short supply. Many messages that should be transmitted secure are often not sent ... or transmitted in the clear during ... battle."

Command and control on the move was an innovation of the Vietnam War with the C^2 console in the back of a UH-1 aircraft. This set-up was really for command, since the staff functions were conducted primarily at fixed base TOCs. UH-1 mobile command platforms were adequate for the environment and pace of the war, but when transplanted to Southwest Asia 20 years later, as an upgraded console in the Black Hawk, airborne command platforms were in far too few numbers and were not self sufficient enough to meet the needs of a fast-paced, far reaching operation.

Ground based TOCs will always be part of the C^2 solution, and so they too must be at least as mobile as the ground forces they support. However, ground TOCs for many units are neither mobile enough to keep up with the fighting vehicles in their division nor capable of effective use while moving cross-country, at 20 miles per hour or

more, with bullets flying and soldiers tense.

Navigation for ground vehicles and aircraft is an important subset of command and control. Good navigation capabilities allow for good execution of operations plans and orders. GPS made its debut in DESERT STORM, but it is still available only in small numbers and is not integrated into radios or navigational equipment. Thus, with binoculars in hand, it is the proverbial second lieutenant that moves units around the battlefield, translating eight digit coordinates from questionable sources or his own dead reckoning onto a paper map with 1/8th inch wide grease pencil marks.

Situational awareness, a function of human brains and eyes, sometimes aided, sometimes not, has different implications at different levels of command. At the lower levels, shortfalls in communications, navigational capabilities and situational awareness lead to fratricide in meeting engagements or misdirected fires. At the higher levels, commanders and staffs have incomplete pictures. It is very difficult to reinforce success when what the commander perceives as success is based on poor situational awareness, i.e. bad information.

Finally, interoperability of communications between services and between the Army and our allies is woefully deficient. Everyone uses different parts of the frequency spectrum, different protocols, different secure devices, different standards to develop and build equipment ... the list goes on. The bottom line is communication is difficult inside and almost impossible outside of our Army on the extended battlefield.

Is it any wonder that most primary issues that surface in every after action report from every conflict or exercise deal with shortfalls in commanders' and staffs' abilities to command and control their forces?

The Chief of Staff of the Army has stated his vision of digitizing the battlefield. Since the Army depends heavily on information via voice and paper exchanges, digitization must take place from the National Command Authority to the soldier in the field. Information must also move horizontally across the battlefield to provide the situational awareness required during fast paced and extended range maneuvers.

Army Aviation's contribution to the digitized battlefield is currently focused at the platform level with the Kiowa Warrior, Apache, and Special Operations helicopters with the MIL-STD-1553B data transfer between black boxes. Since the Army developed the OH-58D with the digital exchange between the aircraft and fire support in mind, the Airborne Target Handover System (ATHS) provides digital burst data in the Artillery TACFIRE format.

ATHS is slated to be replaced by the Improved Data Modem, which could increase the digital data transfer rate more than tenfold.

Aviation brings even more to the battlefield than leading the way in digitization. Able to traverse large expanses of sometimes formidable terrain many times faster than any system that must maintain friction with the ground, Army Aviation can have C^2 systems on station at critical times and places on the most dynamic battlefield for commanders and staffs of all branches and at all levels.

The next challenge is to transition as much voice and paper data as possible to the speed, accuracy, and responsiveness of digital data handling. In both planning for and execution of operations, we can automate a long list of information groups: Operations Orders; Battlefield Graphics; Situation Reports; Engineer Support Plans; Fire Support Plans; Logistics Plans and Overlays; Logistics and Personnel Reports; Air Tasking Orders; Flight Corridors; Medical Status; Weather Reporting; and Mission Planning.

And we can also speed up the perishable information that makes the difference in success or failure on the battlefield: Air Traffic Control; Enemy Situation (Air and Ground Picture); Friendly Locations and Weapons Status; Gun/Target Lines; Anti-Aircraft Sites; Engagement Areas and Other Fire Control Measures; Calls for Fire and Close Air Support; FRAG Orders; and FARP Locations and Status.

Voice and paper exchanges may never go away, but digital information handling and communications will significantly improve the Army's warfighting potential and Aviation's ability to impact it.

Other future Aviation Initiatives with C^2 on the Move include the Aviation TOC (AVTOC). The AVTOC will link aviation units into the Army Tactical Command and Control System (ATCCS), providing vertical and horizontal communications and data links internally, and to the supported and supporting units. The AVTOC will match the ground mobility of today's ground maneuver units and will be tailorable to logistics applications by simple software changes. The AVTOC requirement is crafted to be totally compatible with existing systems and standard radios. The AVTOC, which includes aviation-specific comm and software applications, is based on Advanced TOC (ATOC) being developed under the Combined Arms Command and Control (CAC^2) Advanced Technology Directorate (ATD).

Paper maps and acetate should essentially disappear, as color electronic digital maps of the world, windowed down to the area of operations, provide a common standard

to display a common picture of the battlefield to everyone on the net.

Distance between radios and line of sight will no longer be prime considerations for good communications, as High Frequency radios and SATCOM give Aviation and the Army the ability to communicate next door or hundreds/thousands of miles away. Even in situations where long radio data transmissions are not acceptable, volumes such as the Air Force Air Tasking Order can be distributed on floppy or compact disks.

The Aviation/Army Mission Planning System (AMPS) will be hosted on the same common hardware as ATCCS. At a terminal on the Local Area Network, staffs will be able to handle direct exchange of digital information with the Maneuver Control System (the maneuver piece of ATCCS). Aviation can then use this information to quickly and accurately plan their missions. Automation will allow units to rehearse missions with other members of the combined arms team under the supervision of commanders. Changes or adjustments to the plan are made quickly during rehearsal or even during the mission using AMPS. In aviation, AMPS will be down to the company/troop level. The requirements and distribution for ground maneuver units, however, have not been determined.

The mission plan is quickly transferred to aircraft via the Data Transfer System (DTS) or radio uplink. There is no longer a need to "fat-finger" the preplanned flight data into the aircraft system by hand. The DTS has a solid state RAM cartridge so the crew can transfer data manually to and from the aircraft. Although we usually think about data we will *transfer to* the aircraft, such things as target lists, actual flight path flown, detected threat locations, ASE information, and maintenance data will be *downloaded* from our aircraft.

The Army Airborne Command and Control System (A^2C^2S) installed on a UH-60 C^2 aircraft will provide the third dimension to "C^2 on the Move". A^2C^2S will use DTS, a robust communications suite and full color displays to provide a graphical picture of the battlefield against a moving electronic map.

To ensure command and control on the move is institutionalized throughout the combined arms team, CECOM in conjunction with other laboratories and the TRADOC Battle Labs is developing a CAC^2 Advanced Technology Demonstration (ATD). The CAC^2 ATD is the focal point for the digitization of the battlefield. CAC^2's key feature is a "common picture of the battlefield" for all partici-

(C2 — continued on page 41)

BY CPT JAMES E. BAKER

WHAT HAPPENS ON THE OTHER END OF THE RADIO: HOW THE ARTILLERY WORKS

Winner of the AAAA Communicative Arts Award, AVOAC 93-1.

A look at a practical situation in Command and Control.

Every Aviator receives training during IERW on standard procedures for the Call For Fire (CFF). The programmed instruction teaches aviators about the various artillery weapon systems our Army employs as well as shell/fuze combinations. In addition, the aviator gets a general overview of who the players are and how the fire support system is designed to work. But what actually happens when you call a fire mission in to an artillery unit? Do you know?

In today's Combined Arms Army of Excellence, it never hurts to know how the other guy operates. So follow me through a normal fire mission, and I'll take you through your radio to the inner working of a field artillery platoon.

You are a scout pilot, in a cavalry troop, conducting a screening mission and your unit has an artillery battalion in direct support (M109A3, 155, SP). You identify two BTR-60 IFVs and request permission from higher to use fire support assets to attack. You get the go ahead and call the artillery Net Control Station (NCS).

"Z4V33, this is B2K81, request permission to enter the net, over." The artillery NCS is generally the battalion Fire Direction Center (FDC), which is collocated with their TOC.

The battalion Fire Direction Officer (FDO) or the FDNCO sends back, "B2K81, this is Z4V33, authenticate alpha golf, over."

You access your SOI and transmit, "Z4V33, this is B2K81, I authenticate Sierra, over." You are then cleared and

told to refer all further traffic to M45, abbreviated call signs authorized.

In essence, he has given you a platoon FDC, under his control, to which you may send fire mission. A battalion of this type controls six firing platoons, each with its own FDC.

Now you're ready to call: "M45, this is K81. Fire for effect, over."

At this time, a soldier (13E) assigned as the recorder in the FDC reads back, "K81, this is M45, fire for effect, out." You send, "Grid, ES 746227, over." He reads back, "Grid, ES 746227, out." You send "Two BTR-60s with infantry in the open, DPICM in effect, At My Command (AMC), over."

The recorder, after having written all this down, transmits "Two BTR-60s with infantry in the open, DPICM in effect, at my command, out." This is the point where the radio becomes silent and the average aviator wonders what the hold up is. Let's take a look.

The FDNCO now enters the fire mission data into the Battery Computer System (BCS) while another crew member follows with the handheld Back-Up Computer System (BUCS). The computer then compares the grid location of the target with that of the surveyed position of each weapon. This is why observer accuracy is a crucial part of the equation.

The BCS produces a firing solution for each weapon factoring in differences in elevation, meteorological conditions, and the curvature of the Earth. This solution, termed firing data, is subjected to a four way check prior to being sent to the gunline.

First, the recorder reads back the information to the observer to ensure accuracy. Then the FDO ensures the FDNCO inputs the correct information into the BCS. The BCS firing solution is then compared to that produced by the BUCS and finally, the FDO verifies that each component of the data falls within specified safety parameters.

A well trained FDC performs these checks as a matter of course with minimal delay. Adherence to proper safety procedures only adds a few seconds to mission processing time.

Two things happen simultaneously once the FDO has cleared the mission data: the recorder sends a Message To Observer (MTO) to you and the FDNCO transmits the firing data to the guns. The MTO tells you the firing unit, the number of rounds, the target number assigned by the FDC, and the Time of Flight (TOF). An MTO is specific for each mission and can contain various times of information. You hear, "K81, this is M45, MTO, M, two rounds, target number XW6003, 29 seconds, over." You acknowledge and add, "Send ready."

Meanwhile, the FDNCO has sent the weapon specific firing data of Quadrant Elevation (QE), Deflection (DF), Charge (CHG), and Time (TI) to each gun. The communication between the FDC and the guns can be accomplished either digitally or by voice, both over wire.

All the guns and the FDC are connected by two wire "hot loops". The digital link between the BCS and the Gun Display Unit (GDU) in each howitzer is faster because all the data for each gun is transmitted simultaneously with the push of a button on the keyboard of the BCS. Voice commands must be read individually. Once the sights are set, the proper time set on the fuze, the round and charge rammed, and the breech closed, each gun chief sends "set" to the FDC. When the platoon is "set" to fire, the FDC sends "ready" to you, the observer.

Now those four guns are in your hip pocket. Whenever the time is right, you can simply transmit, "M45, this is K81, fire target XW6003, over." The FDC will immediately send "fire" to the gunline, either voice or digitally, and upon hearing the first round will transmit, "K81, this is M45, shot XW6003, over." You acknowledge with "Shot, out," and at this point can expect effects on target within 29 seconds.

After 25 seconds have elapsed, the FDC will transmit, "K81, this is M45, splash, over." You respond with "Splash, out," and observe the target. Once the last of the eight rounds is on the way, the FDC will transmit, "K81, this is M45, rounds complete, over." This informs you that the final volley is inbound and the FDC is prepared to follow up. Again, you must acknowledge.

Once complete, you make the decision whether to continue or end the mission. In this case, let's end the mission because there is a significant point to be understood here.

Virtually every instructor I encountered during IERW taught students to send the effects observed to the FDC prior to sending End of Mission (EOM). They explained to me that once the FDC hears EOM, they cut you off and ignore you. Let me briefly explain why this is incorrect logic from an artilleryman's point of view.

An artillery piece never sits idle in the field. It is *always* laid on a target. In a defensive posture, weapons are set on Final Protective Fire (FPF) data and on priority target data in the offense when not engaged in a fire mission. When you call for fire, the guns set off your mission data and shoot. So as soon as you have achieved the desired result, send end of mission.

This minimizes response time for firing on those critical targets. It only occupies three seconds of the recorder's time to send EOM to the

gun line. That FDC wants to know what kind of effects you observed. Every soldier in that firing unit wants to hear how well they performed and you are the only feedback they get, but send EOM first.

So there you have it. With one radio transmission, you have set roughly 40 people in motion to accomplish a very complex task. Understanding how the process works goes a long way toward helping you remain patient when the radio goes silent. Our Artillery brethren are not magicians, and what they do takes a little time. They are, however, professionals in the art of fire support and very likely an aviator's best friend in a crisis.

★★

CPT Baker was attending the Aviation Officers Advanced Course 93-1 when this article was written.

C2
(continued from page 37)

battlefield. CAC^2 includes a common digital communication protocol which will allow the direct exchange (without translation) of digital data between aviation, armor, dismounted infantry, etc. CAC^2 is configured as a slice of aviation, armor, and fire support, exchanging digital data during the execution phase of battle. The combat and material development communities will consider additional platforms, when they become candidates.

The challenges remaining are:

- How do we allow the commander to convey his intent to the staff quickly and reliably enough to turn inside the opponent's decision cycle?
- How do we ensure that the commander can allocate his combat power and adequately reallocate it in the ever changing flow of battle?
- How do we get the reconnaissance and intelligence information from all sources to the commander and staff in time, so they can reinforce success by providing the resources to front line units that they need to exploit the "space" and "gaps"?
- How do we get the required and *only* the required tactical information to the lowest levels?
- How can we fend off surprises imposed on us by our adversary?
- How do we harness recent technology advances in digital communications, small powerful battlefield computers, full color graphical displays, etc., to make a revolutionary leap forward in the art of command and control?
- How do we keep many good ideas affordable?

When Army Aviation adds the third dimension to "C^2 on the Move", the Army gains a tremendous combat multiplier. The only remaining question is when and if the U.S. Army will be there first. We can be! Let's do it together.

★★

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COL Sendak is Director, Program Management, Vitronics, Inc.

BY MAJ WILLIAM L. CANFIELD, RET.

GRAMPS IS FIELDED!

Fielding of one of the Army's most complex and innovative mission planning systems.

CECOM/RDEC/ Command, Control and System Integration Directorate (C^2SID), previously known as AVRADA (Mr. David V. Gaggin, Director), was tasked by the GUARDRAIL/ Common Sensor (GR/CS) PM, LTC Darrell Lance and Special Electronic Mission Aircraft (SEMA) PM, LTC Alan Bacon, to provide a single point of control for integrating the RC-12() ASE and selected avionics aboard the GR/CS aircraft. The result is the GUARDRAIL/Common Sensor Aircraft Survivability Equipment/ Avionics Control System Mission Planning System (GRAMPS).

The current ASE and avionics have individual control heads and work independently. By removing the control heads and installing a MIL-STD-1553B state-of-the-art software integrated electronic data bus architecture, the RC-12() aircraft cockpit becomes more user friendly and the pilot workload is lessened.

The pilots now have a single Multi-Function Display (MFD) to view and a single point of data entry Keyboard Unit (KU). The KU is identical to the OH-58D keyboard. The MFD also appears to be the same as the OH-58D's MFD, with the exception of internal circuitry.

The ASE/ACS helps the pilots in the cockpit and also provides them with a Data Transfer System (DTS) to aid them in performing mission planning before entering the aircraft. The DTS consists of a removable electronic cartridge and a receptacle that is wired into the aircraft and integrated with the MIL-STD-1553B data bus.

So what is GRAMPS? GRAMPS is the PC ground station where pilots can sit and plan their mission rather than manually entering their mission information in the cockpit while the engines are burning precious fuel. GRAMPS hardware consists of a user's PC and a cable assembly and power supply, plus the software and documentation that was developed by Honeywell, Inc., Albuquerque, NM. The cable assembly, fabricated by C²SID's Airborne Engineering Evaluation Support Activity (AEESA), Lakehurst, NJ, is used to connect the DTS and its power supply to the PC.

GRAMPS allows a user to define ASE/ACS Mission Data (navigation waypoints, communication frequencies, equipment setups, etc.) prior to a GUARDRAIL mission and to store the ASE/ACS Mission Data onto a DTS programmable cartridge. The DTS cartridge can then be transported to the aircraft and used to upload the ASE/ACS Mission Data into the RC-120 ASE/ACS. The GRAMPS user interface is based on the operator interface defined for the RC-120 ASE/ACS. The MFD display pages and the operator data entry procedures are nearly identical between the on-aircraft ASE/ACS and the ground-based GRAMPS with three exceptions. GRAMPS uses a computer monitor and a computer keyboard in place of the on-aircraft MFD and keyboard to provide the operator interface functions. Two GRAMPS display pages have been added to allow the user to save and retrieve data to/from computer disks, and to specify GRAMPS hardware and equipment interfaces. GRAMPS allows DTS cartridges to be formatted. DTS cartridges must be formatted prior to using the cartridge for the first time or after the cartridge has been zeroized. For someone who is familiar with the RC-120 ASE/ACS, using GRAMPS to define ASE/ACS Mission Data should be simple and straightforward. In fact, a side benefit to GRAMPS is that it can be used to train personnel on the operation of the ACE/ACS.

GRAMPS was fielded during August 1993 in order to meet the October 1993 RC-12N aircraft first unit equip date. It was fielded to the 224th Military Intelligence Battalion (Aerial Exploitation), Hunter Army Airfield, GA. GRAMPS has also been supplied to the Intelligence School at Ft. Huachuca, AZ.

The ASE/ACS requires mission, ASE Training (ASET), and check list types of data. These data types are used to control specific operational characteristics of the ASE/ACS and provide information to the ASE/ACS operators. The data includes communications data

(i.e FM, VHF, and UHF frequency hopping data), navigation data (i.e. waypoint list data, route list data, and TACAN list data), ASET data (i.e. ASE training threat list and score list), Caution/Warning (C/W) history (i.e. number of occurrences of each caution and warning message), and setup data (i.e. FM mode control parameters, UHF mode control parameters, IFF mode control parameters, ASE mode control parameters, navigation alignment position, and datum).

By using GRAMPS for mission planning, the ASE/ACS required data is loaded on the DTS cartridge and carried to the RD-120 GR/CS aircraft to be uploaded through the MIL-STD-1553B data bus to the ASE/ACS.

Additionally, the ASE/ACS will provide airborne ASE embedded training capability to the aircrew. The RC-12N aircraft gives the Army its first embedded ASE training capability which enables the aircrew to train against air defense threats without organic ASE onboard and without an ASE range. Prior to take off, the Instructor Pilot (IP) and/or pilots will be able to setup inflight training scenarios at the GRAMPS ground mission planning station which will be uploaded through the DTS into the ASE/ACS for use during airborne training. A training scenario can also be inserted into the ASE/ACS while airborne. The IP will be able to bring up threat warnings during a flight just as if these threats were actually targeting the aircraft.

The training mode presents the same type of information as the normal active mode allowing the student to practice the evasive maneuvers appropriate for each displayed threat while in the simulation mode. The ASE/ACS also allows the instructor pilot to evaluate the student's performance in relation to the threat displayed. During training, if a real threat is encountered, the ASE/ACS is designed to override and terminate the training session and display the real threat information.

In essence, the RC-120 GR/CS aircraft is being outfitted with one of the Army's most advanced cockpits and most sophisticated ASE suites. The RC-120 aircraft provides the Corps Commander precision location and expanded frequency exploitation with its PME that is composed to the Improved GRV (IGRV), Communications High Accuracy Airborne Location System (CHAALS), and Advanced Quicklook (AQL). The aircraft are being fielded in three battalions of 12 aircraft each to V Corps, 18th Airborne Corps, and III Corps.

★★

MAJ Canfield is an Electronics Engineering Project Leader, C²SID, Ft. Monmouth, NJ.

BY MAJ CHRISTOPHER C. FRY

RC-12N NEW EQUIPMENT TRAINING: SETTING THE STANDARD

A look at the new developments in Army Aviation's Special Electronic Mission Aircraft.

In support of the upcoming fielding of the Guardrail/Common Sensor (GR/CS) System 1 to the XVIII Airborne Corps (ABC) in the second quarter of FY94, our government/contractor team has set a new standard in Special Electronic Mission Aircraft (SEMA) New Equipment Training (NET) for the aircrews of the new RC-12N aircraft.

The RC-12N is outfitted with one of the most advanced cockpits and most sophisticated Aircraft Survivability Equipment (ASE) suites in Army Aviation. The aircraft features an Aircraft Survivability Equipment/Avionics Control System (ASE/ACS) which utilizes a Honeywell MIL-STD-1553B data bus. The ASE/ACS menu also allows for the Army's first Embedded ASE training capability, which permits an aircrew to train against air defense and air-to-air threats without organic ASE on board and without flying against emitters on a range. The cockpit also features a Honeywell Electronic Flight Instrumentation System (EFIS) with four cathode ray tubes.

The cockpit locations of the ASE/ACS multifunction display (MFD), keyboard unit (KU), and EFIS are shown in Figure 1. (For a more detailed system description of GR/CS and the RC-12N, read "Guardrail/Common Sensor: The Army's Premier Intelligence System" in ARMY AVIATION, 30 Nov 92). Additionally, the RC-12N features the Guardrail Aircraft Mission Planning System (GRAMPS), which is discussed in greater detail in the preceding arti-

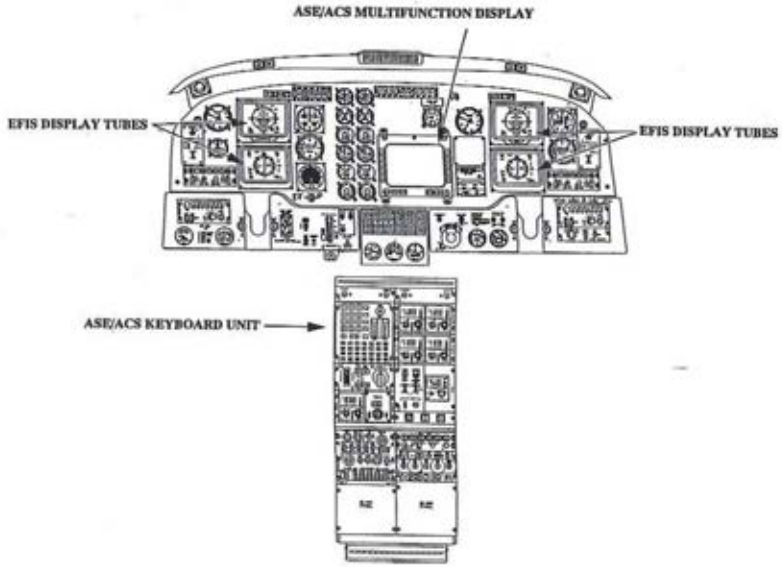

Figure 1: RC-12N/P Instrument Panel and Center Console with EFIS and ASE/ACS.

cle in this magazine.

The SEMA Product Manager's Office (PMO) and New Equipment Training Team (NETT) of the Aviation and Troop Command (ATCOM) applied lessons learned from the RC-12K NET and fielding plan to ensure the best possible NET for the RC-12N users. One of the first steps to this successful plan was for the Communications and Electronics Command (CECOM) to contract with Honeywell,Inc to provide Initial Key Personnel Training (IKPT) on ASE/ACS through hands-on, classroom instruction at the Honeywell plant in Albuquerque, NM.

This training provided an introduction and overview of the sophisticated ASE/ACS to the future RC-12N aircrew instructors. In all, 36 key personnel, representing the SEMA PMO, CECOM, the 224th Military Intelligence Battalion (MI BN) Aerial Exploitation (AE) of the XVIII ABC, the United States Army Intelligence Center and Fort Huachuca (USAIC & FH), the Aviation Center Directorate of Evaluation and Standardization (DES), Beech Aircraft Corporation, and Flight Safety International (FSI), received outstanding instruction on the ASE/ACS between September and October 1992. The newly trained USAIC & FH instructors later provided this same instruction to twenty-eight 224th MI BN (AE) pilots in April and July 1993 at Hunter Army Airfield, Savannah, GA.

The SEMA PMO also provided IKPT to the USAIC and FH instructors for GPS, SINCGARS, and HAVEQUICK II operations prior to the July 1993 class at Hunter Army Airfield.

Another early and critical milestone in the successful RC-12N NET plan was realized in June 1992. The SEMA PMO constructed a Memorandum of Understanding (MOU) among eight responsible agencies to field three RC-12N "slick" training aircraft to the 224th MI BN (AE) and USAIC & FH between February and April 1993 in support of the FY94 system fielding. Training was required at USAIC & FH as the Intelligence School picked up proponency for all SEMA aviator training in November 1991.

"The USAIC and FH personnel transformed the contractor deliverables into a TRADOC training package in about 90 days ..."

The SEMA PMO and Beech provided a fourth aircraft to the 224th MI BN (AE) in September 1993. With dedicated training aircraft at each location, the Intelligence School was able to commence SEMA aviator ground and flight classes for future RC-12N aircrews, while the 224th MI BN (AE) commenced initial pilot qualification for currently assigned aircrews. Beech Aerospace Services, Inc (BASI) provides Life Cycle Contractor Support (LCCS) at each unit location in support of aircraft maintenance requirements.

Prior to commencement of the ground and flight classes, the Beech subcontractor, FSI, conducted initial, 50%, 75%, 100%, and final Training Conference Reviews of the training material and deliverables. Deliverables to the user included 35mm slides with an inventory list, a ground school program of instruction (POI), student handout, student exam, instructor guide, and a flight POI. The USAIC & FH personnel transformed the contractor deliverables into a TRADOC training package in about 90 days, and commenced the first Intelligence School ground class in August 1993.

In the Spring of 1992, the SEMA PMO modified an earlier 1989 contract with Beech based on lessons learned from the RC-12K fielding. This modification moved the FSI ground and flight training classes from the Beech plant at Wichita, KS to the user locations at no additional cost to the government. Subsequently, one Instructor Pilot (IP) ground

school for ten students, and one IP flight training class for four students was taught at the USAIC and FH in January 1993; one ground school and one flight school for 14 pilots was taught at the 224th MI BN (AE) at Hunter Army Airfield, Savannah, GA in February 1993; and a final pilot ground school for 14 students was again conducted at the 224th Military Intelligence Battalion (AE) in June 1993. Cadre from theUSAIC & FH provided additional flight training for two IP's of the 224th MI BN (AE) in July 1993.

FSI provided all contracted ground and flight instruction. Ground school topics included: Avionics System (INS, TACAN, and GPS), Powerplant/Propeller, Electrical System, Anti-ice/De-ice System, Landing Gear, Oxygen System, mission equipment provisions, and the EFIS.

FSI provided instruction to 18 students during the flight training portion of NET. FSI was tasked to train to a proficient (safe) level for each ATM task. Intelligence School Standardization Instructor Pilots (SIP) provided the final RC-12N qualification. On the whole, IPs received 8-12 hours of flight instruction, and pilots received 15-20 hours in order to reach Readiness Level 2 (RL2).

The RC-12N aircraft to be fielded to the 224th MI BN have been undergoing a 6,000 flight hour integration, test and calibration effort of the Primary Mission Equipment (PME) into the RC-12N at Moffett Field Naval Air Station, CA since April 1992. In February 1993, the SEMA PMO expanded upon the June 1992 MOU to allow concurrent mission training at Moffett Field of RC-12N qualified pilots from the 224th MI BN (AE) and the Intelligence School without interrupting the PME flight test program.

The expanded MOU served as a basis to ensure the effective mission training of the 224th MI BN (AE) pilots to a level acceptable for the fielding of the RC-12N. Each pilot receives 5-7 mission flights (20-28 hours) to include a checkride by Army IP's for advancement to RL1 status. The 224th MI BN (AE) pilots continue to utilize the Moffett Field MOU to maintain mission currency of RL1 pilots.

The objective of a successfully executed NET and continuation training plan is user satisfaction. The SEMA PMO, ATCOM NETT, Intelligence School, and industry partners will work together to improve the RC-12N training package in anticipation of the FY97 fielding of the GR/CS System 2 with the RC-12P subsystem. Meanwhile, the soldiers in the field have expressed a tremendous satisfaction with all aspects of the RC-12N NET.

★★

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BY CPT JEFFORY A. PERKINS

ALPHA COMPANY IS GONE – LONG LIVE ALPHA COMPANY!

The introduction of Unmanned Aerial Vehicles to U.S. Army, Europe.

There are unique moments in military history where we, as participants and/or observers, suddenly find ourselves from time to time. These moments have a strange habit of sneaking up on us and may even vanish before we realize their full impact. Well, this time, we were ready and we pause, but for an instant, to reflect.

Were you to visit Alpha Company, 1st Military Intelligence Battalion (Aerial Exploitation) in Wiesbaden, Germany, you would be greeted by resounding enthusiasm and echoed cries of "UAVs Lead the Way!" UAVs? That's right! Much has changed in the last few months, and Alpha Company is right in the middle of one of those aforementioned unique moments. We proceed dutifully, albeit a bit sadly, to retire the OV-1D Mohawk from the European theater of operations and prepare for the scheduled fielding of the Unmanned Aerial Vehicle.

It's been said that "Once a Mohawker, always a Mohawker." Rarely, in fact, has any piece of Army equipment evoked the kind of pride and loyalty as the OV-1 Mohawk. To say that the opportunity to fly a twin engine, single pilot, acrobatic, all weather, high performance airplane with U.S. Army stenciled on the side is unique may qualify for the understatement of the decade. It is this uniqueness which may be the cause for the emotion and the intense devotion to an airplane called ugly by some, but beautiful by those who have flown it.

Beautiful or not, the OV-1 has

fought the good fight. It has served in numerous wars dating back to Vietnam and has never failed to deliver. Perhaps no other aircraft has been more responsible for the United States' success in winning the Cold War in Europe.

As part of Alpha Company, 1st MI BN (AE), the Mohawk was the focal point for Peacetime Aerial Reconnaissance (PARPRO) missions upon unit activation, 16 June 1986. Although OV-1s have been in Europe since the Vietnam era, the breakup of the Warsaw Pact saw a change in mission requirements for Alpha Company. With this change came the inevitable "final Mohawk flight", and on 9 September 1993, the last OV-1 to fly over European soil departed for Korea. Once there, it will continue to serve as it has for over 30 years. No questions asked.

"On the horizon are bright new challenges and opportunites presented in times of austere budgets and unit inactivations."

Meanwhile, even though the faces may change and the airplanes come and go, the mission continues.

Providing actionable intelligence to commanders has been and will continue to be the objective of the company. To do this we must embrace change and tap into emerging technologies to perfect our craft. On the horizon are bright new challenges and opportunities presented in times of austere budgets and unit inactivations. Once seized, these challenges and opportunities will boost the OPTEMPO of our mission and start yet another unique moment in military history — full scale deployment of the Unmanned Aerial Vehicle (UAV) to Europe.

The mission of Alpha Company, 1st MI BN (AE) is to provide command, control, communication, and coordination during the transition and fielding of the Hunter UAV to V Corps and USAREUR scheduled to begin in November 1993.

In order to accomplish our new mission, we have reorganized from 134 authorized personnel to a small cadre of officers and enlisted soldiers, each with a specific purpose in mind to facilitate the UAV fielding. In addition, the company has retrograded eight RV-1D and 11 OV-1D aircraft, all associated supplies and equipment back the Army inventory. No small task. Next come the challenges of an aggressive fielding plan currently in validation.

In the future, Alpha Company will conduct operations utilizing 16 air vehicles associated UAV support and mission equipment with 106 authorized personnel. Fielding will

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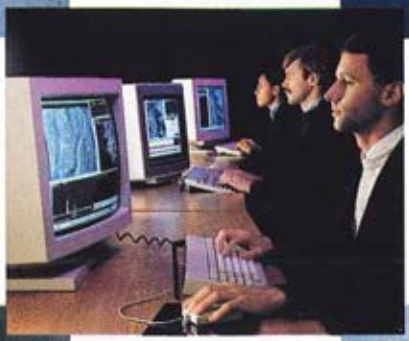

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be under Total Package Fielding and incorporate Integrated Logistic Support. Initial train-up will take place at Ft. Huachuca, AZ with the air vehicles and associated equipment deployed to Europe upon completion. All other associated equipment (HMMWVs, M-16s, etc.) will be requisitioned through normal channels in-country.

Several issues exist. Airspace over Europe is congested and airspace use for UAV training and operations will, perhaps, be our greatest challenge. Frequency allocation and utilization is another challenge which may prove to be extensive as the already burdened frequency spectrum is tightly controlled. And finally, safety will, of course, be our absolute standard and we must be able to demonstrate such prior to any host nation fielding.

The "new" Alpha Company will be totally dedicated to providing aerial imagery intelligence to V Corps and USAREUR as well as supported ground commanders. How unique it is in these days and times to reorganize rather than deactivate! We are ready for the challenges which await. As Alpha Company, 1st Military Intelligence Battalion (AE) prepares to transition from manned aircraft to the UAV, the proud history of providing actionable intelligence to commanders will continue.

★★

CPT Perkins is Commander, A Company, 1st Military Intelligence Battalion (Aerial Exploitation), Wiesbaden, Germany.

BY COL BRADFORD M. BROWN

UNMANNED AIRCRAFT MAKING STRIDES

Present developments at the UAV Joint Project Office (JPO).

The long-awaited Unmanned Aerial Vehicles (UAVs) are nearing the time when they will join Army Aviation and shoulder some "dull, dirty, and dangerous" missions now assigned to manned aircraft.

Missions for which the UAV seems uniquely suited are several which pose high risks to pilots and crew. These include initial entry into heavily defended airspace, long-endurance patrols lasting 24 hours or longer, and conducting air sampling to check for harmful chemical, biological, or nuclear agents.

As this issue of ARMY AVIATION went to press, several significant UAV efforts were underway involving not only Army UAVs but ones with potential Navy and non-military applications as well.

Off the coast of Southern California, the Hunter Short Range UAV was conducting demonstrations to show its "sea legs" by operating from the amphibious ship, USS *Essex*. The Hunter is managed for the Department of Defense (DoD) and the UAV Joint Project Office by the Army's Short Range UAV Project Office based in Huntsville, AL. COL Paul K. (P.K.) Tanguay, a veteran Army Aviator, is the Army UAV Program Manager.

The at-sea demo covered four days of flight operations in which the Hunter, under radio control, made approximately 33 flights to and from the *Essex*. The demo was planned to show whether the Hunter, originally planned only as a land-based Army and Marine Corps aircraft, could

Above: The Pioneer UAV provides near-real-time Reconnaissance, Surveillance, Target Acquisition (RSTA), Battle Damage Assessment (BDA), and battlefield management within line of sight of a ground control station, both day and night.

meet Navy needs. Initial results seem favorable since the demonstration included deck launches, touch-and-go landings, and arrested landings with a "tailhook". The Hunter is in Low Rate Initial Production, and TRW/IAI will deliver the first of seven Short Range UAV systems in May 1994.

The Short Range UAV is one of a "family" of UAVs under development to meet operational requirements of military organizations ranging from units of squad size up to theater commands. The Short Range, for example, will have an operating radius of 150 kilometers or greater, and stay aloft from eight to 12 hours while providing "live" imagery from potentially hostile territory.

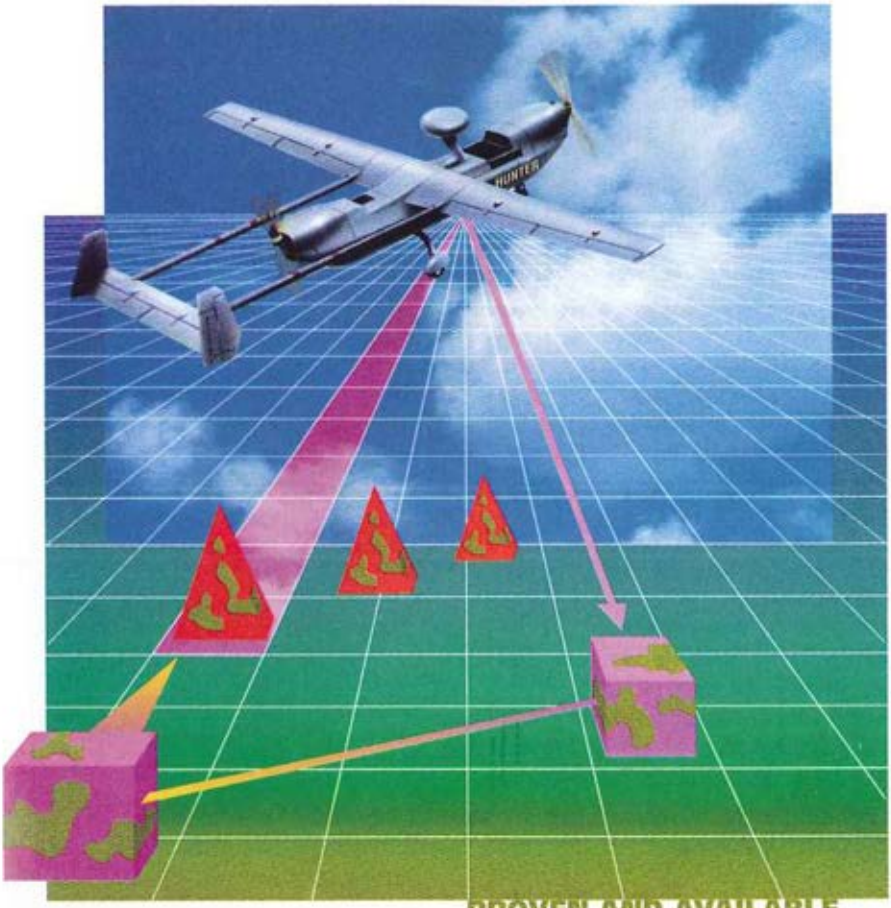
They will enable Army forces to conduct reconnaissance, surveillance, target acquisition and, in the future, additional tasks such as signals intelligence, signal relays, electronic warfare, and others.

Another UAV getting a hard look from the Army is the hand-launched Pointer, a nine-pound aircraft which can be carried into battle in a soldier's backpack and launched by being flung into the air like a javelin. The Pointer is battery-powered, has a nine-foot wingspan, and will fly for about an hour, out to a distance of three to five miles. Its payload is a daytime television camera mounted in the Pointer's nose.

It is under consideration by the Army's III Corps, which has tried it out in exercises at the National

HUNTER

THE TACTICAL UNMANNED AERIAL VEHICLE SYSTEM THAT HAS MET EVERY CHALLENGE



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Kuwaiti Sands Give Up Remains of Pioneer UAV Lost in DESERT STORM

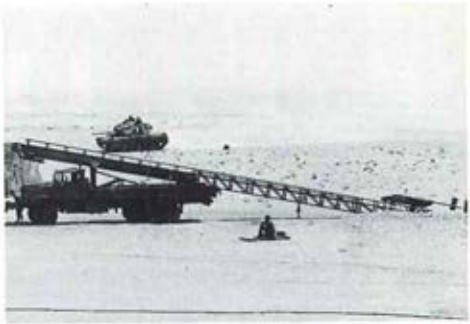
by Ray Colemon
P.A. Officer for the JPO

The desert sands around Kuwait City have yielded the remains of the only Pioneer UAV lost to hostile fire during Operation DESERT STORM.

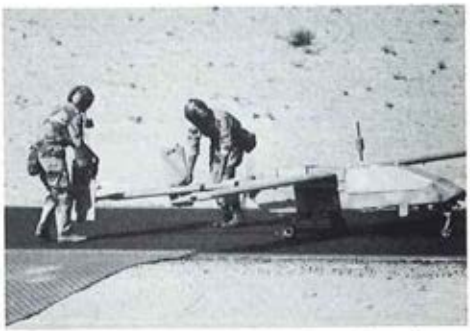
An Explosive Ordnance Disposal (EOD) team clearing unexploded ammunition and other explosives stumbled across Air Vehicle No. 187. The Pioneer had been reported lost to hostile fire while operating from the battleship USS *Missouri*, and was uncovered last December.

The Pioneer was flying over Iraqi forces in Kuwait City when operators back on the *Missouri* began seeing antiaircraft artillery rounds whizzing by the Pioneer. The air vehicle was shifted to another area to get away from the antiaircraft fire and some clouds. When the UAV began retransmitting, more rounds were seen before the images suddenly stopped. It was assumed that the Pioneer, or at least its camera, had been struck by hostile fire.

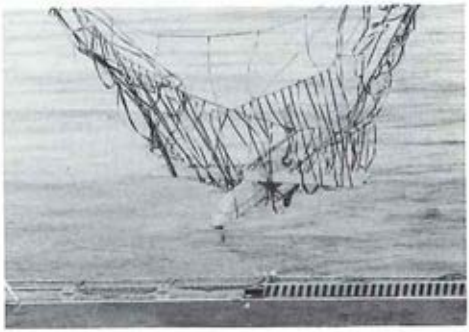
The Pioneer has a low radar cross-section and a small infrared signature, minimizing its detectability. First deployed in December 1986 aboard the Navy's battleship USS *Iowa*, the Pioneer is currently assigned to two ship-deployable USN detachments, three USMC companies, one USA platoon, plus testing and training units.



Above: A Pioneer UAV being prepped for a daytime rail launch in Southwest Asia.



Above: An idling Pioneer UAV is positioned on a small asphalt strip prior to launching under its own power for a reconnaissance mission.



Above: Retrieval of a Pioneer UAV aboard a U.S. Navy vessel, the USS *Denver*.

Above: The Hand-Launched UAV, named the Pointer, is a low-cost, simple reconnaissance and surveillance device providing intelligence for soldiers at the Brigade/Battalion or lower levels. It has an airspeed of 22-50 MPH, a range of 3-4 miles, and a duration of more than an hour.

Training Center and at the Joint Training Center, Ft. Polk, LA. III Corps is especially interested in equipping its Scout and light infantry units with Pointer to give them a capability of looking "over the hill" and around the bend.

The Pointer is also getting a look-see from several non-military government agencies. The Bureau of Land Management, for example, has an urgent need to keep watch over public lands in the Western U.S. Poachers, inspired in part by last summer's hit movie, *Jurassic Park*, have been disturbing public lands looking for dinosaur bones and other relics of the past which the BLM is charged with protecting. Representatives from the Bureau of Land Management have attended demonstrations of the Pointer and expressed interest in having such a system to extend the range and coverage of its agents overseeing public lands.

So-called "dual use" or non-military uses for UAVs also are under consideration by the Drug Enforcement Administration for use in counter-narcotics operations. The UAV also is under consideration by government and private organizations for such missions as forest and cropland reporting, pipeline patrol, civilian police agencies, and firefighting organizations.

★★

COL Brown is the Army UAV Project Manager, Joint Project Office-Unmanned Aerial Vehicles, Washington, D.C.

BY CPT RODIE CHUNN

VIRTUAL WARFIGHTING SIMULATION IN ARMY AVIATION

The last of two essays which tied for Second Place in the First Annual AAAA Essay Contest.

The concept of "warfighting" using virtual simulation is relatively new in the discipline of training for warfare. If we subscribe to the theory that anything short of actual conflict is simulation, we can define three types of simulations: real, constructive, and virtual.

The future of Army Aviation simulation and training in the 21st Century.

Real, or live simulations, are events that occur at the combat training centers and field training exercises where actual personnel and equipment are used in engagements. Constructive simulations are those computer based simulations such as Janus, Brigade and Battalion Battle Simulations (BBS), or Corps Battle Simulations (CBS) that are used for training, exercises, and analytical studies.

The third group of simulations is virtual simulations. Here we place soldiers in interactive simulation devices to allow free play between individuals, crews, and units that can potentially fight a common enemy or even against each other. To augment the man-in-the-loop simulations, semi-automated forces are generated by computer and are usually not distinguishable from manned devices.

"Virtual Simulation" creates an environment that allows us to explore a full range of Doctrine, Organization, Training, Materiel, and Leader (DOTML) issues for the Army and Army Aviation. In order to "hone" in on DOTML issues through simulation, the Directorate of Simulation was formed. This important conceptual change to

"business as usual" establishes a priority on warfighting simulation to explore new territory using virtual simulation to enhance warfighting capabilities.

The Aviation Test Bed (AVTB) is the aviation component of Distributed Interactive Simulation (DIS) technology, and provides Department of Defense agencies with an aviation-oriented, Research, Development, and Acquisition (RD&A) facility. DIS, simply stated, means that simulator devices are placed at diverse locations and can interact with each other on common terrain. The AVTB, as a part of DIS, serves as a joint and combined arms tactical trainer in a training development role. AVTB functions center around the five "domains" that exist in warfighting simulation. These are training, materiel development, doctrinal development, training development, and testing.

The training and training development domains of warfighting are the primary cornerstones of most simulations that exist today. Active as well as Reserve Component units conduct crew and collective training in the AVTB. The Aviation Officer Advanced Course (AVOAC) and the Aviation Officer Basic Course (AVOBC) conduct training in the AVTB as part of their course assignments. During these courses, trainers conduct otherwise dangerous and expensive training in a safe Warfighting Simulation environment without the fuel and ammunition costs normally associated with aviation training.

Training development in the AVTB takes training skills learned at an individual, crew, and collective level and expands this training using a repetitive cycle that allows trainers to use various scenarios. For example, the AVOAC may brief and execute an attack helicopter mission in the AVTB and then assess the soundness of their plan at the After Action Review (AAR). Likewise, skills learned in the classroom regarding attack helicopter operations are used in the AVTB.

Materiel and doctrinal development have established our armed forces as world leaders in the past. Our government buys new combat systems (materiel) when the current systems become mature with time. Additionally, new systems are bought to maintain a technological advantage over our potential adversaries. Procurement of new systems requires doctrinal development. Warfighting simulation provides an arena to conduct materiel and doctrinal development before new equipment is bought or new doctrine and tactics are implemented.

The testing domain of warfighting simulation allows its users to obtain facts about doctrine and materiel. Many areas of research

and testing can be conducted in simulation that otherwise could never be tested.

For example, questions concerning the effects of lasers on the battlefield could never be adequately examined without simulation. Yet we can progressively degrade vision safely in simulation without any adverse effects to test subjects. These kinds of capabilities within the AVTB are developed to support specific tests designed to derive specific quantifiable data. When a user indicates the AVTB is needed for a test, a feasibility study is conducted to ensure the test is capable of being accomplished within established parameters. The capabilities are then brought by the user and built into the AVTB to support the test. Tests include various aspects of simulation technology as well as evaluation of command and control, communications, situational awareness, roles and missions, and joint/combined operations.

Through the use of warfighting simulation, materiel and doctrinal development will emerge as a necessity to reshape our Army. Huge defense cuts may force us out of our aircraft cockpits and ground vehicles for testing and development and into simulation.

Mr. George Singley, Deputy Assistant Secretary of the Army (Research and Technology), stated that, "Materiel developers will shorten acquisition time while reducing both costs and development risks by employing Distributed Interactive Simulation (DIS) during concept definition, concept exploration, design, MANPRINT assessments, and prototyping. Combat developers," Singley says, "will use DIS to help them assess new doctrine and tactics, develop requirements, and evaluate force structure."

". . . the effects of lasers on the battlefield could never be adequately examined without simulation."

The six TRADOC Battle Labs continue to work toward the goal of being able to "link" or "interact" on the growing Defense Simulation Internet (DSI) network. Additionally, this effort of using warfighting simulation over the DSI network aligns closely with the Louisiana Maneuvers (LAM) '94 effort.

Warfighting simulation provides us with a training quality that is arguably unmatched. For example, an attack company commander can plan and brief a Combined

Arms Live Fire Exercise (CALFEX), conduct the mission using warfighting simulation in the AVTB, and get training quality as though it were real. How? By using the actual combat rostered crews, the actual terrain data base, and conducting the actual briefed mission, the commander can achieve excellent training quality. Additionally, the mission can be rehearsed and conducted many times until it is done correctly before ever buying a single Hellfire missile or consuming an ounce of aviation fuel.

Dwindling resources are a reality. Time, money, and available training areas are declining every day. Personnel cuts may force us to wear not only a few "hats" but many. Training and maintaining requirements remain but with less manpower. Additionally, training areas have become smaller and more restrictive, causing limitations on the number of large scale FTXs. Warfighting simulation allows us to enhance our warfighting skills using less time and fewer dollars, while providing opportunities and nearly unlimited training areas.

Safety is paramount in warfighting simulation as in a real field environment. The safety aspect of virtual simulation allows crews and teams to practice air combat drills or "duke" it out with an air defense system designed to eliminate you. However, no one has ever died in or destroyed a $9 million dollar aircraft flying a simulator. This is not to say that safety goes out the window in warfighting simulation. Safety is still paragraph six of the OPORD even in warfighting simulation.

Perhaps virtual warfighting simulation such as that found in the AVTB will never fully replicate the sudden jolt of a 30mm cannon when fired. Nor will it allow one to feel the pressure on the spine after jumping a tank ditch in a M2/M3 Bradley at 30 mph. However, warfighting simulation creates an environment that allows its users to explore a full range of DOTML development issues exploiting the phenomenal power of virtual simulation for the Army and Army Aviation.

★★

CPT Chunn is assigned to the Aviation Test Bed (AVTB), Directorate of Simulation, Ft. Rucker, AL.

CORRECTION:

Due to an editing error, the November 30, 1993 issue of ARMY AVIATION Magazine misstated the biographic sketch for the author of "Army Aviation: A Political Agenda for the 1990s and Beyond". Mr. Fallon did not serve during Operation JUST CAUSE, but was deployed to Panama immediately prior to that conflict.

BY CPT KENNETH S. PRYGOSKI

AIR CAVALRY IN THE COUNTER-RECONNAISSANCE FIGHT

The winner of the AAAA Communicative Arts Award for AVOAC 93-03. Over 90 students competed.

The air cavalry is ideally suited to accomplish one of the most important missions on the battlefield: the counter-reconnaissance (CR) fight. Current doctrine, however, does little to incorporate air cavalry and even less to synchronize its efforts into the overall CR plan. It is time that we recognize this deficiency and start employing air cavalry as a doctrinally integrated aspect of the CR fight. This will greatly enhance the success of this mission, and thereby vastly increase the probability of success in the ensuing close battle.

Applying the Air Cavalry Troop to the CR fight to ensure victory in the main battle close fight.

The current bible for air cavalry operations, FM 1-116, spends one generic paragraph glossing over the air cavalry's role in CR. Likewise, the current doctrine on CR, FM 34-2-1, fails to mention air cavalry as a specific player at all. These holes in our doctrine lead to the improper and unsynchronized use of air cavalry in the CR fight evident in most tactical units.

Since it is not a doctrinal priority, what occurs in the field is usually a haphazard employment of the air cavalry assets in reaction to an unanticipated CR problem. What should occur is the execution of a combined arms CR plan which integrates the air cavalry and is developed and synchronized with the same precision as the main battle. The now successful CR fight would destroy enemy reconnaissance before it creates an operational hazard for the main forces.

It is important to understand that the reconnaissance elements we will be countering are not the Combat

Reconnaissance Patrol (CRP) and the Forward Security Element (FSE), against which the air cavalry is doctrinally employed. It is the Divisional and Regimental Reconnaissance Teams (DRTs), operating anywhere from 25 to 100 kilometers in front of the main body, that must be defeated in order to win the reconnaissance battle.

They operate almost exclusively with ground based systems usually employed as small teams to cover the widest possible area. During three rotations at the National Training Center, I saw that while defeat of the CRP and FSE did not always lead to victory in the battle, defeat of the DRTs always did. The reason for this is simple. If you fail to defeat the DRTs, they have already identified your weak points, rendering the intelligence of the CRP and FSE as nothing more than confirmations. However, defeat of the DRTs forces the CRP and FSE to enter the battle blindly, allowing us to shape the battlefield for the main battle.

The CR battle is the battle we must win at all costs. To achieve victory we must place the same emphasis on this battle as we currently do on the main battle. To begin with, we must integrate and conduct a thorough Intelligence Preparation of the Battlefield (IPB) for the CR fight. The following list details those things that must be accomplished:

- Templating of enemy DRT positions.
- Designation of these positions as Named Areas of Interest (NAI).
- Tasking of who is responsible to clear these NAIs to the appropriate units.
- Synchronization of all assets tasked (ground forces, air cavalry, electronic warfare assets, etc) through the use of a CR execution matrix.

The air cavalry possesses unique capabilities that make it a key player in the CR effort. With minimal combat power, such as one scout/weapon team, air cavalry assets can cover NAIs that are inaccessible to mounted ground based elements. They also can cover vastly separated NAIs in comparatively little time and can destroy small, light patrols with their internal firepower. Air cavalry literally wreaks havoc on DRTs which have infiltrated our deep area. Air cavalry is much more survivable and effective against lightly armed DRTs than when used forward in the main battle area. You simply get much more bang for your air cavalry buck when you use it to take the enemy's eyes away.

The goal of synchronizing our efforts will take some time to develop. The air cavalry will enhance its effectiveness by developing SOPs which will allow it to initiate the CR fight almost upon occupation of an

area of operations. The S-2 simply needs to identify the DRT NAIs during his battlefield area evaluation to begin the collection and destruction effort. This initial DRT sweep could be accomplished with minimal assets and since it would be conducted in concert with a standard zone reconnaissance, it would have no adverse impact on future operations.

It would, however, allow the friendly commander to breathe much easier knowing that his moves are not being observed from the onset. As the remainder of the CR assets enter the area of operations, the synchronized CR battle could be picked up by other air cavalry assets who are more thoroughly briefed and can significantly enhance the CR efforts of the initial sweeping force.

The CR fight is not limited to a Soviet model force. CR efforts are equally important when conducting operations in urbanized terrain and in low intensity conflict. Regardless of what type of force we are up against, the enemy will be trying to observe us through the earliest and most economical means possible. Although the Soviet system may be fading, the tactics we use to defeat its DRTs will continue to serve us in whatever type of conflict we may find ourselves in.

Air cavalry is critical to the successful CR fight, and a CR victory is critical to our success in the close battle. Although our current doctrine fails to integrate air cavalry into the overall CR fight, we must tie these assets into our CR plan. Air cavalry is the most responsive, versatile, and well-suited force to conduct CR missions. All intelligence and operations officers in air cavalry units need to ensure they are employing their forces in a standard, well-planned, synchronized effort to defeat the enemy reconnaissance elements, forcing the enemy commander to play into our friendly commander's hands. The comparatively small effort we put forth in the CR fight will save us great effort and many lives later on. Victory in the CR fight gives us the upper hand in the ensuing clash of our main forces in the close fight.

"Air cavalry is critical to the successful CR fight, and a CR victory is critical to our success in the close battle."

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CPT Prygoski wrote this article while attending the Aviation Officer's Advanced Course 93-03, Ft. Rucker, AL.

BY LTC PAYNEE O. LYSNE, RET.

IN THAT BOX IS AN AIRPLANE

How an ad hoc group of Aviators was trained in North Africa for the Fifth Army in World War II.

When the Second U.S. Army Corps went to England in 1942, it presumably went with a full complement of L-4 Cub planes and pilots, two pilots and planes per Field Artillery Battalion. These pilots were presumably and probably graduates of Class One or Two at Ft. Sill, OK.

Before the invasion of North Africa, or shortly thereafter, someone discovered that there were not enough pilots and airplanes to fill the authorized TO&E for the artillery. Sometime in December, 1942, I was sitting at the Company CO's desk, G Company, 591st Engineer Boat Regiment, and read a flyer that in essence said "We need pilots to fly L-4 type aircraft."

I didn't know an L-4 from a B-17, but I did have my private pilot's license which I received through the Civilian Pilot Training Program (CPTP) during college in 1940-1941.

On 3 February 1943, HQ Fifth Army issued orders to nine officers and seven enlisted men in various units throughout North Africa, placing them on Detached Service to the Fifth Army Air Op School at Sidi-Bel-Abbes, Algeria, North Africa. Sidi-Bel-Abbes was then the home of the French Foreign Legion.

My Company Commander, CPT William G. Gardner, G Company, 591st Engineer Boat Regiment, took me to the school in his command car. When we were close to the school, we saw those Piper Cubs flying around. The comment from CPT Gardner was, "Do you see those planes, Lysne? They're just covered with

cloth — you're going to get your ass shot off." My answer was, "Until then, I'll be able to sleep between sheets instead of in a damn mud hole."

Upon reporting to the school, we reported in "Pinks and Greens" (officers) to LTC John D. Salmon (non-pilot), Commandant, Fifth Army Air Op School. CPT John T. Walker was the Executive Officer, and CPT Delbert Bristol was the Adjutant. Walker was killed as a Major in an airplane crash taking off out of Rome, Italy for return to the States in 1944; Bristol made it to Colonel, and passed away several years ago.

After reporting I was told along with two others by a tough-looking Sergeant, "Do you see that large box? Well, in that box is an airplane, which you'll take out carefully. Assemble it by the book, and tomorrow, you'll fly it. And that box will be your home for as long as you're here in the school. Make yourselves comfortable, and get to work."

We did.

The flight instructors were Lieutenants Kaufman, Strok, Hall, Hendrix, Oswalt, Albert, Ely, Hartsfield, and Robertson. The students were Lieutenants Eifrig, Kleinsasser, Board, Johnson, Righter, Weil, Clark, Feinburg, Bollard, Staggers, Dale, Mack, myself, and Sergeants Herbert, Lynn, Huttlin, Sabadini, Stegall, Moody, Jellison, Atkinson, Kietzman, Cassel,

McCullum, and Sheppard.

Most of us received an average of 70 hours of contour flying, road landings, chasing goats, sheep, Arabs, etc. — very similar to the training program at Ft. Sill, with one exception: shooting touch and gos on the tops of Trailways busses as they were going down the highway west of Lawton, OK. When the bus company decided to wash the busses, they found many tire tracks on the tops.

The facilities at the airfield were adequate: a large sod field with no obstructions, a couple of hangars, and one or two other buildings. The aircraft crates were converted into cozy billets. There was considerable air activity in the vicinity — low-level training in B-25s and B-26s, C-47s towing and releasing gliders, and low-level practice runs by fighter planes.

At some time during our training program, the school was moved to an airfield near the town of Mascara, Algeria. This area was noted for its vineyards and wines. The war put a stop to the wine activities. The billets for the officers were in a winery with 900 gallon vats all around — not too good for the would-be pilots, but we were saved as the vats had drowned rats floating around in them.

One of the prerequisites to graduation was "don't break a propeller"; if you did, you were automatically terminated from the school, since there was a real shortage of props in the North African theater of operations.

Upon graduation, we were sent to various units throughout the theater that were short pilots; almost all went to Field Artillery units. I was sent to the HQ, Fifth Army at Oujda, Morocco as Fifth Army Air Courier Officer, attached to the Fifth Army Artillery Section under General Thomas E. Lewis.

From North Africa, some of the pilots went on to Sicily, others went on to Italy. Lieutenants Robert S. Feinberg and Ross Fleming were launched off an LST PSP (Pierced Steel Planking) runway during the invasion of Italy at Salerno. Their job was to recon, observe, and adjust artillery on the enemy. This was a one way trip, as you could not come back and land on the LST.

When the pilots ran low on gas, they had to land and refuel from any source available, usually a truck or tank with five or ten gallons of gas, and then continue their mission. There was one pilot, PFC Charles R. Holladay, that prior to the war was a test pilot for Aeronca. He was a ground pounder in the VI Corps, and was picked up by the Corps Artillery Aviation Officer to come and fly with him to fill a vacancy. He was an expert and knew all the tricks, as he was

one of the civilian demo pilots during the Louisiana Maneuvers.

All graduates from the Fifth Army Air Op School continued to fly combat missions. But someone opened a can of worms by "discovering" that those pilots which were trained in North Africa were not properly rated "Liaison Pilots" — in other words, they hadn't been rated by the Army Air Corps Instructor Pilots at the Primary Flight School at Pittsburg, KS. From there, the students went on to Ft. Sill for advanced training, graduation, and rated Liaison Pilots.

In February 1944, HQ Fifth Army published Special Order #33, which relieved 26 officers and enlisted men from duty in the Mediterranean theater of operations and assigned them to Ft. Sill for the purpose of undergoing further training with a view to being rated Liaison Pilots.

What a big deal — we were all combat qualified, had many hours of combat flying, artillery adjustment, fire control, reconnaissance, aerial resupply, float plane operations, and other types of missions. Many of us were up for promotion, but when these orders were published, all recommendations were stopped. I personally had acquired some 500 hours in Africa and Italy.

We were authorized to travel by belligerent vessel, commercial transport, Army transport, Navy vessel, and/or rail — in fact, any way we could get there was OK with DA.

Upon arrival at Ft. Sill, we were more or less put in a pool and looked upon as odd balls until the IPs from Pittsburg, KS were sent down to give us our check rides for out rating. My check ride consisted of taking off and climbing to 4,000 feet on a Southeasterly heading away from Post field. At 4,000 feet, my IP eased back on the throttle and said in a loud voice, "FORCED LANDING!" I almost shouted back, "NO S--!" but instead asked if he wanted to land back at Post Field or in one of the fields below. He said one of the fields would be OK.

We glided and glided, checked for carb ice, and glided some more. I set up an approach to a large pasture, and on long final, the IP said, "OK, let's go back to Post Field." We did, I passed, and my orders rating me a Liaison Pilot were forthcoming. All the others that came back under the same circumstances suffered the same strenuous check ride.

This school was a one time affair, one class only. After this class, the school was closed. Upon graduation, each of us were issued an airplane, a roll of safety wire, a pair of needle-nose wire cutters, and a pocket knife. The knife, we were told, was to carve a propeller in case we broke one.

Hopefully I've remembered all of this accurately — after all, it's only been 50 years.

★★

LTC Lysne was first an L-4 pilot during World War II.

BY 1LT SILVIU P. BORA

MORE THAN ARRIVAL AND DEPARTURE: THE TACTICAL ATS PLATOON

How a single ATS platoon can enhance the ground tactical commander's scheme of maneuver.

An elite four man team is flying to its target area in a C-130 at an altitude of 500 feet. The team is completing its final equipment checks while two other teams are approaching their targets by UH-60 Black Hawk helicopters.

"Green light — go!"

The four men jump out the door of the C-130 and count to four. Their parachutes open; everything is quiet as the paratroopers float to the ground and prepare for a parachute landing fall. The second team has completed its insertion into its target area. The third team's helicopter hovers above a small opening in the trees. The soldiers quickly rappel down 100 foot ropes to the ground and begin navigating to their target area. Their missions: to infiltrate a deserted airfield without being detected, assess and report conditions, and control the airdrop and AirLand operations of the follow-on Army force.

This is one of the many missions of an Army Tactical Air Traffic Services (ATS) platoon, the "pathfinders" of Army Aviation.

Army ATS organizations provide their services to all airspace users at the tactical, operational, and in some instances, the strategic level. These services enhance the command and control capabilities of all maneuver commanders. Army ATS elements are employed in support of maneuver commanders within the framework of military operations characterized as deep, close, and rear, as well as across the spectrum of military operations.

The 1st Battalion, 58th Aviation Regiment of the 159th Aviation

Group (Airborne) is comprised of five companies. Alpha Company supports the 101st Airborne Division (Air Assault) and the XVIII Airborne Corps; Charlie Company supports the 24th Infantry Division (Mechanized); Delta Company supports the 10th Mountain Division (Light); and the HHC provides command and control as well as administrative and logistical support to all the companies. Bravo Company, located at Ft. Bragg, NC, supports the 82d Airborne Division and the XVIII Airborne Corps aviation assets. HHC also contains the A^2C^2 element which interfaces with the Corps A^2C^2 cell.

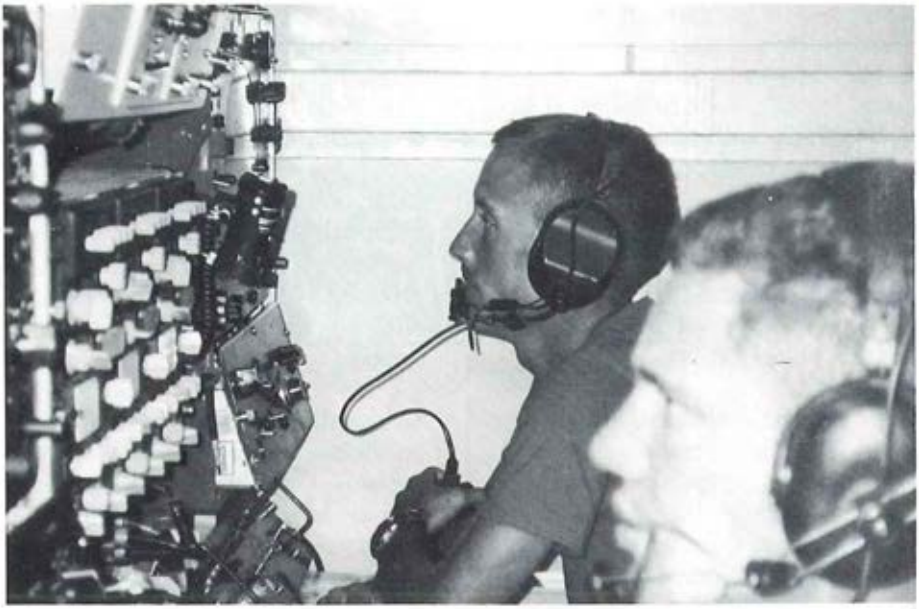
Bravo Company is organized into three ATS platoons and one support platoon. Each tactical ATS platoon is task organized into four sections and is capable of operating a fully instrumented airfield in support of a division-size element. Each platoon is also organized to be self-sustaining, with its own maintenance, C&E, and PLL support.

The Flight Following section provides enroute services and procedural control of aircraft from an AN/TSC-61B Flight Operations Center (FOC)/Flight Coordination Center (FCC). The TSC-61B FCC provides real-time interface for changes, coordination, and assists in the deconfliction of airspace requirements. Aircraft navigational assistance in provided by an AN/TRN-30(V)2 Non-Directional Beacon (NDB) which has a range of 100 nautical miles, depending on the terrain and altitude of the receiving aircraft. The FCC also provides a full range of airspace user information to include enroute structure, restricted areas, PIREPS, artillery/ADA positions, and weather information.

The FCC is a ground-to-air communications system consisting of one HF, three FM (SINCGARS), three VHF, and three UHF radios. Additionally, this unit has a KY-68 secure MSE telephone, a grid matrix computer, and the capability to monitor fifteen landlines. The FCC has three operator consoles with each console capable of monitoring all communication equipment.

The Ground Control Approach (GCA) section operates from an AN/TSQ-71B Landing Control Central System consisting of two FM (SINCGARS), three VHF, and three UHF radios. The GCA provides positive control, terminal ASR/PAR radar approaches, sequencing, and spacing for all aircraft. The unique capability of this system is its ability to assist aircraft recovery in IMC conditions. The GCA also has IFF interrogation and aircraft tracking capabilities through the use of its radar.

The Tower section provides terminal services from AN/TSW-7A (or -70A) Tactical Tower consisting of



three FM (SINCGARS), three VHF, and three UHF radios. The tower permits the movement, takeoff, landing, and sequencing of all aircraft (rotary, fixed wing, UAV) to or from a particular point or place on the ground. This section also has the ability to provide navaid support with an AN/TRN-30(V)1 tactical NDB with a range of 30 nautical miles, issue traffic advisories, and provide tactical airfield lighting for runways.

The Tactical Aviation Control Team (TACT) section consists of a four man team that can rapidly deploy within six hours of its alert. The TACT is a highly mobile, light team with pathfinder training and airborne capabilities. They are equipped to conduct and sustain 24 hour operations. This highly flexible team is versatile enough to support all contingencies (including natural disasters) while providing ATS battlefield services across the spectrum of military operations. The team requires minimal logistical support for a period of 72 hours, but their tactical movement is dependent upon the mobility of the supported unit.

The TACT is equipped with an AN/PRC-119 (FM), an AN/PRC-113 (VHF/UHF), and AN/ARC-104 (HF), and two AN/PRC-127 (handheld VHF) radios. These radios are manportable, secure voice, and databurst communications packages. In addition, the TACT is equipped with a HMMWV containing the AN/GRC-

206 system (FM, VHF, UHF, HF radios) which can be remoted up to three kilometers from the operational airfield, an AN/TSQ-97 (FM, VHF, UHF, altimeter and wind gauge), an AN/TRN-30(V)1 tactical NBD, and a Global Positioning System. This unique capability allows the TACT to be co-located with the ground unit commander in order to keep him apprised of the aviation tactical plan.

The mission of the TACT is to provide air traffic control services into and out of unimproved and austere landing areas to include landing/pick-up zones, drop zones, FARPs/RRPs, and airheads. This mission requires the TACT to be task-organized and capable of performing operations at multiple sites simultaneously. If the TACT is deployed by airborne assault, the teams will carry man-portable radios. This will limit the capability of operating multiple sites to one type of frequency (FM, VHF, UHF, HF) per site.

During a typical tactical deployment of the 82d Airborne Division's maneuver brigade, the TACT and the supported unit deploy within six hours of notification to conduct an airborne assault in the forward area where they prepare to accept and support follow-on elements in subsequent combat operations. The airborne assault is usually conducted into a probable airfield where the TACT will provide air traffic control services, advisories, and airspace coordination for follow-on elements. This, in turn, provides the commander a decisive advantage by coordinating and deconflicting airspace and enabling timely employment of airspace users. These services will be provided for a three to five day period or until the TACT is replaced by elements of the parent ATS company with semi-permanent terminal services.

Once the ATS platoon and follow-on elements arrive at the airfield controlled by the TACT, the tower takes over ATS operations from the TACT. This enables the TACT to prepare for follow-on missions. As the airhead continues to expand, the remainder of the platoon sections proceed to transform the airhead into a fully instrumented airfield with terminal radar, navaid, and flight following services.

Tactical ATS offers much more than just arrival and departure clearance. It is envisioned that ATS has the capability to support the entire range of enroute service and terminal operations at landing areas and/or airfields at division and corps level. When properly integrated into the maneuver commander's overall scheme of maneuver, Army ATS can greatly enhance combat operations.

★★

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SGT Melvin J. Bell
SPC Jillian A. Bernier
PV2 John P. Bonfigcio
SGT Gregory Brooks
SPC Marlon C. Bryant
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SPC Larry M. Collins
PFC Lino Cordero
PV2 Michael E. Curtin
SPC Kenneth L. Davis
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PFC James N. Glenn
PV2 William E. Goss
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SGT Jody G. Harris
CPL David E. Heath, II
SGT Clark K. Herring
SPC Darvel Hodge
SP4 David T. Hord
PV2 Jason J. Hunt
SPC Julie A. Irwin
SPC Kyung Shin Jang
SGT Solina Johnlinn
SSG Herman Jones
PFC Andreas Jung
PV2 Warren Kidwell
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SGT Dirk Laraby
PV2 Brian J. Lee
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CW3 Ray E. Robinson

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Mr. Eric D. Goode
MAJ David B. Jason

WINGS OF THE MARNE CHAPTER
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1LT Michael J. Backus

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Mr. Raymond L. Christopher
Mr. Patrick A. Foley
CW3 Travis N. Johnson, Jr.
Mr. Terry Moline
Mr. Rick Rathbun
CDT Clint D. Tabor

NEB MINUTES

AAAA's National Executive Board (NEB) conducted its Winter meeting at the NCO Club, Fort Rucker, Alabama, on 1 December 1993. Major actions included:

AAAA 1994 CONVENTION - REVIEW OF REGULATIONS GOVERNING DOD PARTICIPATION. Mr. Coakley referred the NEB to the Memorandum from the Secretary of the Army, The Honorable Togo D. West, Jr., establishing a blanket determination that it was in the Army's interest for Army military and civilian personnel to attend the 1994 AAAA Convention.

FUTURE CONVENTION SITES - 1995. A motion was approved to approve Atlanta as the site of the 1995 AAAA Convention.

FUNDING REQUESTS. A motion was approved to allocate projected excess funds as outlined in the Agenda as follows: 1) $115,700 to the Emergency Fund; 2) $9,000 to the Hall of Fame Escrow Fund; 3) $3,000 to the Archives; 4) $25,000 to the AAAA Scholarship Foundation; and $13,553 to the Army Aviation Museum Foundation.

NOMINATIONS: SLATE FOR 1994-1997. A motion was approved to accept the Nominations Committee's recommendations that the following individuals be placed on the ballot for the election on Thursday, April 21, 1994 at the Annual Membership Meeting: COL Sylvester C. Berdux, Jr., Ret., LTG Jack V. Mackmull, Ret., and Mr. George T. Singley III.

ESTABLISHMENT OF AAAA STRATEGIC PLAN. MG Robinson advised the NEB that he and MG Beatty, co-chairman of the Planning Committee, were developing a vision for the AAAA that would aim to: 1) raise awareness of Army Aviation; 2) broaden support of Aviation; 3) communicate with Congressmen and DoD officials; 4) focus staff; and 5) minimize cost and overhead. MG Robinson advised that the committee was reviewing: 1) AAAA's purposes and objectives; 2) sources of AAAA membership and trends; 3) AAAA programs and activities; 4) AAAA finances; and 5) AAAA management including the AAAA By-Laws. MG Robinson advised the NEB that the committee would present its final report at the April 20, 1994 NEB meeting.

AAAA NEB NOMINATIONS. In accordance with the AAAA By-Laws, notice is hereby given that in addition to the nominations recommended by the Nominations Committee for those NEB offices in which vacancies occur at the time of annual election, floor nominations may be made at the Annual Meeting, provided that the name of the floor nominees appear on nomination petitions signed by 25 AAAA members and said petitions are provided to the Chairman of the Nominations Committee at the AAAA National Office at least 30 days prior to the conduct of the AAAA Annual Meeting.

CAREER TRACK

Active AAAA members may have a 30-word classified employment ad published in two consecutive issues of ARMY AVIATION MAGAZINE free of charge. Write to the AAAA National Office, 49 Richmondville Ave., Westport, CT 06880-2000, or call (203) 226-8184 for Career Track applications. Inquiring organizations contact the National Office.

USAR CW2 UH-1 Aviator desires FW transition/pilot slot with Reserve/Guard unit. IERW 1991. FAA commercial instrument multi fixed wing. Very hard worker won't let you down. 93-12-01

National Awards Presented at

The AAAA Army Aviation Air/Sea Rescue and the Army Aviation Trainer of the Year Awards were presented at the AAAA Aviation Center Chapter Banquet, December 2, 1993.

The **50th Medical Company (Air Ambulance)**, Ft. Campbell, KY, was named this year's winner of the Army Aviation Air/Sea Rescue Award sponsored by Lucas Aerospace. This award is presented annually to "the crew or crew member who has performed a rescue using a personnel rescue hoist that saved the life or eased the suffering of an individual or individuals during the awards period encompassing September 1, 1992 through October 31, 1993." MG John D. Robinson, Commanding General, USAAVNC and Ft. Rucker (above left) and MG Harrison, Ret. (above center left) presented the award to MAJ Garry Atkins, Commander of the 50th Medical Company (above right). Richard Murphey (above center right), Lucas Aerospace Regional Marketing Executive, was present to offer congratulations on behalf of Lucas.

The 50th Medical Company (AA), was recognized for rescuing 86 hikers stranded by the "Blizzard of the Century" from March 14—18, 1993. Four Aeromedical Evacuation Helicopters equipped with internal hoists routinely flew 10-11 hour days in adverse environmental conditions to rescue isolated hikers in the 1500-square mile region of the Smoky Mountain National Park. Most rescue operations involved pilots hovering their aircraft for up to 45 minutes, while the crewchiefs maneuvered the hoist lowering the medic to rescue the multiple frost bitten hikers at each location.

In one instance a crew found two unconscious individuals lying in water, snow, and ice. The medic was lowered on the hoist by the crewchief as the pilots maneuvered the aircraft closer to their location. The individuals were unable to ride the hoist unassisted, so the medic secured the patient to the jungle penetrator and rode with the individual to the aircraft above. They were flown directly to the University Hospital in Knoxville, TN, and received emergency medical treat-

Fort Rucker Ceremonies

ment enroute that clearly saved their lives. Both patients had severe frost bite and exposure and were within minutes of their death.

In all, 29 hoist missions were conducted at altitudes of 3,000—7,000 feet in extremely mountainous conditions utilizing up to 200 feet of hoist cable to rescue the stranded hikers.

The 1993 AAAA Trainer of the Year was presented to **SFC Alexander A. Tejada**. Sponsored by CAE-Link Corporation, this AAAA National Award is presented to "the trainer who has made an outstanding contribution to Army Aviation during the awards period encompassing September 1 through August 31."

SFC Alexander Tejada was cited as a highly motivated, enthusiastic trainer who consistently excelled. He is a Master Instructor who teaches Latin American students in Spanish in support of the interests of the United States and Latin America. SFC Tejada is a Master Fitness Trainer and Spanish Instructor Trainer. He also serves as senior training evaluator for the Fort Eustis School of the Americas, and is universally recognized within the Aviation Logistics School as a superior noncommissioned officer and teacher.

Pictured above (from left to right) are Mr. Al Gagne, V.P. Program Management, CAE-Link Corp., MG John D. Robinson, MG Benjamin L. Harrison, Ret. and SFC Tejada.

Also, recognized at the December 2, 1993 event were the AAAA U.S. Military Academy Cadet of the Year, **2LT Marc A. Wehmeyer**, and the AAAA ROTC Cadet of the Year, **2LT Roy R. Trumble, IV**

AAAA local Aviation Center Chapter award winners included: **CW5 James Raiford**, the James H. McClellan Aviation Safety Award; **Rickie L. Barron**, the Joseph P. Cribbins Outstanding Department of the Army Civilian Award; **Aviation Training Brigade**, the Robert M. Leich Award; **SFC Sherman A. Loney**, the Army Aviation Soldier of the Year Award; **CW4 James Church**, the Army Aviator of the Year; **CW3 Stephen Woods**, Trainer of the Year Award; and the **1st Battalion, 11th Aviation Regiment**, the Outstanding Aviation Unit Award.

New AAAA Chapter Officers

Aloha Chapter:
MAJ Larry H. Hysell (Sr. VP)

Armadillo Chapter:
LTC Christopher G. Gallavan (VP, Memb)

Aviation Center Chapter:
LTC Walton C. Carroll (Treas)

Cedar Rapids Chapter:
LTC Richard E. Ferguson, Ret. (VP, Memb)

Colonial Virginia Chapter:
MAJ Alan K. Yeske (TRADOC Liaison)

Iron Eagle Chapter:
CW5 Lance V. McElhiney (VP, Warrant Officer Affairs)

Hudson-Mohawk Chapter:
MAJ Alan J. Murray (Pres); CW2 Kent W. Wagner (VP, Memb)

North Country Chapter:
CW2 Michael W. Tucker (Secy); MAJ Brett J. Johnson (Treas); CW3 Paul H. Clarke (VP, Memb); 1LT John M. Vannoy (VP, Prog)

Pikes Peak Chapter:
CW4 William D. Wade (Secy); MAJ George H. Rhynedance (Treas); 1LT(P) Susan M. Duke (VP, Prog)

Ragin' Cajun Chapter:
LTC Harry A. Shively (Pres); LTC Paul J. Pozorski (Sr. VP); CPT Scott S. Burgess (Secy); CPT James E. Larsen (Treas); CPT Michael Negard (VP, Memb); CPT Ray D. Gentzyel (VP, Prog); SFC Thomas B. Parton (VP, Enlisted Affairs)

Razorback Chapter:
SFC Jerry Johnson (Secy); WO1 Daniel Dunn (Treas)

Savannah Chapter:
MAJ Larry W. Fleniken (Secy); CPT Steven A. Boylan (Treas)

AAAA Chapter News

In the last few months, AAAA has had one new chapter activate and two chapters change names. AAAA's newest chapter, the **Flying Tigers Chapter**, activated at Fort Knox, KY in late summer and now numbers 78 members under Acting President, MAJ (Dr.) Rogelio L. Carrera. On 23 October 1993, the Chapter awarded Bronze Orders of St. Michael to SSG Donald G. Sparks and CW4 Donald A. McLaughlin.

The two chapter name changes involved the former Hanau and Wings of the Devil Chapters. The Wings of the Devil became the **Ragin' Cajun Chapter**, Fort Polk, LA and Hanau became the **Iron Eagle Chapter**, Hanau, Germany.

In other chapter news, the **Pike's Peak Chapter** held a general membership meeting on 14 December 1993 and drew a crowd of over 140 personnel. COL Robert J.H. (Andy) Anderson, Chapter President and Commander, 4th Aviation Brigade, gave a Safety Briefing and Aircraft Accident Review followed by an address by BG Burt S. Tackaberry, Command Director, North American Aerospace Defense Command, Peterson AFB, CO. The results of the chapter election appear at left. A buffet and membership drive closed the event.

The **Iron Mike Chapter** at Fort Bragg held a professional Lecture at the JFK Special Warfare Center Academic Facility on 15 December 1993. The new Chapter President, COL Henry C. "Hawk" Ruth III, Commander, 159th Aviation Group, stated his intent to establish a strong and vibrant chapter and then specified some of the future planned activities. BG Thomas Konitzer, Commanding General, 1st ROTC Region was the guest speaker who briefed on the history and future of the Aviation Branch. In other Iron Mike news, SGT Joseph T. Ebuen, Company B, 1st Battalion, 58th Aviation Regiment, has not only been named XVIII Airborne Corps NCO of the Year, but was also recently named the Distinguished Graduate for the USAF AN/GRC-206 Maintenance Course. He is believed to be the first soldier to attend this USAF course. He received an AAAA Certificate of Achievement in recognition of his outstanding achievements.

AAAA ANNUAL ESSAY CONTEST

The 1994 Second Annual Essay Contest is underway. Suspense date is July 1, 1994.

DOCUMENTATION

The official application form should be used and is attainable from the AAAA National Office, 49 Richmondville Avenue, Westport, CT 06880-2000; Telephone: (203) 226-8184, FAX: (203) 222-9863.

AWARD PRIZE

First prize earns a $500 honorarium; second prize earns a $300 honorarium; and third prize earns a $200 honorarium.

AAAA Scholarship program offers $125,000 in 1994

Scholarships now "set aside" for AAAA Enlisted, Warrant Officer, Company Grade Officer and Civilian members. Two scholarships also "set aside" for spouses of AAAA members.

To apply, please request a Scholarship Grant/Loan Application and return it to the **AAAA Scholarship Foundation, 49 Richmondville Avenue, Westport, CT 06880-2000** on or before **May 1** (postmark will govern). For further information call: Telephone: (203) 226-8184 FAX: (203) 222-9863.

AAAA CALENDAR

A list of upcoming AAAA Chapter and National dates.

February, 1994

Feb. 2-4. 20th Annual Joseph P. Cribbins Product Support Symposium sponsored by the AAAA Lindbergh Chapter, Stouffer Concourse Hotel, St. Louis, MO.

Feb. 3. AAAA Outstanding Aviation Logistics Support Unit of the Year Award Presentation & Industry Award Presentations, Stouffer Concourse Hotel, St. Louis, MO.

March, 1994

Mar. 25-26. AAAA USAREUR Region Professional Sessions and USAREUR Region Ball.

April, 1994

Apr. 20-24. 1994 AAAA Annual Convention, Cervantes Convention Center, St. Louis, MO.

Apr. 20. AAAA National Executive Board Meting, Cervantes Convention Center, St. Louis, MO.

Apr. 21. AAAA Scholarship Board of Governors Annual Meeting, Cervantes Convention, Center, St. Louis, MO.

July, 1994

Jul. 15. AAAA Scholarship Board of Governors Executive Committee Meeting, Best Western, Arlington, VA.

Hall of Fame Nominatons Due July 1, 1994

An AAAA-sponsored Army Aviation Hall of Fame honors those persons who have made:

- an outstanding contribution tc Army Aviation over an extended period;
- a doctrinal or technical contribution;
- an innovation with an identifiable impact on Army Aviation;
- efforts that were an inspiration to others, or
- any combination of the foregoing, and records the excellence of their achievements for posterity.

All persons are eligible for induction, except active duty Generals and Colonels. Membership in AAAA is not a requirement.

Contact AAAA National Office (203-226-8184) for Nomination Documentation requirements. All nominations must be postmarked not later than July 1, 1994.

An eight member Board of Trustees is responsible for selecting a specific number of candidates from all nominations received for placement on the Army Aviation Hall of Fame ballot. The ballot will be mailed to AAAA members with two or more years of current continuous membership in the Fall of 1994.

NEVER LOSE TOUCH

WITH THE ROCKWELL/HARRIS SOLUTION FOR ARMY NAP-OF-THE-EARTH COMMUNICATIONS.

Interoperable air and ground high-frequency communications are assured by Rockwell/Harris team experience. The two leading HF suppliers in the world have joined forces and technical expertise to meet the Army's most important NOE COMM requirements through the ARC-220 pursuit. Separately, it has taken Rockwell (airborne HF) and Harris (ground HF) more than 10 years and significant individual investments to develop the key technologies to implement U.S. MIL-STD Automatic Link Establishment, Electronic Counter Countermeasure and data modem waveforms.* Not an easy task, yet accomplished through diligent engineering and innovation. Together, these two industry-leading companies offer complementary low-risk solutions for the full range of NOE COMM requirements, for air and ground. They have conquered the complexities of some of the toughest waveforms ever developed and made it all very easy to use. Rockwell and Harris have off-the-shelf production equipment available today to demonstrate that they can meet the stringent requirements of the U.S. Army's NOE COMM program. Communications are assured with the high-frequency systems from the Rockwell/Harris team -- the source for advanced HF products to meet tough requirements. The ARC-220 will be a quality solution from the experienced leaders in HF communications. For more information, contact the Rockwell/Harris NOE COMM Program Office at (319) 395-1600, fax to: (319) 395-5111, or write to: Rockwell/Harris, NOE COMM Team, Dept. 120-131, 350 Collins Road NE, Cedar Rapids, Iowa 52498.

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Communications Division

HARRIS

RF COMMUNICATIONS GROUP

*MIL-STDs are ECCM 188-148, ALE 188-141A, Modem 188-110A.