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APRIL 1978

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Air Combat Maneuvering - page 7

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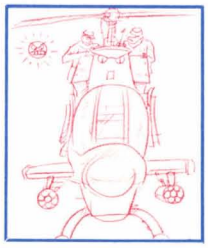

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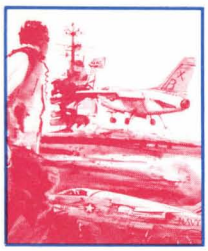

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Richard K. Tierney
Editor

The mission of the *U.S. Army Aviation Digest* is to provide information of an operational, functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine and other related data.

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When we write and talk about the FARRP—where it should be, how it should be equipped and supplied, who should work there—I can't help but think of something I would like to share with you.

I remember a place back of the forest where PFC Fred Knox is going about the business of refueling aircraft and stuffing rockets. This is good, but Fred is saying to himself, "Was that *one* chaff and *two* smoke—or *three* illumination and *one* chaff—or *what?* Let's put in a bunch and see what happens."

We should never forget that it's always raining in the FARRP; it's always dark in the FARRP—or too hot or too cold; fuel pumps and hoses and gauges never want to work properly and need constant attention in the cold, dark FARRP; the thing that carries the ordnance *always* has a flat tire in the FARRP—where Fred works.

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FORMULA FOR A FARRP

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A NUMBER OF articles have appeared in military publications concerning the forward area refueling and rearming point (FARRP). They explain why a FARRP is needed and what it is. However, the articles omit many answers to the most important questions. Who establishes the FARRP? Where do its assets come from? When is it established? And most important of all, how does a helicopter unit commander establish this logistical lifeline?

Contrary to popular belief the logistic "tail" of helicopter units does not get unplugged and plugged into logistics supplies like an umbilical cord, nor can the support requirements be pushed totally upon ground combat units.

If you as a helicopter or ground unit commander were ordered to establish a FARRP, what would you do? This article—and TC 1-60, "Forward Area Refueling and Rearming Point (FARRP) Operations"—provide guidelines (see March *Digest,* page 43, for more on TC 1-60). First, get rid of the Vietnam syndrome of what a FARRP is. We established very, very few FARRPs in Vietnam. We set up countless numbers of refuel and rearm points—but not many FARRPs. How many gun pilots ever refueled out of a 500-gallon blivet of JP-4 and a stack of ammo out in the boondocks?

FARRP RECOVERY (MINUTES)	ORDNANCE MAX IN 5 HRS	SORTIES PER AH IN 5 HRS	TOS MIN PER AH
34	280	2⅓	40
32	280	2⅓	38
30	320	2⅔	36
28	320	2⅔	34
26	360	3	32
24	400	3⅓	30
22	400	3⅓	28
20	440	3⅔	26
18	480	4	24
16	520	4⅓	22
14	600	5	20
12	640	5⅓	18
10	720	6	16
8	735	7	14
6	750	8⅓	12
4	750	10	10
2	740	12⅓	8
0	750	16⅔	6

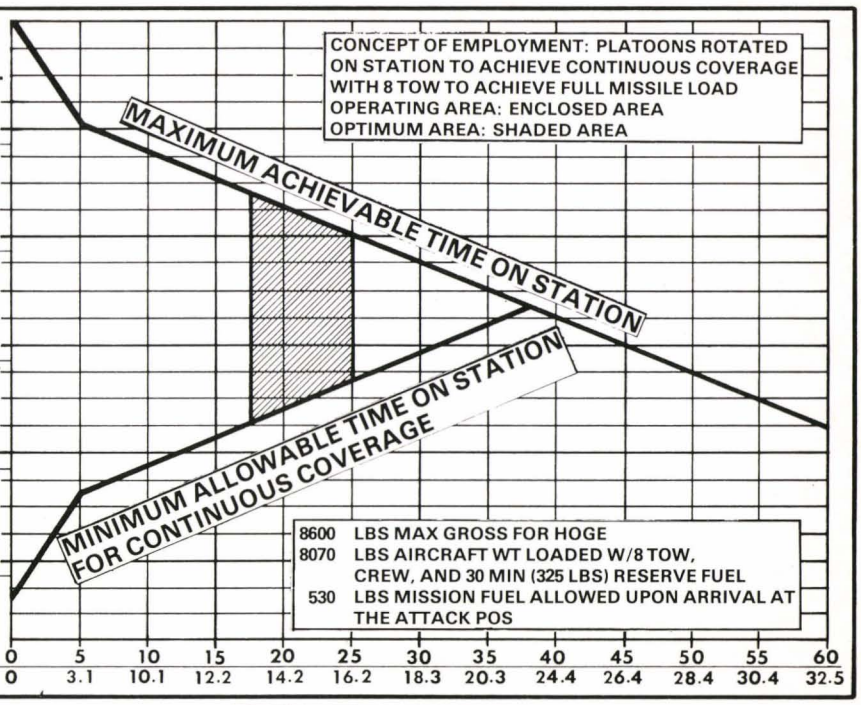

Figure 1: Effects of various FARRP locations on attack helicopter company capabilities (AH-1Q)

All right, let's start back at the beginning in the tactical assembly area where you received your mission and are fairly certain you need a FARRP.

Here is the situation: You are the commander of one of the two attack helicopter companies from an armored division's aviation battalion. The division is assigned to 1st Corps and is defending in the main battle area (MBA) with three brigades on a north-south line.

The mission of your attack helicopter company is as follows:

From division reserve, the company is to move to occupy assembly area VICTOR. It will be under the operational control (OPCON) of the 2nd Brigade; and on order, OPCON to the 3rd Brigade and the 1st Brigade, respectively. The company is to be prepared to revert to division control and occupy battle positions ALPHA, BRAVO, CHARLIE and DELTA. Company liaison officers are to be sent to the brigades for coordination. The aviation battalion S4 will coordinate the resupply of all FARRPs.

Faced with this mission, troop leading procedures are reviewed by the company commander. The concept of the operation includes developing operations plans (OPLANS) in each brigade sector in conjunction with division and brigade staffs. The attack helicopter company prepares for multicommitment within the division sector with priority to the most threatened avenue of approach in the critical 2nd Brigade sector. Liaison is established with division and brigade headquarters. FM 17-50, "Attack Helicopter Operation," describes the tactics and doctrine of employment of the company.

Leaving the tactical planning for a moment, consider the combat service support planning activities in progress by the company, the aviation battalion staff and the division support command (DISCOM) to support the operation. The company executive officer will coordinate with the battalion S4, who will coordinate the resupply of all FARRPs with the DISCOM staff. The company must ensure that organic helicopters have the correct mix of class III and class V and that the company's three GOER tankers and the six GOER ammo trucks are filled.

The company FARRP chief and crew are ready to move the FARRP to one of the three locations (one planned in each brigade sector) selected by the company commander and coordinated with each brigade ahead of time. DISCOM already has loaded 12-ton S&P trailers with the requested mix of class V for immediate dispatch to the FARRP.

The requested number of 5,000-gallon fuel tankers of JP-4 also are earmarked to support the company's FARRP operation.

Meanwhile, the platoon leaders have been briefed by the company commander on the concept of the operation and the proposed location of the FARRPs.

Now, leave the battlefield for a few moments and establish some terms of reference and the operating characteristics of the FARRP.

The FARRP is established in

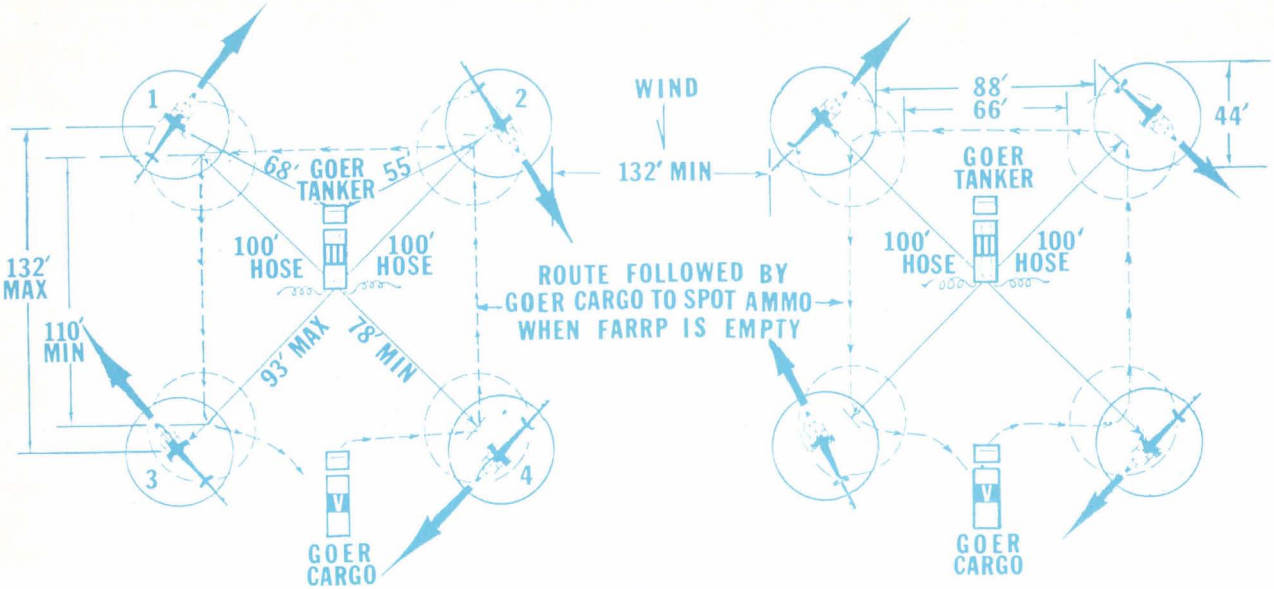

Figure 2: ARRS facility

the forward area and designed to optimize the timely and sustained employment of air cavalry and attack helicopter assets in combat. Specifically, the FARRP permits from five to eight helicopters (attack and scouts) to refuel and rearm simultaneously and be recommitted to the battle with minimum loss in turnaround time. The FARRP permits the attack helicopter and the air cavalry units to bring maximum pressure on the enemy by optimizing the mix of ammo and fuel for maximum firepower and flight time.

The essential characteristics of a FARRP are:

- It is planned for a short duration of only 3 to 6 hours at one location. This is necessary to reduce enemy targeting opportunities against the FARRP with indirect fire or tactical air sorties.
- It is usually located within a committed brigade zone of operation, between 17 and 25 kilometers from attack helicopter platoon attack positions. Such positioning ensures that it is far enough back to prevent normal enemy preparatory medium artillery fires from targeting the FARRP, yet permits quick turnaround of both the helicopters and the logistical transportation supporting the FARRP operation.
- The decision to establish a FARRP or not depends upon resupply time; distance from the trains area to the battle; and the tactical situation. If the distance from the unit trains area to the attack position is greater than 30 kilometers, then it is probably advantageous to the unit commander to establish a FARRP. If the distance is less than 30 kilometers, the attack and scout helicopters can probably use the unit trains area to refuel and rearm and there is no need to establish a FARRP. Thirty kilometers is the tradeoff point for the commander to ensure that sufficient fuel, mission time and armament are available to accomplish the mission as shown in figure 1. Resupply time involves the time necessary to move class III and class V to the FARRP location to sustain operations. Naturally, the tactical situation will affect supporting FARRP operations.
- The FARRP, while normally located in the brigade rear, should not be colocated with the brigade trains because this may result in both air and ground congestion in the trains area. Being near the brigade trains is desirable to permit resupply of the FARRP vehicles from the trains in the shortest possible turnaround time.
- When commanders decide to commit an attack helicopter unit, logistical planners and managers at COSCOM and DISCOM must ensure that adequate class III and class V supply points are pushed forward. This will enable FARRP vehicles to be replenished and limit turnaround time (from FARRP to trains replenishment and back to FARRP) for the aviation unit's FARRP vehicle to no more than 1½ hours. (If turnaround time exceeds 1½ hours, the FARRP either will be moved or out of class III and class V.)

Installation of a FARRP is contingent upon many factors, including time, location, accessibility, supply, weather and available equipment. The commander must analyze these factors before making a decision. Since it is unlikely that both ground

Figure 3: Personnel To Establish A Ground FARRP

Position	Attack Hel Co	Air Cav Troop
FARRP Chief	1	1
Flight Operations Coordinator	1	1
Aircraft Fuel Handling Specialist	3	2
Aircraft Armament Subsystem Mechanic	10	8
Ammunition Handler	1	1
Equipment Operator	1	1
TOTAL	17	14

NOTE: Depending on the number and type of transport assets available within the TOEs, additional personnel would include two per GOER and two per 5-ton truck.

Figure 4: Equipment To Establish A Ground FARRP

	Attack Hel Co	Air Cav Troop
Truck Cargo: 2½ Ton		1
Truck Cargo: 5 Ton		2
Aircraft Weapons Handling Vehicle	1	1
Truck Tank: Fuel Servicing 2½ Ton		4**
Trailer Ammunition: 1½ Ton		2
Truck Cargo: 8 Ton, 4×4 (GOER)	6*	
Truck Tank: Fuel Servicing 2,500 Gal (GOER)	3*	

* These vehicles are only available to attack helicopter companies not organic to the ACCB. ACCB attack helicopter companies have these assets in augmentation only. The aircraft refuel rearms study (ARRS) indicates that these trucks should be organic to attack helicopter units. This contention is supported by the author.,

** Divisional and ACR air cavalry troops have tank and pump units mounted in trucks in place of M49C.

and air transport would be used in the effort, a key point is that a FARRP can be emplaced and supplied by either method.

Another possible consideration is to establish a battalion or squadron FARRP to support company/troop operations. However, with this concept there is a danger that aircraft will become "stacked up" waiting to refuel and rearm. This increases the probability of detection. It also complicates the logistical siting by requiring a much larger piece of favorable terrain. Additionally, a battalion FARRP may often preclude multiarea commitment of air cavalry troops or attack helicopter companies due to lateral distances involved. This reduces the inherent flexibility of air cavalry and attack helicopter assets.

For basically the same reasons, an area support concept of FARRPs throughout the area of operations is not a realistic employment concept. Under this concept, multicommitment of units in an area could well result in a single FARRP being severely overloaded. Meanwhile, valuable class III and V would not be used in other areas because no units are committed in that sector.

Therefore, the large quantity of class III and V necessary to sustain an attack helicopter company or air cavalry troop for operations strongly supports the primary method of establishment of the FARRP by ground means. This method also allows for greater mobility and tactical flexibility.

A secondary method of FARRP establishment is by helicopter (either UH-1H Huey, UH-60 Black Hawk or CH-47 Chinook). Due to the large bulk quantities of class III and class V required, plus the supporting equipment and personnel, it is generally not effective to establish and maintain a FARRP by aerial resupply alone. However, aerial establishment always should be planned for during any operation to afford quick reaction to any unexpected contingency mission.

Under certain tactical situations *a third method or combination of aerial and ground* established FARRPs may be operationally desirable. For example, if an attack helicopter company received a very rapid commitment order, the FARRP may be established initially by air (enough class III and class V for one turnaround per helicopter) until relieved by the organic ground vehicles which then take over support and resupply of the FARRP mission.

Before returning to the tactical situation, examine what specific personnel and equipment are needed to establish a FARRP and the specific proposals made thus far for ground and aerial FARRP operations.

Figure 2 is a concept for an operational ground FARRP. In this concept, the FARRP has the capability of refueling and rearming eight aircraft (five attack helicopters and three scouts) simultaneously. Since rearming takes longer than refueling, two aircraft can be refueled in the time it takes one crew to rearm an attack helicopter. Thus, in this concept, a GOER tanker with two 100-foot hoses refuels four aircraft.

Pre-positioned ammunition (TOWs and rockets) are placed at each pad by a GOER cargo truck with boom which enables the ammo handler to rearm the aircraft. The scout aircraft probably will need only refueling and may not need rearming; as such they can be re-

Figure 5: FARRP Equipment Available To Air Cavalry And Attack Helicopter Units By TOE

The following list of equipment is available for FARRP use by specific TOE. The first two columns are the recommended equipment from the Aircraft Refuel Rearm Study (ARRS). The rest of the columns are what is available in current TOEs. The final column indicates whether equipment is used for aerial (A) or ground (G) emplaced FARRPs.

	ARRS AHC 17-111	ARRS ACT 17-58 17-108 17-208 17-208 17-278 17-98	TOE 17-111	TOE 17-387	TOE 17-58	TOE 17-98	TOE 17-108	TOE 17-208	TOE ACCB 17-208	TOE 17-278	TYPE FARRP
Control Pressure Filling Non-Vented Drum	2	2	4	6	2/1	0	2/1	2/2	2/2	2/2	A
Drum Fabric Collapsible: 500 gal	9	6	12	18	6/3	6/6	6/3	6/6	6/6	6/6	A
Forward Area Refueling Equipment (FARE)	3	2	4	6	2/1	2/2	2/1	2/2	2/2	2/2	A&G (if necessary)
Radio Set AN/PRC-77	1	1	0	1	2	2/2	2/1	2/2	2/2	2/2	A&G
Sling Multi Lec 15,000 lb Rat Cap	6	6	6	12	6	2/2	2/1	2/2	2/2		A
Testing Kit Petroleum	1	1	0	0	1	0	0	0	0		A&G
Tie Down Kit Collapsible Fabric Drum	3	2	4	6	2/1	2/2	2/1	2/2	2/2	2/2	G
Tool Set Aircraft Armament Requirement	5	4	11	20	13	14	14	14	14	13	A&G
Yoke Towing & Lifetime Collapsible	2	2	4	6	2/1	2/2	2/1	2/2	2/2	2/2	A
Aircraft Weapons Handling Vel (Dev)	1	1	0	0	0	0	0	0	0	0	A
Truck 8T Cargo				0/6							G
Truck 2500 gal GS				0/3							G

fueled and returned to the area of operations more quickly than the attack helicopter. In the interval between departure of this platoon and the arrival of the next, the GOER ammo trucks place additional unpackaged ammunition at each pad and the operation continues.

Resupply of the FARRP is accomplished by rotating the class III and V FARRP trucks to the brigade trains or corps supply points where they take on class III and class V from the assets that were pushed forward from COSCOM and DISCOM. If the FARRP is forced to move due to enemy indirect fire, it easily can be displaced and reestablished 1 to 3 kilometers away. The mobility and flexibility of this concept provides for rapid establishment and disestablishment times for attack helicopter missions.

Under this concept any road or small open area becomes a potential FARRP location.

In the case of air cavalry troops, trucks replace the GOERs and the 6,000-pound rough terrain forklift (RTFL) is used to move the ammunition around to the pads instead of the GOER with cargo boom. Above all else the FARRP remains mobile with minimum on-the-ground supplies. It remains ready to move and does not become another fixed logistical target for the enemy. The 6,000-pound RTFL is available in all aviation units by current TOE. However, a weapons service/general purpose vehicle is being developed and eventually will replace the RTFL.

The personnel listed in figure 3 are needed to establish a ground FARRP by type of organization.

The equipment listed in figure 4 is available within the TOE to establish a ground FARRP. (A complete listing of equipment is at figure 5.)

In an aerial emplaced FARRP, ammunition is brought in cargo nets; fuel is delivered in 500-gallon collapsible fabric drums (blivets); personnel, the FARE system (pump), and the forklift are all emplaced by CH-47s from corps or other non-organic aviation assets. If absolutely necessary, UH-1H or UH-60A helicopters can be used to carry 250-gallon blivets (if available) and some limited amounts of ammo.

A typical aerial emplaced FARRP can be seen in the photographs in figures 6 and 7. A considerably larger area is required to operate this FARRP because an unloading area where CH-47s can place their external loads must be designated.

As class III and V arrive, they are placed in separate holding areas and moved as needed to the pad area by the rough terrain forklift. However, establishment and disestablishment times for aerial emplaced FARRPs can be considerably longer than for ground emplaced FARRPs due to the number of sorties necessary to emplace FARRP materiel, personnel, class III and V. Also, because the CH-47 helicopter is found only at corps, this FARRP may be difficult to move if the CH-47 sorties are dedicated already to resupply elsewhere in the corps.

Personnel assets available by TOE to emplace an aerial FARRP are similar to those used for emplacing a ground FARRP; however,

Figure 6: CH-47 Chinook brings in sling-loaded cargo of blivets filled with JP-4 fuel

additional personnel are necessary as follows: 5 per CH-47 and 10 personnel to prepare and hookup slingloads in the rear staging area.

TOE equipment available for an aerial emplaced FARRP besides the complete listing of equipment at figure 3 is shown in figure 8.

Now, return to the battlefield and the attack helicopter company. The unit is ready for commitment in the division's area. When the decision is made to commit the company, the FARRP will immediately be dispatched and established at the proposed FARRP location.

For sustained commitment of attack helicopter assets, the attack helicopter platoons will be rotated into the battle by maintaining one onstation, one in the FARRP and one enroute to commitment. This concept permits the maximum sustained combat power of the attack helicopter company to be used.

The FARRP is an important short life logistical function in the employment of attack helicopter and air cavalry assets. It permits commanders to fully use their mobility, firepower, reconnaissance capability and to sustain the shock action that attack air cavalry and attack helicopter units provide to the battle.

GLOSSARY

ACCB	air cavalry combat brigade
ACR	armored cavalry regiment
ARRS	aircraft refuel rearms study
CFA	covering force area
Class III	fuel
Class V	ammunition
COSCOM	corps support command
DISCOM	division support command
FARE	forward area refueling equipment
FARRP	forward area refueling and rearming point
GOER	8-ton truck or tanker
JP-4	jet propulsion fuel
MBA	main battle area
OPCON	operational control
OPORD	operations order
RTFL	rough terrain forklift
S&P	stake & platform (semitrailer)
TOE	table of organization and equipment
TOW	tube-launched, optically-tracked, wire-guided missile

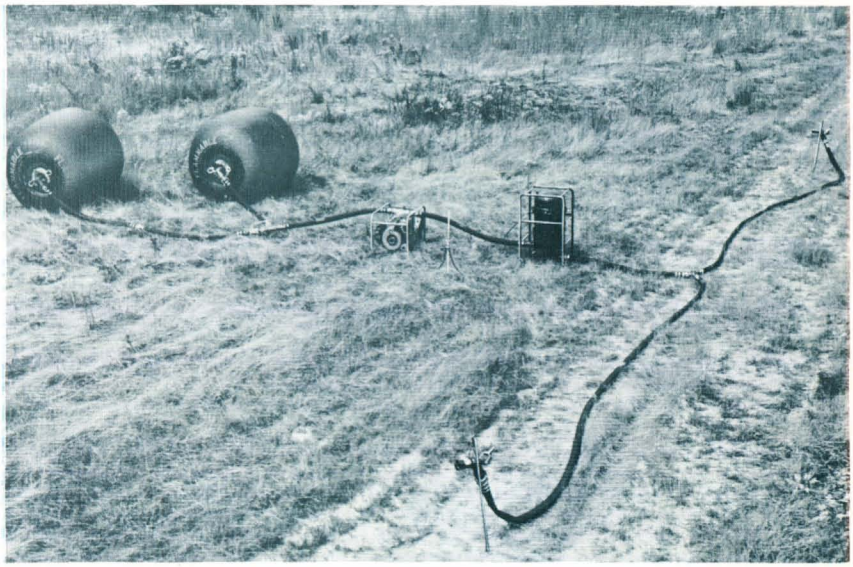

Figure 7: FARRP pump and collapsible JP-4 blivets allow for expeditious refueling in remote areas

Figure 8: Equipment To Establish An Aerial FARRP

Equipment	Attack Hel Co	Air Cav Troop
Drum, fabric, collapsible: liquid fuel 500-gal capacity	18	6
Forward Area Refueling Equipment: FARE	6	6
Sling multileg 15,000 lb capacity	12	2
Yoke Towing and Lifting	6	2
Truck Lift Fork: 6,000 lbs rough terrain	1	1
Truck Platform Utility: ½ Ton	1	

Analogies And Implications From Fixed Wing ACM*

The author offers his concepts about helicopter air combat maneuvering. His ideas are thought provoking for the article includes discussion of combat between helicopters and between rotary and fixed wing aircraft. Ideas expressed in this article are the author's exclusively and do not reflect an official position within the Department of Defense. Mr. Haering adapted this article from his presentation at the Air to Air Symposium last October

George Haering
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and
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Washington, DC

THE PURPOSE OF this article is obvious: there must be some generalities from fixed wing ACM which apply to combat between helicopters.

The thoughts I express in this article are based on my own experience which covers more than 130 ACM sorties (most in the past two years). While this is not extensive experience, it has been intensive and spans fighting in seven distinct types of fighters against 15 types of adversaries in fights ranging from one versus one to a 55-airplane engagement. Virtually all the sorties were with or against the ACM

***Air Combat Maneuvering**

instructors of four different air forces.

This article covers four topics:

- *The place of helicopter versus helicopter combat*
- *Differences and similarities compared to fixed wing*
- *Relevant fixed wing ACM lessons*
- *What to do next*

Helicopter versus helicopter combat is inevitable and may be desirable. It's inevitable because helicopters are armed and will encounter each other. In fact, the first helicopter air-to-air kill is history. In 1972, a North Vietnamese AN-2 trying to bomb a place in Laos was intercepted and shot down by an Air America UH-1 Huey.

Helicopter versus helicopter combat could be desirable if all types of fixed wing aircraft continue to have the difficulty demonstrated in tests to date attacking *aware* helicopters. It is obvious to me, therefore, that rotary wing air combat is not an academic matter. It is also obvious that it:

- is in its infancy;
- will be different from fixed wing ACM;
- will be similar to fixed wing ACM.

Infancy is evident from the fact that, although there has been some reasonable amount of testing, the first symposium on this subject occurred only last October at the U.S. Army Aviation Center, Ft. Rucker, AL.

We know that at least the following differences between fixed and rotary wing combat exist:

- Speeds, altitudes, time and distance, G (gravity) loads, endurance, sortie rates, etc.
- Movement of nose/velocity vector
- IR (infrared) signature
- Weather limitations
- Presence of rotor(s)
- Helicopter can land; has no ejection seats; carries troops vice bombs
- GCI (ground controlled interception)
- History, tradition, doctrine, training
- Details

I'm sure the above list is not all-inclusive, but it's a starter. I won't belabor any of the items, but will "tick off" a few.

Helicopters fly slower, lower, longer, more gently and more often than fighters. More gently has key implications: the absence of high G loads probably means avoidance of the memory problems which complicate fixed wing ACM training. (Longer endurance may work the opposite way.) It also means that helicopters don't have one dimension of fixed wing maneuverability and unpredictability.

Compensating for this is the relative freedom of the helicopter from momentum. It can turn and move sideways much better than fixed wing aircraft. Whether it can get the nose up better is unclear to me, as is the relevance of this dimension of agility in helicopter combat.

Helicopters don't have afterburners, and they do have rotor downwash. This, plus operating near potentially adverse background, makes them different IR targets.

Helicopters may operate in weather which cancels all or many fixed wing operations. The implications for combat with other helicopters are obvious.

The rotor makes another obvious difference. There are several reasons why a fighter likes to be at his opponent's dead six (directly behind). One is that he is safe from the opponent, and the opponent is maximally vulnerable. Looking at a helicopter through his rotor arc is an analog: he can't shoot at you, and your target is larger.

. . .people who say "That isn't our (your) mission". . . .What they don't think about is that the mission can be thrust on you by the enemy: we can control our missions only in peacetime. . . .

The fact that a helicopter can land more readily than a fighter means that this is one conceivable (not necessarily desirable) reaction to attack or damage. The latter is somewhat balanced by the absence of ejection seats. It could be made attractive for transport helicopters by the fact that their payload may be armed.

Fixed wing aircraft operate in an environment keyed to detect, track, and maybe, help it against other aircraft. While not true for helicopters, this may be balanced by wartime developments: destruction of ground controlled interception (GCI), jamming and increased sensitivity of ground units to enemy helicopters.

Next to last, and far from least, fixed wing ACM has been intensively developed (with a few interruptions) for more than 60 years. Those of us who train in it have an institutional memory stretching to 1915, and valid principles dating back that far. Further, fighter versus fighter training has been emphasized strongly since 1969 and tested in combat in 1972. It is the most vital, innovative and sophisticated branch of military training I have seen in 25 years. This is not true of helicopter versus helicopter combat: a situation that the symposium, held at the Army Aviation Center, is intended to help change.

As a start, let's look at what's similar:

- Adaptive multiplayer duel
- Machine guns to missiles
- Gunnery is an art
- Some turn well, some don't
- Some are larger, some are small
- Majority of force has no air-to-air mission
- Complex major operations
- Multithreat environment
- Aggressiveness

The contest, sometimes clinical, sometimes desperate, of several skilled human beings against each other is one key similarity. In fixed wing, it moves too fast to be adequately simulated by the largest computer. Between helicopters—we'll see. The weapons aren't identical yet, but they're analogous. They range from relatively short-range ballistic items to several kinds of guided missiles. And I'll bet they're not simple to use. Fixed wing gunnery is simple if all you have to do is put your nose on somebody and say, "ATOLL/FOX 2/Guns/Bang, you're dead." Gun camera film and other instrumentation often brings disillusion to the shooter and relief to the target. Helicopter shooting could be even more complicated, because it involves trainable as well as fixed weapons.

Quite clearly, helicopters share with fixed wing some major differences in performance and size, the latter equating to visual detectability.

A primary mission other than air-to-air is a common characteristic, the implications of which I will discuss later. And next to last, both fixed wing and helicopter forces typically carry out multifaceted operations of substantial complexity in the face of and sometimes with fighters, SAMs (surface-to-air missiles), AAA (antiaircraft artillery) guns, artillery and whatever.

Finally, there is a common denominator, probably common to all successful people in combat. Aggressiveness may, almost certainly should, be tempered with caution, patience, insight of whatever. But if you aren't a killer, you won't succeed at this, or any other, personal struggle. The key in fixed wing ACM is the self-discipline to modulate your aggressiveness to the mission at hand, in peace or war. We'll return to this subject.

With this preliminary, and probably amateurish, basis, let's now talk about some things from fixed wing ACM which seem to be directly applicable to helicopter versus helicopter combat.

- Sight
  - ✓lose sight, lose fight
- Sophistication
  - ✓Guts help, but brains are essential
- Training
  - ✓is paramount
- Safety
  - ✓is a byproduct
- Other
  - ✓minor details

It is obvious that few maneuvering air-to-air engagements can occur without "tally" or long endure without it. The general principle is so broad that it must apply directly and in considerable detail to helicopter combat. First "tally" confers advantage—if you identify the enemy, and also see the enemy's

friends. Then you must read their reactions—or their absence of reactions—and act rightly. None of the above is simple in fixed wing ACM. Your abilities vary with:

- Experience
- Size of opposing aircraft
- How they're painted
- The background (Earth, sky and weather)
- The other guy's (guys') activity

Our next analogy with fixed wing ACM is the amount of sophistication required. This is inherently difficult to illustrate. The following are some examples:

- Using nature
  - ✓ Sun, weather, ground
- One versus one
  - ✓ Essential training
  - ✓ Learn, exploit aircraft weaknesses, strengths
  - ✓ Weapons: penalties and bonuses
- Two versus One/Two
  - ✓ Stylized training stepping stones
- Many versus Many
  - ✓ Different from one versus one, two versus two
  - ✓ But needs them
  - ✓ But which part of them?
  - ✓ How to avoid peacetime training reflexes?
- Weapons/wars change, but fundamentals remain
  - ✓ Which fundamentals?
  - ✓ Which fundamentals *now*?
- Surviving versus Killing
  - ✓ When to hang it out?

I'll focus on just one aspect of sophistication: the relation of training to combat. In fixed wing ACM training, we progress from one versus one fights to two versus one and two versus two. All of these are highly stylized and sanitized evolutions which bear almost no relation to combat. The reason we use these stepping stones is to teach aircrews fundamentals about themselves, their airplanes, the opposition and mutual support. In a combat engagement, they may use 10 percent of what they learn, but *which* 10 percent is unpredictable and changes every time.

The basic fact is that if they fight in combat the way they fight in, say, a one versus one training engagement, they'll die sooner or later, no matter how good they are. The basic characteristic of air combat is that you don't know, can never know, how many enemies are present. If you fixate on one or a few opponents, you're asking for an unseen attack from someone or something else. This means that in combat, the reflex aggressiveness we inculcate in training *must be tempered with a sophisticated caution.* Failing to do this is a self-destroying prophecy: those who are only reflexively aggressive won't survive many victories.

Given all the above, it is obvious that *training is the key element of air-to-air combat effectiveness.* Tabulated below are some of the relevant factors which we constantly observe in fixed wing ACM.

Untrained aircrew can't

- See
- Recognize
- Estimate range, aspect, etc.
- Talk
- Remember
- Etc.

Insufficient training means

- Second tally and/or lost sight
- Blunders
- *Surprises against dissimilar aircraft*
- Poor coordination within/between aircraft

Adequate training involves

- Highly experienced adversaries
- Suppressing ego
- Painstaking debriefing
- A progression from one versus one through two versus two to many versus many
- *Self-discipline* and sound rules of engagement

The basic fact is common to all military operations: you don't want people to encounter something for the first time in combat if you can show it to them in peacetime. Moreover, you want them to have habit patterns which will carry them safely through that initial tunnel vision produced by mortal stress without demanding much thinking and reasoning. In aviation, and especially in fixed wing ACM, this training is perishable. Last year's, even last month's, doesn't count for much.

Now there is a myth that air-to-air combat training is dangerous. Like most myths, this one has a real foundation: unbriefed, unstructured ACM does produce accidents. Historically, commanders have sometimes reacted by restricting or forbidding ACM. This in turn produces unscheduled, unstructured ACM—and accidents—and more restrictions.

In fact, professional ACM training is safe for the reasons listed below:

- Improved airmanship
- Increased self-discipline
- Deemphasized ego

It's relatively hard to demonstrate this statistically, but here is a try. The accompanying figure lists ACM flying hours and ACM accidents for the majority of Navy units involved in ACM training. Also shown is the percentage of their flying devoted to ACM, and it can be seen that we're not in every case dealing with people who exclusively fly ACM. The overall accident rate due to ACM is less than one per 10,000 hours of ACM over a 4-year period. This is essentially half of the accident rate for all flying by Navy and Marine fighters during the same 4 years. While this doesn't prove that ACM is safer, it supports the pro-

ACCIDENT RATES

ACM Adversary/Instructor Units

Unit	%ACM Hours	FY 74-77 ACM Loss Rate (Per Thousand Hours)
Navy Fighter Weapons School	95%	1.46
VF 171 Det Key West	65%	1.46
VF 126	60%	0.73
VF 43	55%	1.13
VA 127	8%	0
Overall ACM Loss Rate		0.83
		(5 in 60,000 hours)

	FY 74-77 *Total* Loss Rate
All Navy/Marine Fighters	1.6
All Navy/Marine Light Attack	1.3
	1.46
	(241 in 1,650,000 hours)

fessional opinion of everyone who flies ACM a reasonable amount.

Finally, I'll make four subsidiary observations from fixed wing ACM.

- Experience is the only teacher
- Simulators are problematical
  (Visual cues are inadequate)
- Analysts tell you what you already know
  (If you're lucky)
- Mission preoccupation is a bureaucratic hurdle

If you haven't done it, you don't understand it. Using simulators is fun, but they don't adequately simulate the sky, the ground or the sight of the other airplane. (For helicopter air combat, I'd worry about simulator failure to adequately present the ground.) In fixed wing ACM, most ground-based analysis has been, at best, useless. This may not be quite as true for rotary wing because the art is not as well-developed. And, finally, the people who say "That isn't our (your) mission" can be a problem. What they don't think about is that the mission can be thrust on you by the enemy: we can control our missions only in peacetime.

In summary,

- Everybody who flies needs *some* air-to-air
  Insight
  Training
  Reflexes
- Every aviation community needs
  Air-to-air expertise
- From the above
  Somebody needs intensive helicopter versus helicopter training

If you agree with what I've said thus far, then I have a modest proposal, some of which has already been implemented by the Marines:

1. Train instructor pilots
2. By forming a post-graduate school
   (Like Top Gun? — 1 major, 7 captains/warrant officers, 9 gunships/LOHs)
3. Let them
   - Develop and codify elementary tactics
   - Fly in fixed wing ACM
   - Teach selected aviators
4. In order to train line units

The key in this proposal is following the basic step we took in the Navy in 1968-1969. Form a small, elite cadre of junior officers and tell them to become aces if they aren't already. Let them develop rules of engagement, tactics, and procedures for helicopter air combat and use them to train aircrews from line units. This is a cheap, easily executed option which the Navy devised to turn around a bad exchange rate in Southeast Asia. It worked brilliantly, as shown by our MIG kill box score in 1972. It should work even better for rotary wing today.

TAC INSTRUMENTS... HERE WE GO AGAIN!

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This article is written using terms and phrases that the author feels will best communicate to the individual Army aviator. The sound of officialdom speaking was deliberately avoided

BEFORE WE GO into the "sales pitch" for tactical instruments, I would like to pose three questions. Do you recall the "old hand" in your unit designing an instrument approach for your *noninstrumented* field so you could land in *marginal weather?* How many of us used makeshift instrument procedures in Vietnam in order to get the job done? What did you think of these procedures at that time?

Under the current doctrine of mid- to high intensity combat, the U.S. Army *will* use its air assets within the range of enemy anti-aircraft weapons. We must have a procedure to use to get the job done when weather becomes a factor. Call it what you will, but a need exists to fly instruments under parameters with less buffer distances than Federal Aviation Administration (FAA) instrument approaches. For those of you who have flown in combat, you know that normally weather only slowed you down; the mission was accomplished. For those of you who haven't had the opportunity to fly in combat, ask those crusty old duffers in your unit how they handled weather.

Why then do tactical instruments leave such a bitter taste in your mouth? Tac instruments are something to be answered on the annual writ and paid lip service to on standardization rides. This is a typical attitude.

For the answer to that, let's start back at Fort Rucker. Let's look at this tactical instrument business from three different viewpoints:

- Training and Doctrine Command Initial Entry Rotary Wing, Course of Instruction (IERW COI), objectives.
- Fort Rucker command level, i.e., the Directorate of Training up to and including the Commander.
- The instrument instructor pilot.

One of the major IERW course objectives is an FAA recognized U.S. Army standard instrument rating. Considerable time, money and assets are spent achieving this goal. (During the mid-1960s through the very early 1970s, the tactical ticket issued to IERW graduates did not have as a base the Army standard ticket.) In fact, without it you cannot be graduated as an Army aviator. This cannot be said for anything relating to tactical instruments.

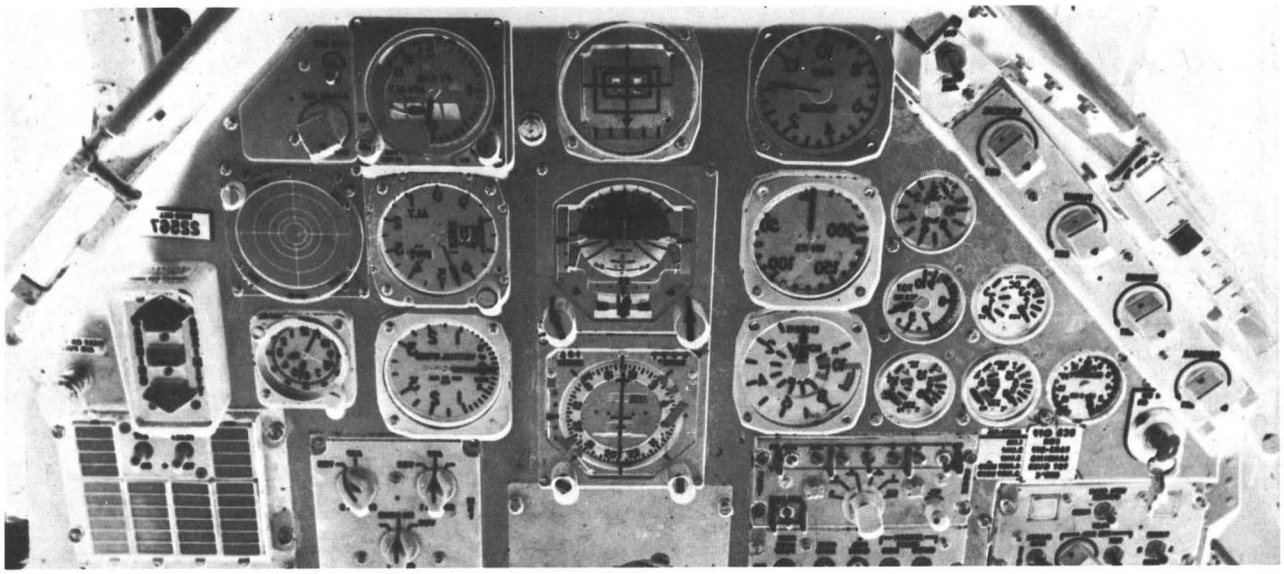
The command level at Fort Rucker recognizes the problems inherent in tactical instruments and has put out the *word* to the training departments. "Tactical instruments are important, educate your instructor pilots (IPs) on its importance; change their (IPs) attitude toward tactical instruments."

The instrument instructor pilot teaches the automatic direction finder (ADF) approach (backbone of the *present* tactical instrument procedures) as:

- The least precise instrument approach
- It is designed to get you to the field boundary
- Its minimums are the highest of all the approaches
- If a choice exists, choose a more precise approach procedure, i.e., VHF omnidirectional range (VOR), ground controlled approach (GCA), instrument landing system (ILS).

Every year all Army aviators in flying positions spend considerable amounts of time flying aircraft and simulators, and studying regulations in preparation for renewing their standard instrument qualification, not an Army standard tactical qualification.

Instructor pilots armed with the



following naturally view tac instruments very negatively:

- Maps used by them are habitually out of date. This makes it very difficult to determine an obstruction clearance altitude for a tac instrument flight.
- At the battalion level and below, intelligence on the enemy's capability is sketchy at best (how do you plan a tac instrument flight under the enemy's air defense threat without this information?).
- A 20-degree angle of bank while slowing to 60 knots is approaching an unusual attitude (under instrument conditions). Using tac instrument procedures this angle of bank is a standard approach. (Note: TC 1-5, "Tactical Instrument Flight," is in draft and is being staffed for publication in August 1978. It will replace Chapter 22, Tactical Navigation and Instrument Flight, of FM 1-5, "Instrument Flying and Navigation for Army Aviators." This TC, when published, will alter present tactical procedures.)
- Although the command levels say tac instruments are important, the major thrust of the IERW course (in the instrument area) is the initial instrument qualification (see AR 95-63).

Summing all this up, what has happened is that the FAA instrument flying procedures have been institutionalized. Any approach procedures deviating from the FAA procedures are considered unsafe, if not downright dangerous; this is the implied thrust of the FAA regulations as taught in the examiner and instrument instructor pilot (IMOI) courses.

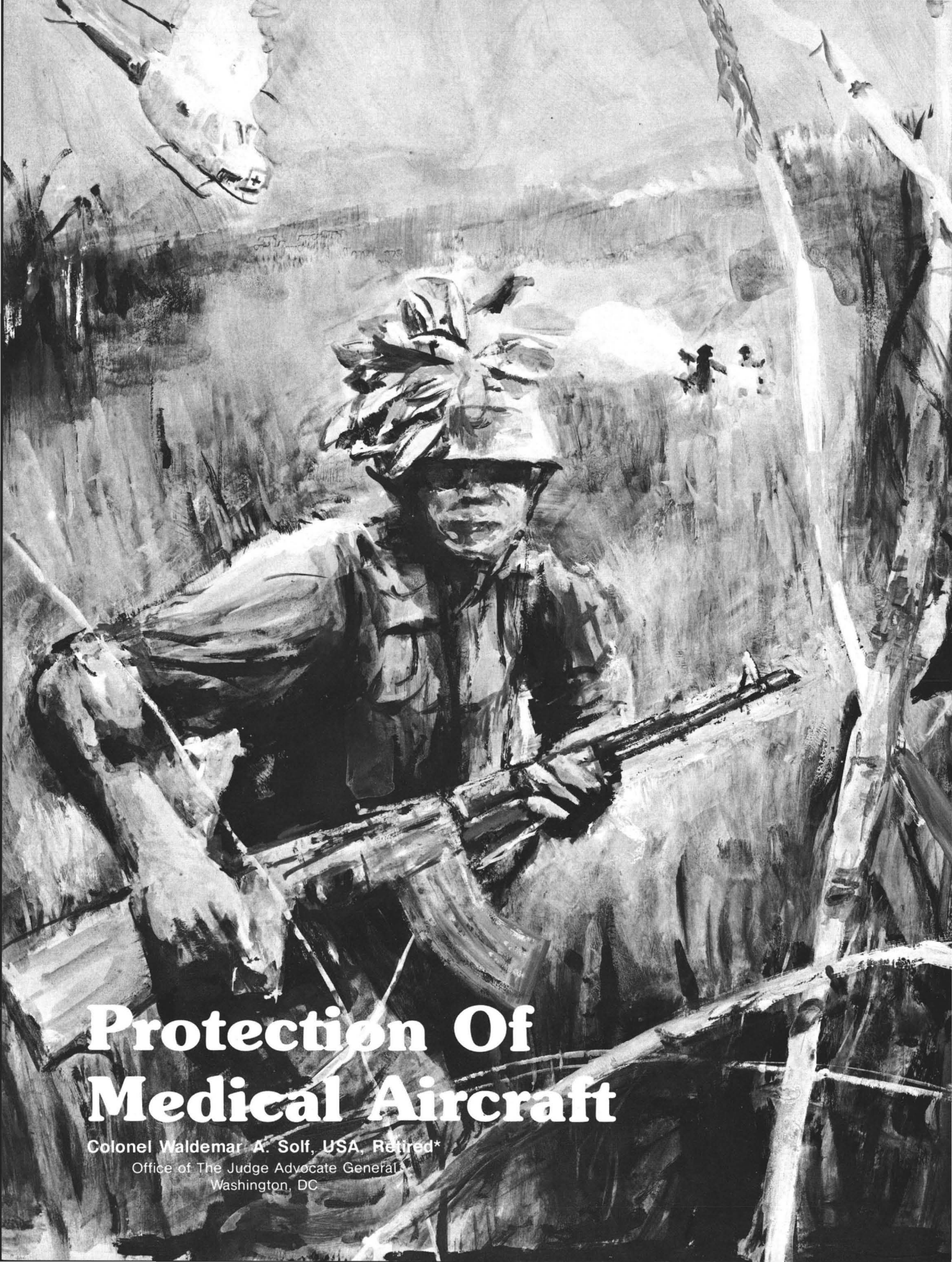
Now some of you are probably saying, so what, everything that has been said so far hasn't changed a thing. You are right. But this is how we can take a large step forward. The Army instrument instruction structure must be reorganized. We must make the current instrument qualification, as we know it today, the basic block from which students progress toward an Army instrument qualification rating, without which they cannot graduate as an Army aviator and which they must requalify annually. The instrument program in the IERW course is being reviewed to improve training benefits and enhance tactical instrument training integration in the present course of instruction.

The thrust and major amount of resources must be directed, in all instrument instruction, toward the planning of and execution of a tactical instrument flight and approach. Tactical instrument flight capabilities must be like a contingency plan that all rotary wing aviators must be capable to employ, no matter what their current mission (Scout, AH-1 Cobra or CH-47 Chinook). How else will we fulfill the goal of a force capable of 24-hour all-weather combat?

The only time the majority of Army aviators will concentrate on FAA instrument procedures should be in the IERW course, with the goal for graduation being an Army instrument qualification rating which must be reexamined annually.

New and more accurate tactical instrument procedures are on the drawing board and in the test stage. The volume of and accuracy of enemy intelligence available at battalion level and lower must improve. Up-to-date maps must be available at the unit level. Last, without organizing the Army's instrument instruction around tactical instrument procedures, the negativism will never disappear and the appropriate amount of lip service will be paid very carefully to the importance of tac instruments.

Given the typical Army aviator's tenacious attitude toward mission accomplishment, we are doing ourselves an injustice if we do not prepare for tactical instruments now instead of waiting for the shooting to start.



Protection Of Medical Aircraft

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Editor's Note: This is the first of a four-part article. Parts two, three and four will appear in subsequent issues of the *Digest*

A TWO BATTALION air mobile force has penetrated deep into Vietcong (VC) held territory. As a result of a firefight, the force has sustained and inflicted casualties. Two UH-1 Hueys, painted Army green with standard size Red Cross emblems painted on the nose, side panels and lower surfaces, arrive to evacuate seriously wounded U.S. and VC casualties. On the return flight, one medevac helicopter with three wounded VC and one wounded U.S. trooper aboard is shot down by a VC surface-to-air missile. All aboard are killed in the crash. What war crime, if any, was committed by the VC in their attack on the medical aircraft?

The answer may be disappointing: Probably no war crime was committed by the VC in this case.

Under Articles 19 and 35 of the 1949 Geneva Convention for Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field (First Convention), a ground ambulance "may in no circumstance be the attacked, but shall be respected and protected." This rule does not apply to medical aircraft which are covered by Article 36 of that Convention. Under that Article, medical aircraft have no protection unless they are "flying at heights, times and routes specifically agreed upon between the belligerents concerned." Moreover, "unless agreed otherwise, flights over enemy or enemy occupied territory are prohibited."

In our situation at the start of this article there was no agreed flight plan. Indeed the First Convention provides no feasible technical procedure for arranging a timely agreement on such a flight plan. Furthermore, the helicopters were flying over an area controlled by the VC. Finally, it is doubtful that the not very large Red Cross emblems on a white ground painted on the green surfaces of the Huey were recognizable by the VC missile crew. (In 1970 dedicated medical aircraft were painted white and the size of the Red Cross was enlarged. Leaflets were dropped in VC areas explaining that only medical aircraft would be so painted. There was a pronounced reduction in the incidence of VC attacks on medical aircraft. This result may be inconclusive because the intensity of combat action was reduced at about the same time.)

When the 1949 Diplomatic Conference considered the role of medical aircraft in the light of World War II experience, the delegates concluded that the capability to engage aircraft by interceptor planes or with modern antiaircraft weapons had exceeded the means for recognizing protected aircraft by visual means. Moreover, there was concern that medical aircraft pose a security threat if they abuse their protected status by undertaking reconnaissance as a sideline, particularly if they fly over territory controlled by an adverse party.

Accordingly, the 1949 Conventions afford no protection to medical aircraft unless they fly under an agreed flight plan; the Conventions prohibited their flight over territory controlled by the enemy.

The effect of these provisions was either to keep medical aircraft grounded or to subject their operations to the risk of attack without legal protection. Agreement on flight schedules has seldom been feasible as no provision was made for technical channels of communication.

Two developments since 1949 suggested a reexamination of the legal limitations on the protection of medical aircraft:

> The development of helicopter ambulances makes feasible the prompt evacuation of the wounded directly from the battle area, thus greatly enhancing the possibility of prompt treatment and the chance of survival.
>
> Advances in identification procedures, in particular those involving radio communication, electronic identification procedures and flashing lights, can greatly extend the range of recognition.

On 10 June 1977, a Diplomatic Conference originally convened by the Swiss Government in 1974 for the purpose of updating International Humanitarian Law Applicable in Armed Conflict finished its work with the adoption of two protocols to the 1949 Geneva Conventions. Protocol I, which updates the rules relevant to international armed conflict, includes extensive provisions for the improved identification and protection of military and civilian medical aircraft.

These provisions evolved from proposals made by the United States Delegation at the 1972 Conference of Government Experts convened by the International Committee of the Red Cross to do the preparatory work for the forthcoming Diplomatic Conference.

***Colonel Solf, now retired, was with the International Affairs Division Office of the Judge Advocate General, DA; a member of the U.S. Delegation to the Diplomatic Conference on International Humanitarian Law Applicable in Armed Conflict, 1974 to 1977. The opinions expressed are those of the author and do not purport to reflect the views of the Department of the Army or any other Government agency.**

Protection Of Medical Aircraft

The 1972 U.S. proposal was outlined in detail in the June 1972 issue of the *Army Aviation Digest.* In brief, the U.S. proposal included:

An improved identification system with provision for distinctive signals exclusively reserved for medical aircraft. These were:

a. Radio signals consisting of a common priority call for the medical aircraft to be used as a prefix on frequencies allocated, or recognized, by the International Telecommunications Union (ITU) for identification, notification, arrangement of agreed flight plans or other relevant communications with the adverse party.

b. Improved visual identification through the conspicuous display of the distinctive Red Cross emblem on a white ground and flashing blue lights.

c. An electronic signal based on Secondary Surveillance Radar (SSR) System using international standards, practices and procedures contained in Volume I of Annex 10 to the Chicago Convention on International Civil Aviation. This envisions transponder transmissions on a Mode and Code reserved for medical aircraft which can be received by air traffic control and target acquisitions radars.

d. A mechanism for periodic review of the system in the light of changing technology and a feasible means for amending easily the regulations governing the system based on the result of such review.

Substantive provisions for the protection of medical aircraft including:

a. Protected medical aircraft are defined as those under the control of the military services of a Party to the conflict when used solely in the performance of a medical mission. They may be permanently dedicated medical aircraft which are protected at all times, or temporary medical aircraft protected only while performing a medical mission.

b. The requirement for agreed flight plans is eliminated for medical aircraft operating over areas controlled by friendly forces in battle areas as well as in rear areas.

c. Protection of medical aircraft flying over areas controlled by the adverse Party is contingent on a tacit agreement through: (1) notification to the adverse Party of the flight plan and (2) that party's acknowledgement of the notice. The adverse Party would be authorized to require alternative altitudes and routes, but would not be

permitted to vary the time of flight.

d. Restrictions on the use of medical aircraft to prevent abuse of protected status included provisions that they be unarmed, that they do not carry any cameras or other equipment for the acquisition of intelligence data. Within the forward part of the battle area or over territory controlled by the enemy they may not, except by prior agreement, be used to search for the wounded. Medical aircraft overflying enemy territory may be ordered to land for inspection and are required to comply with such orders.

After extensive debate and intensive study, the 1972 government experts accepted much of the concept proposed by the U.S., but they would not accept the provision's tacit agreement on flights over enemy held territory. A prerequisite to protection in such flights continued to be an agreed flight plan. After an initial clash based on misunderstanding, a consensus was achieved at the 1972 Conference.

This consensus formed the basis of a proposal cosponsored by the U.S., Belgium, Canada, France, Netherlands, Norway and the United Kingdom which was tabled during the 1974 Session of the Diplomatic Conference. The statement of the U.S. representative introducing the proposal will appear in next month's issue.

After some modification, Committee II of the Conference adopted these proposals at its 1975 session, and in 1976 that committee adopted the regulations on identification. In June 1977 the Plenary of the Diplomatic Conference adopted these provisions without a dissenting vote. Both North Atlantic Treaty Organization (NATO) and Warsaw Pact delegations worked enthusiastically to maintain the consensus and to make technical improvements in the text. This attests to the concluding words of the 1972 article in the *Army Aviation Digest:*

"Subject to some exceptions, the experience of the Red Cross for over 100 years has been that its emblem and the protection of the wounded and sick in war have been respected. The value represented by the Conventions concerning the wounded and sick are shared by all countries and Parties to a conflict. There is good reason to hope that the air ambulance for all wounded and sick will be free to perform its essential humanitarian service free from the present restraint of an agreed flight plan."

The text of the relevant provisions of Protocol I and brief explanatory notes are set forth below.

The protocols were opened for signature on 12 Dec 1977 for a period of one year and were signed by the United States and 46 other countries. They will be considered by the Senate which must give its consent prior to ratification. They will go into effect for the U.S. six months after the instrument of ratification is deposited with the Government of Switzerland. The time involved in this process will give us several years to study the implications of the regime governing legal protection of medical aircraft.

Part two of "Protection of Medical Aircraft" will appear in next month's *Digest*

Museum Needs Artifacts

THE U.S. ARMY Aviation Museum, Ft. Rucker, AL, needs your support. The museum is looking for items of military historical significance, especially those related to Army aviation.

At the top of the most wanted list are old uniforms, such as the World War II "Ike" jacket, which will be displayed on mannequins inside the museum. Other items of flight clothing relating to a specific period of Army aviation also are needed. These include a female aviator's uniform and such articles as spurs, boots and "pinks and greens" britches from the 1940 period.

Aircraft like the L-13, L-15 and Doman YH-31 also are being sought for display. If the whereabouts of these or any other "rare" type aircraft are known, please write the U.S. Army Aviation Museum, P.O. Box H, Ft. Rucker, AL 36362. Or, call commercial 205-255-4507/4516; AUTOVON 558-4507/4516.

Persons who donate items for display will receive appropriate recognition from the museum.

from APPROACH
USAAAVS Richard P. Shipman

Don't Embarrass The Command

LT BOB McCLEAN, Safety Officer of VA-71, was disturbed. He had the Pri-Fly watch and had just observed his good friend and roommate, LT Clay Felts, bolter twice even though his hook had been in the landing area. Clay had an excellent reputation as a carrier pilot, and in fact, stood well up on the squadron landing efficiency board. Therefore, after the second bolter, LT McClean requested the binoculars to look over Clay's aircraft. LT Felts was just too smooth a pilot to induce two consecutive hook-skip bolters.

As requested by Pri-Fly, LT Felts took his A-7 up the port side of the ship, tower high. Bob trained his "eyes" on the *Corsair* for a close inspection. His discovery was not good.

"Boss, 404's hook point is on backwards! I think we'd better bingo him to the beach. We've got a maintenance det there that can put it back on the right way."

"How in the hell can you install a hook point backwards?" thundered the air boss. "What were the pilot and plane captain looking at during their preflight? The Old Man's gonna be mad as hell that we gotta bingo that bird. You know how he feels about diverts."

With a final diatribe, the air boss picked up the conspicuous red phone that connected him directly with the captain of the ship.

"Yes, sir, we're going to have to bingo him. Yes, sir, I know you don't want to bingo any aircraft, but the only other choice is the barricade."

"I don't understand how it happened either, Captain. OK, I'll pass the word to bingo him right away. Yes, sir, I'll have the squadron skipper meet with us in your cabin at 2200."

The red phone was returned to its resting point awaiting the next crisis.

When the Raspberry net reported 404 safely ashore, LT McClean went below deck to the ready-room, upset and unhappy. He was very upset that maintenance had installed the hook point incorrectly and just as disturbed that nobody in the safety review chain had caught the error. The collateral duty inspector missed it, the plane captain missed it, the pilot missed it, and nobody else in the flight noticed anything unusual. Lots of people had an opportunity to catch this dangerous error, but nobody did. Bad business. The squadron's excellent safety record could easily be cut short by slip-ups like this.

Beyond this, LT McClean was unhappy because the squadron had really fallen on its sword. He had a lot of pride in the squadron—as did most members of "The Demons"—and the professional reputation of the squadron meant a lot to everyone in VA-71. Besides, they were well in the running for the "Battle E" award. This kind of publicity they didn't need.

Knowing this, LT McClean tried to phrase the first draft of the required incident report to minimize the

embarrassment to his command. But every way he tried, it still looked bad. "Well," he reasoned, "not much choice but to pull a Howard Cosell and 'tell it like it is.' As the old Murphy's Law goes, 'If an aircraft part can be installed incorrectly, someone will install it that way.' If a Sierra Hotel maintenance department like ours can do it, chances are excellent that someone else will, too. Maybe this report will spare them the same problem."

The safety officer soon realized that he needed more information before he could write a complete report. He left the readyroom and proceeded to his stateroom to look for LT Felts. There he ran into Clay, who had just returned from the beach with his aircraft fixed. Since it was close to chow time, they decided to talk over dinner. After going through the line in the dirty shirt wardroom, the two pilots found a relatively clean place to sit down, and Bob started talking.

"How'd you miss that hook point, Clay? Wasn't it obvious on your preflight?"

"Not really. The aircraft was spotted tail-overwater, so I couldn't preflight the tailpipe area or look into the hook well."

"I can see that, but I wonder why the plane captain didn't catch it when you dropped the hook after taxiing out of your spot?"

"Well, to be perfectly honest, the air boss wanted me to expedite launch since the catapults were being starved, so I didn't stop for the hook check. I wanted to impress the boss with our squadron's can-do spirit."

The jello and cookie for dessert didn't appeal to Bob, so he left Clay to finish dinner while he went down to maintenance to investigate. He found the maintenance control chief in the maintenance admin office.

"Chief, how'd that hook point get put on backwards, and why wasn't it caught by the CDI?" Bob asked.

"Well, sir, it shouldn't have happened. But Brown was assigned the job—he's a new man, you know. It looked like such an easy job that he couldn't screw it up, so Phillips, his supervisor, went to chow. He'd been working for 9 straight hours and needed some food and a break badly.

"Right about this time, Ops called, saying we had an add-on hop that would make the squadron look good if we would cover it. Well, the only comer we had was 404, so we started hustling to get the paperwork in.

"Then, to top it all off, hangar deck started screaming to get the bird topside so it could be spotted. I guess somewhere in between, the CDI never got done. It's bad business, but it happens sometimes when you operate like we've been."

Later that evening, with all the facts in his head, LT McClean finished his rough draft of the incident report. "Same old story," he thought. "Operational commitments, rush for launching, add-ons to make the squadron look good, overworked and undermanned maintenance department, breakdown in communications—all the factors were present in this incident that have been identified time and time again as causes of accidents. Well, we were lucky this time; no accident. At least it will make a good incident report and maybe spare some other squadron the problems I'm going through now—or even more important—prevent an accident."

With the rough completed and routed, Bob went to the readyroom to catch the evening movie already in progress. His entrance went largely unnoticed, as most of the squadron was captivated by an Italian western movie, known in readyroom circles as a "max ordnance flick." The junior ensign was posted at the blackboard, logging the body count as bad guy after bad guy fell victim to the blazing .45 of the hero. Bob settled into his "Rocket 8" readyroom chair and was soon joining in with groans and boos.

The readyroom went silent momentarily as the black-hatted villain lined up the hero in the crosshairs of the telescopic sight of his high-powered rifle. Lo and behold, he shoots and misses, prompting the hero to leap from his horse, draw his .45, and, while suspended in midair, gun down the villain 500 yards away. The ensign logged one more dead while a hail of ballcaps, pens, NATOPS Manuals, and other fixtures of the readyroom not nailed down bombarded the screen in protest. When the dust settled, the phone was ringing, belatedly answered by the hatless duty officer.

"Yes, sir, he's right here. I'll send him down."

"Bob, the CO wants to see you in his room right away."

Bob exited with the body count at 48 and proceeded to the CO's room on the second deck. He knocked upon arrival.

"Come in, Bob."

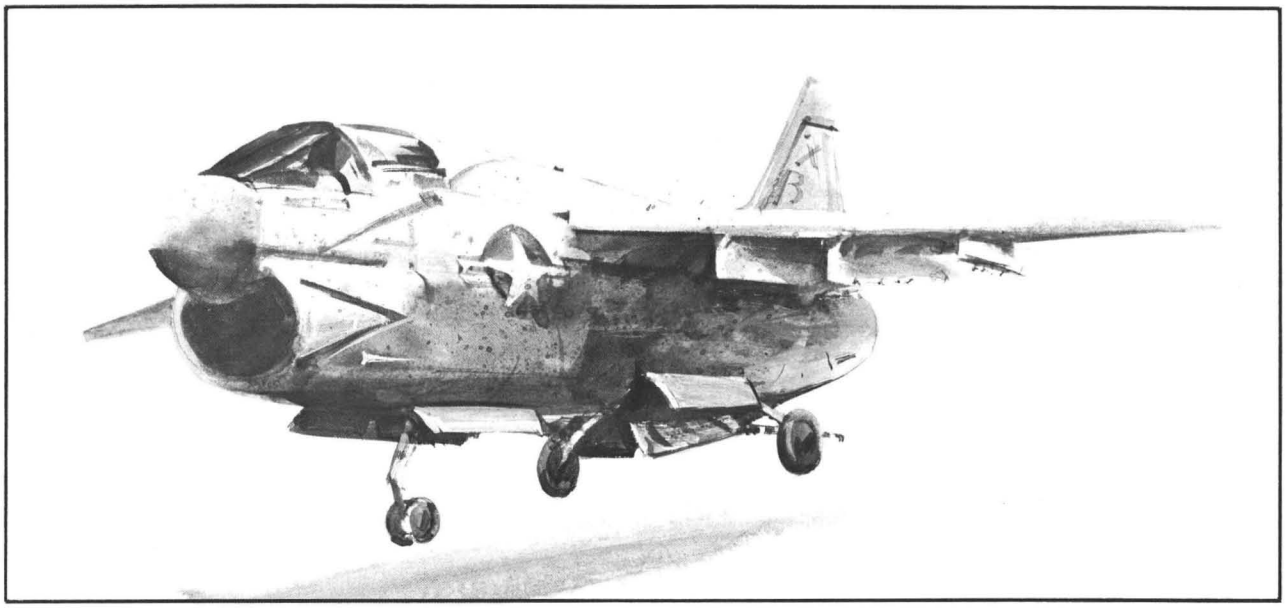
"Hello, skipper. You wanted to see me? I'll bet it's about the incident report. Is something not clear?"

"Not really, Bob. It's a good report with the facts pretty much straightforward. But, you know, I don't think we should send it out."

"Do we have a choice, skipper? OPNAVINST 3750.6 says it's a requirement. Even more important, it might save somebody else from doing the same thing and having an accident."

The skipper contemplated the overhead momentarily before he replied.

"Let's be realistic, Bob. If we publish this, we'll



embarrass the command. We'd be hanging out our dirty laundry for the entire fleet to see. And you know how much everyone wants that 'E.'"

"But, skipper, this report might save someone else from making the same mistake and maybe even getting hurt. It's our professional responsibility."

"Oh, I think you're exaggerating. It was really a fluke incident that wouldn't happen again in 100 years. It won't do anybody any good—and it will just make us look bad. We'd be putting ourselves on report.

"No, I appreciate your good work, but let's just leave this incident report here in the squadron. You work up a procedure so it can't happen to us again, and let it lie at that."

Bob was tempted to argue further, but he had found early in his military career that you can press your opinions only so far with seniors, and then you have to desist. He felt he had reached that point. Besides, if Bob were to be truly honest with himself, he would admit a measure of relief at not sending out the report. After all, it reflected poorly on him as safety officer.

Walking back to the readyroom, Bob could not help but think how ironic the whole situation was. "If only we weren't so good, maybe we wouldn't have to be so afraid of ever looking bad. Even great squadrons have people who make mistakes. After all, that's what a squadron is—humans—and humans err. What do 'they' expect? Why can't we be mature enough to 'fess up' to our errors so that others can learn?"

There were so many conflicting thoughts going on in his mind that Bob could not enjoy the rest of the movie, even though the body count stood at 76. Frustrated and upset, he returned to his room.

It was but 5 weeks later that LT McClean was reading the message board and ran across a preliminary accident report on an opposite-coast A-7 squadron. The message read, "On normal night recovery, aircraft engaged No. 4 wire. After 15 feet of wire pullout, hook disengaged from wire. Aircraft continued over the angle and impacted the water inverted. No ejection was observed. Alpha damage, Lima injury."

Bob could feel a knot tightening in his stomach and a cold tingle come over his entire body. Was the hook point installed backwards? Nah, probably a fatigue failure of the hook point or shaft, or a failure in the crossdeck pendant. But a nagging doubt kept after him.

One month later, the complete investigation summary was on the message board. The aircraft wreckage had been salvaged, and there in the conclusions, loud and clear, came the statement Bob didn't want to read.

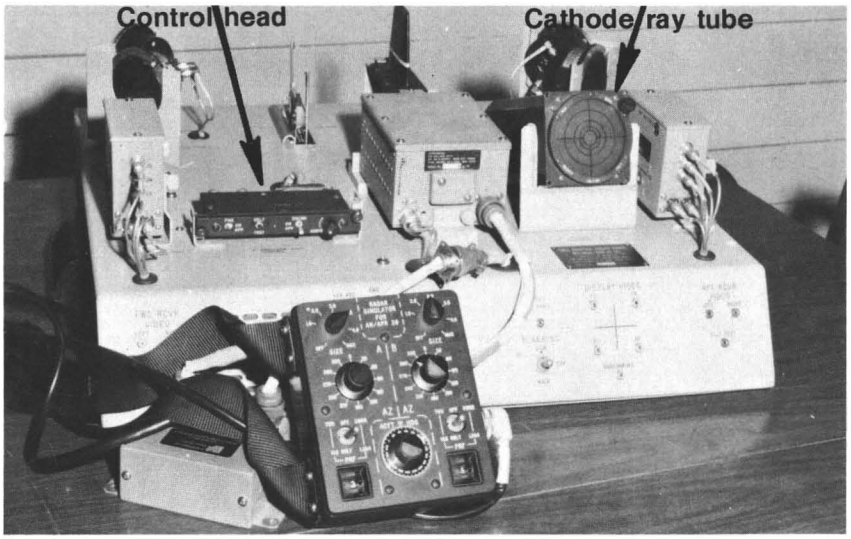
"The hook point was found installed backwards on the hook shaft. There was enough protrusion from the back side of the hook point to engage the wire momentarily. When the hook finally slid off the wire, the aircraft had decelerated to a point where it could not regain flying speed."

LT McClean's legs were shaky and he felt lightheaded and dizzy as he walked back to his room. The price that squadron had paid so that his squadron didn't have "to be embarrassed" was the highest extracted in naval aviation. No—his squadron had not been embarrassed; it had been shamed.

This is a fictional article about a problem which, unfortunately, is not fictional.—Ed.

Threat Radar Warning Receiver

Captain John F. Paull
Institutional Training Branch
Directorate of Training Developments
U.S. Army Aviation Center



Training Device For Signal Recognition

THE AN/APR-39 V1 radar warning receiver was developed and fielded to enhance aircraft survivability on the modern battlefield. The system provides the aviator with the capability to recognize the type, mode and relative bearing of the radar emitter that the APR-39 V1 is receiving. This information is provided through a series of aural alert tones and visual strobe displays, on the cathode ray tube.

It is imperative that the aviator be able to immediately recognize threat radar warning signals displayed and take appropriate action. To assist in learning and practicing threat radar signal recognition the AVRADCOM, Program Manager for Aircraft Survivability Equipment (ASE) has contracted for the production of a training device to be used both in the classroom and cockpit. The device will simulate the aural and visual signals of threat radar emitters likely to be encountered on the modern battlefield. It is envisioned that this interim training device (photo above), called the "knee board trainer" will provide an effective means for learning and practicing signal recognition both on the ground and in the air.

The knee board trainers will be issued in conjunction with the fielding of the new equipment training (NET) team scheduled to begin in USAREUR in June 78 followed by Korea and CONUS.

Familiarization Training Device

WITH THE RECENT addition of the AN/APR-39 V1 radar warning receiver to the growing family of aircraft survivability equipment (ASE), the Aviation Center has developed a classroom training device to aid the operator in learning the procedures for placing the system in operation and conducting the self-test. The training device (left photo) is a large scale mock up of the control head and the cathode ray tube (CRT) display. It provides a replica of the aural and visual signals as presented by the APR-39 when placed into the operate and self-test modes. Although the training device has no threat radar signal presentation and thus cannot be used as an aid in signal recognition, the instructors in the Combat Skills Branch, DOAT find it a valuable tool in APR-39 V1 familiarization training. Further information on this training aid is available by contacting: Cdr USAAVNC, Directorate of Training Developments, ATTN: ATZQ-TD-TS-TA.

OPMS CORNER

Officer Personnel Management System

Aviation Career Incentive Pay

LTC George A. Morgan
Chief, Aviation Management Branch
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THE ARMY IS nine months into the final phase of implementation of the Aviation Career Incentive Act (ACIA). This law has brought about extensive changes in incentive pay. In this regard there appears to be some confusion in the field as to who, when and for how long the aviator is entitled to this pay.

The terminology alone generates some confusion. Incentive pay has been referred to as flight pay, hazardous duty pay, crewmember and noncrewmember pay. There are several categories of incentive pay including: Aerial flight; submarine duty; parachute duty; deck duty; demolition duty; experimental stress duty; and leprosarium duty.

The aerial flight category of incentive pay, as it pertains to officers and warrant officers, is the subject of this article. This pay is controlled by the ACIA of 1974. Final implementation of this law became effective on 1 June 1977. Since that time an extensive review of the records and entitlements of some 13,000 plus Army aviators has been (is still continuing) conducted.

As we get down to the finalization of who is entitled to incentive pay, we are beginning to discover that perhaps some individuals have been erroneously receiving payments. In these instances, commanders have been asked to investigate.

Let's review what the law states about when you are entitled to receive incentive pay and when and how it stops. The one aspect that should come to your attention is that "you" are the one responsible for the money that you receive. If by some error your pay check should contain incentive pay to which you are not entitled, it is your responsibility to initiate the corrective action.

The Aviation Career Incentive Act requires career screening gates at the 12th and 18th year of aviation service. Aviation service is that period of service that an officer is a rated or designated aviator. A commissioned or warrant officer must have performed at least six years of prescribed operational flying duty (including flight training, but not to include proficiency flying) upon completion of 12 years of aviation service to remain entitled to continuous Aviation Career Incentive Pay (ACIP) until 18 years of aviation service.

Officers must have performed at least 11 years of operational flying duties (including flight training, but excluding proficiency flying) to be entitled to continuous incentive pay until their 25th year of Total Federal Officer Service (TFOS) for commissioned officers and throughout their aviation service for warrant officers. (TFOS is all periods of commissioned/warrant officer service, active and reserve.) However, if officer aviators have performed at least nine years, but less than 11 years of prescribed flying duty (including flight training, but excluding proficiency flying), they will be entitled to continuous incentive pay through 22 years of officer service. If less than nine years of prescribed operational flying duty has been performed at the completion of 18 years aviation service, entitlements to continuous ACIP ceases at this point.

An update of all Army aviators operational flying credit is published annually in a Department of the Army (DA) Circular (DA Cir 600-series).

Incentive pay eligibility is being evaluated for the first time at DA using automated means and will continue in the future. If you have any questions about your pay, it would be to your advantage to initiate an appropriate inquiry or change with your servicing Finance and Accounting Officer or call Military Personnel Center (MILPERCEN) (AUTOVON 221-0727/0794).

Low
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DURING THE PAST few years, the U.S. Army has talked a lot about (and trained for) flying at low altitudes. But tests conducted by the Combat Developments Experimental Command (CDEC); Modern Army Selected Systems Test, Evaluation and Review (MASSTER); and U.S. Army, Europe (USAREUR) indicated this wasn't necessarily the answer. Thus Army aviation began to talk about flying as close to the terrain as nature and common sense allow.

Lately, the full implication of the threat and the effects of the threat on helicopter survival in a high threat environment have resulted in prodding even the least imaginative aviators to equate their survival in terms of flying not low, not lower—but *lowest.*

Confusing? Yes. When it takes an aviator 30 minutes of jargon and hangar flying to relate to a fellow aviator exactly what kind of flying was actually done, then it's time to sit back and take a long look at the existing terms and definitions that depict terrain flying.

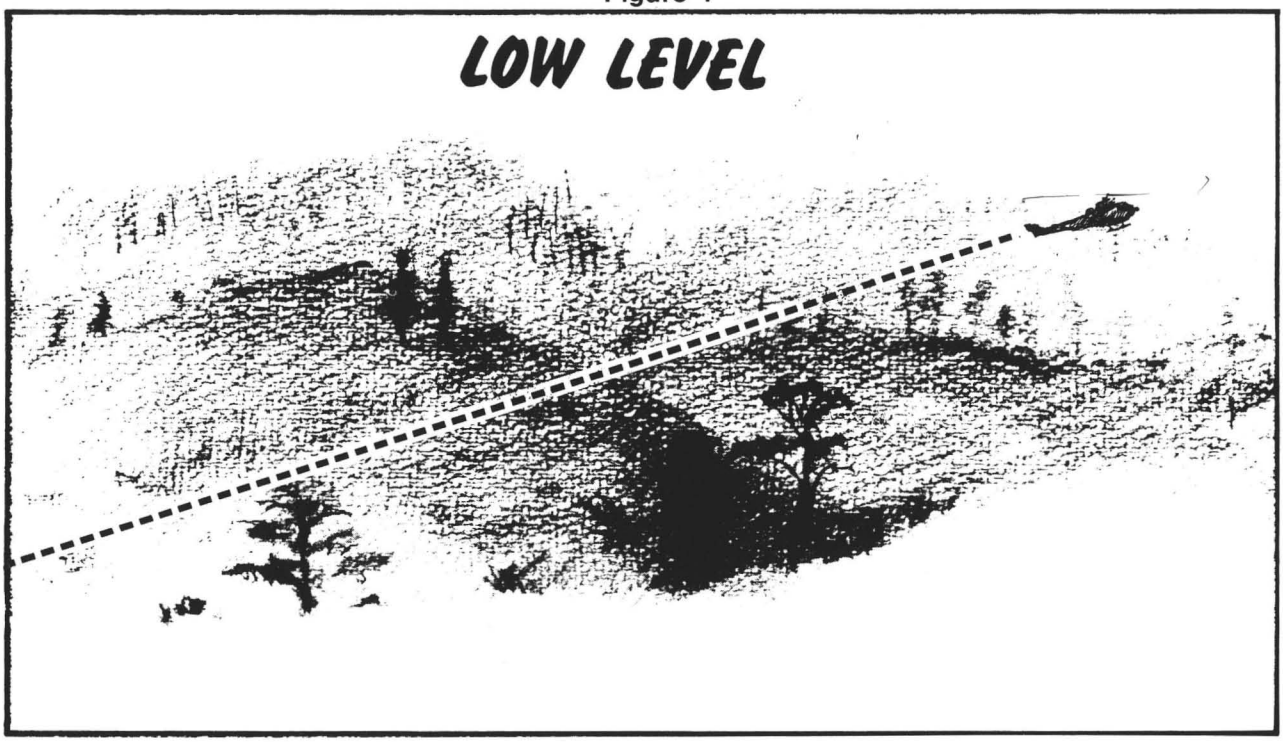
The specific modes of flight that need to be understood clearly are those depicting aircraft flying at varying degrees of closeness to the Earth. There is a great deal of confusion and misinterpretation among aviators, ground commanders, authors and trainers concerning the meaning of many aviation slang words and legitimate terms such as "contour flying," "nap-of-the-earth," "on the deck," "low level" and "treetop flying."

In selecting the number of terrain flight modes to address, we not only consider the inexperienced aviator but the experienced aviator as well who must be taught entirely new concepts of low altitude flying.

The various terrain flight modes must be understood so that each aviator may be efficiently and safely trained for terrain flight. These flight modes fall into three general categories: low level, contour and nap-of-the-earth. More would be duplication; fewer would not meet essential needs.

On close analysis the three are in many ways quite separate from

Figure 1



LTC Charles W. Abbey
Department of Flight Training
Directorate of Training
U.S. Army Aviation Center

and

Major Frank L. Carson
District Recruiting Command
Niagara Falls, NY

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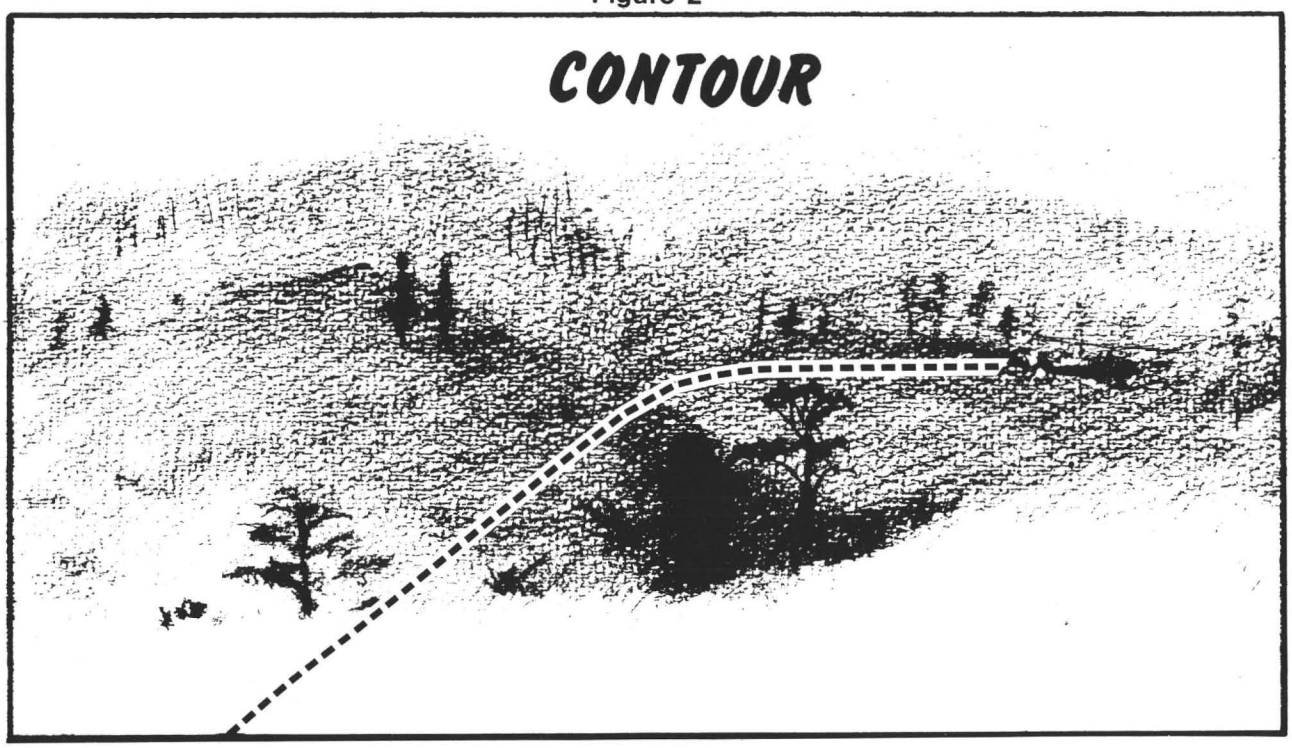
one another. These differences include distinct flying techniques and training considerations for the aviator, and different applications when considering aircraft type, mission and numbers. For instance, a CH-47 Chinook hauling an 11,000 pound internal load must use different terrain flying techniques and considerations than an OH-58 Kiowa in the role of aeroscout.

What is the purpose of terrain flying? According to FM 1-1, "Terrain Flying," it is flight in the face of the enemy. It is to the aviator what creeping and crawling is to Infantry troops—a means of survivability. It is appropriate that the definitions of the three modes of flight be presented (quoted from FM 1-1):

- *Low level flight* is flight conducted at a selected altitude at which detection or observation of an aircraft or of the points from which and to which it is flying is avoided or minimized. The route is preselected and conforms generally to a straight line and a constand airspeed and indicated altitude (figure 1). [*Author's comment: This is straight and level flying albeit 100 or 200 feet above the ground.*]
- *Contour flight* is flight at low altitude conforming generally, and in close proximity, to the contours of the Earth. This type of flight takes advantage of available cover and concealment in order to avoid observation or detection of the aircraft and/or its points of departure and landing. It is characterized by varying airspeed and a varying altitude as vegetation and obstacles dictate (figure 2). [*Author's comment: This is flying right along the tree tops at near normal airspeed.*]
- *Nap-of-the-earth flight* is flight as close to the Earth's surface as vegetation or obstacles will permit, while generally following the contours of the Earth. Airspeed and altitude are varied as influenced by the terrain, weather, ambient light, and enemy situation. The pilot preplans a broad corridor of operation based on known terrain features which has a longitudinal axis pointing toward his objective. In flight the pilot uses a weaving and devious route within his pre-

Figure 2



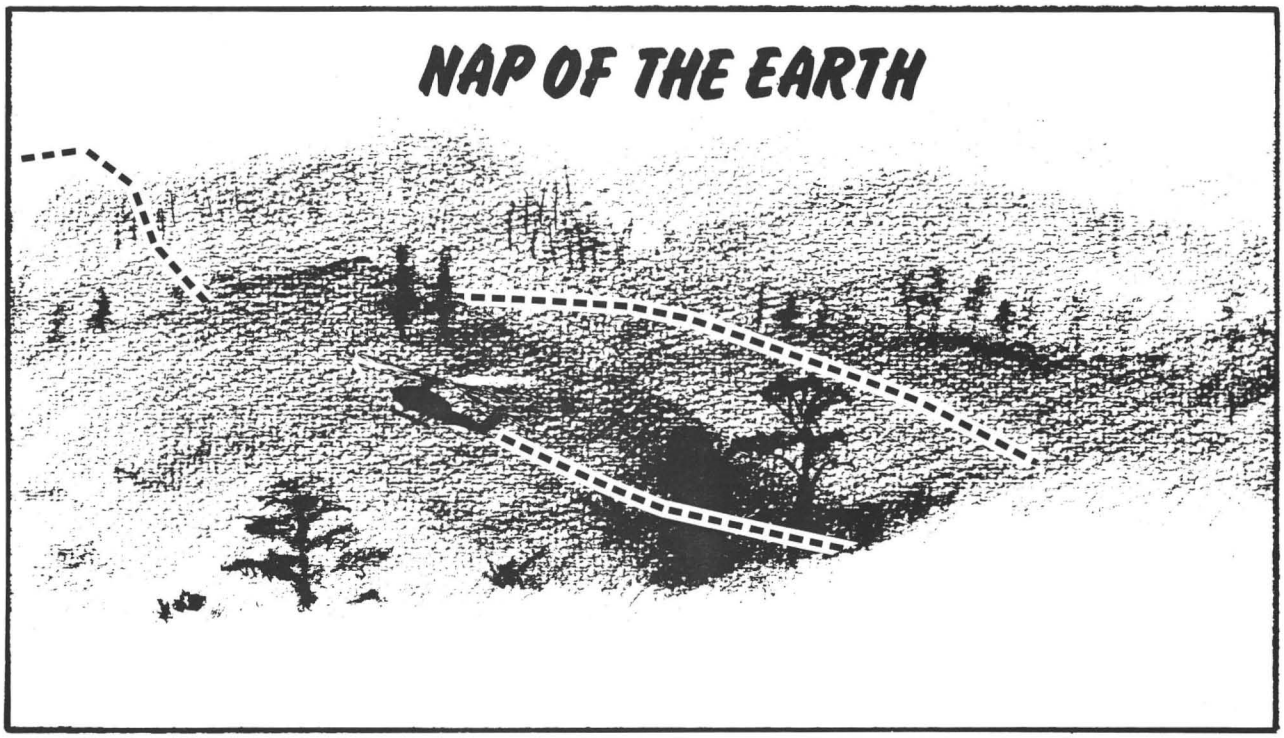


Figure 3

planned corridor while remaining oriented along his general axis of movement in order to take maximum advantage of the cover and concealment afforded by terrain, vegetation, and manmade features (figure 3). [*Author's comment: This is slow and stealthy movement with the aircraft amongst and below the level of local vegetation where possible.*]

By using examples one can see the advantage of reaching a common ground of understanding in respect to the flight modes and also make immediate application of modes of flight when referring to any general type of mission. The term low level would apply when an aviation unit is given a mission of resupply in the division trains area or other generally secure areas about 50 kilometers behind the forward edge of the battle area (FEBA). Massive troop movements in large helicopter formations in these rear areas can be safely performed using low level flight.

Suppose another aviation unit conducts an airmobile raid or assault in the vicinity of the FEBA. The combat environment is different in this example because the area is not secure and the unit's survival depends to a degree on using some concealment and cover afforded by vegetation and terrain. The flight must accommodate more than a few aircraft and is required to reach its destination in a minimum amount of time. The appropriate flight mode is contour flying.

Finally, we are concerned with a limited number of aircraft when an aviation unit is assigned a mission to reconnoiter near enemy positions or destroy enemy combat elements. The helicopter unit's flying is characterized by generally low, slow and deliberate movements which *is* nap-of-the-earth flight.

Another less obvious consideration in understanding the proper terms is the aspect of *time* in employment of aviation assets.

From the above examples, if the threat were insignificant enough to enable the aerial unit to fly a direct route at normal airspeeds over all obstacles, the commander could easily compute an accurate time estimate as to the arrival of the unit at its destination. If the enemy situation dictates that the unit circumnavigate certain dangerous areas and fly closer to the ground, the commander must consider the additional time requirements necessary for the unit to move under these conditions.

A careful analysis of the terrain, enemy and distance are required to ensure that Army aviation assets will be judiciously employed.

As mentioned, the three modes of flight do necessitate three separate, but correlated, training requirements, not only for the new aviator at Fort Rucker, AL, but also for the experienced unit aviator. These requirements prepare the aviator to accomplish successfully one or more of these modes of flight. Training considerations, emergency procedures and flying techniques have differing significance for each of the three modes.

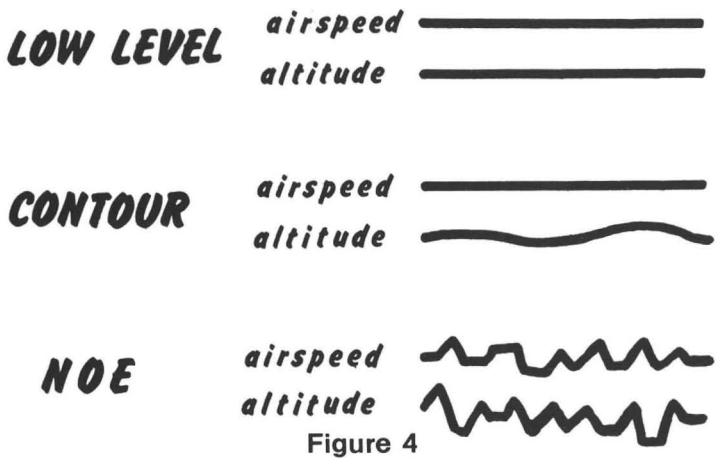


Figure 4

Low level flight is the most familiar to aviators trained prior to the early 70s because it is closest to the training received at Fort Rucker during initial flight training. Emergency procedures stressed in flight school need little modification and flying techniques are generally compatible with current training. Contour flying, however, introduces the necessity for unit training programs to emphasize the extremely low altitude and high speed hazards which require quick reaction with emphasis on applying the appropriate emergency procedure if needed.

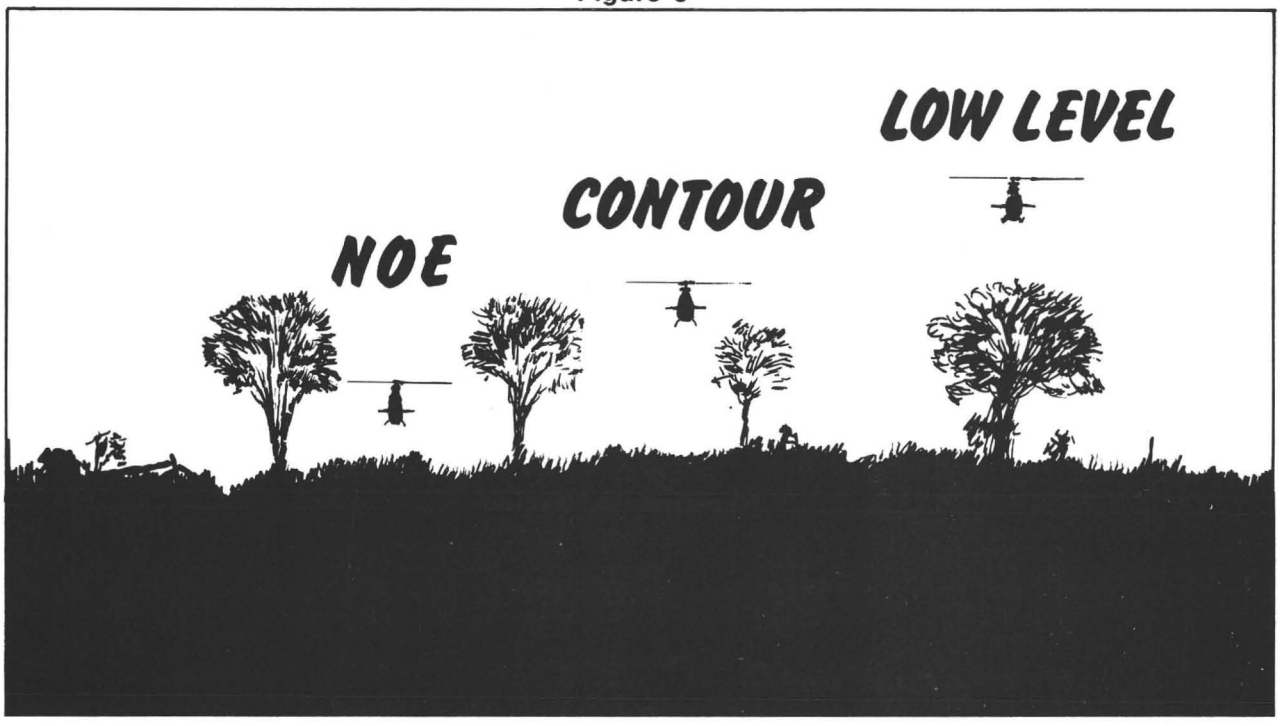
Nap-of-the-earth flight shifts emphasis in training to a new dimension altogether. Flying techniques are primarily concerned with deemphasizing speed and emphasizing hovering and deliberate movement techniques. Aviators who achieve a solid "feel" for the exact dimensions and capabilities of their aircraft in this environment should, through training, develop a concept of stealth and ground observation techniques comparable to those used in Armor and Infantry operations.

The goal of all aviation units destined for employment in a high threat environment is mission accomplishment and survival to accomplish the next mission. Training must be accomplished to allow safe conduct of all three of the modes of flight. Unit training must be structured to build experience and increase the degree of difficulty for the individual aviator as proficiency progressively increases.

It follows that a mode of flight used initially that allows a constant airspeed and altitude would be desirable in low level flight training (figure 4). Next, a mode allowing maintenance of airspeed while following the contour of terrain is logical. Finally, each aviator graduates to the mode that requires continuing variations in airspeed, altitude and flight path to avoid obstacles while simultaneously taking full tactical advantage of all available terrain and vegetation for cover and concealment.

Training of aviators to conduct nap-of-the-earth operations at Fort Rucker and other posts has shown that all three definitions are necessary for efficient and understandable discussions and demonstrations of the modes of Army terrain flying (figure 5). Armywide understanding of the three definitions, not only by the aviator, but by the ground commander as well, will significantly reduce the problems of understanding and planning for training which exists today.

Figure 5



How To Retain Your Instrument Rating

CW2 Thomas E. Wright
Instructor Pilot
Department of Flight Training
U.S. Army Aviation Center

AS AN AVIATOR in the U.S. Army, regulations state that you must attain and maintain a standard instrument rating. While we are all familiar with the sometimes traumatic experiences surrounding the attainment of this rating, it is the maintenance of which that I would like to address.

Why is it, that as the time approaches to renew the standard instrument rating, a familiar feeling of panic begins? This is, of course, nothing that you can't handle. Attaining your instrument rating was significantly more demanding than your renewal. Perhaps this feeling is more a lack of confidence stemming from being unfamiliar with the subject matter.

Most aviators can maintain an adequate amount of physical proficiency with the aircraft and, with little practice, can improve that proficiency to a point where they can maintain the aircraft within the designated criteria for satisfactory instrument flight.

Their familiarization with regulations and procedures, on the other hand, is a different story. Each unit has its own flying hour program and only a small portion of that is dedicated to instrument flying. This lack of familiarization can be summed up with a phrase I'm sure you have all heard before, "If you don't use it, you'll lose it."

While the Army Regulations and Field Manuals on instrument flight provide a wealth of information, there are certain areas in these publications that contain procedures most often used. I would like to review these areas in an effort to help those aviators whose primary military duties do not allow the time to maintain proficiency in their secondary duty of aviation.

It is no mystery that there are a minimum of three publications that always will be used for planning as well as inflight—an Enroute Low Altitude Chart; a volume of the Low Altitude Instrument Approach Procedures; and the Instrument Flight Rules (IFR) Supplement. Of these three basic publications, the IFR Supplement has the most overall information. Besides the fact that the legend in the front will help you interpret the Aerodrome/Facility Directory within, there is invaluable information in the back; the most relevant of which would be *Pilot Procedures (FAA) and Emergency Procedures* section. And, don't forget the back cover. It has formats for position reports and for changing and filing flight plans while enroute.

Since we are on the subject of flight information publications (FLIP), let's take a look at *General Planning.* For you people who recently have been in a nonoperational flying position and are returning to flight duty, that is the old Section II. To begin with, there is an index for Aeronautical Information (Chapter 1) that tells you the portion of FLIP in which you can find a specific piece of information. This is particularly useful during the oral phase of an instrument renewal.

Probably the most relevant chapters, the chapters that contain procedures that are most often used under IFR, are Chapters 4 and 5. Chapter 4 explains flight plans; how and when to use them. So, if you have any doubts as to how to fill out a flight plan, refer to Chapter 4 and it will explain in detail how to do it. Chapter 5 is the procedures portion. It contains, perhaps, the most relevant information on departures, enroute, and arrivals.

Additionally, if you need to know about inflight weather advisories, briefings and broadcast—or have difficulty interpreting weather reports—take a look

at Chapter 8 of General Planning.

While there are several ARs that pertain to aviation, in keeping with the theme of this article, I would like to discuss two of them. AR 95-63, Chapter 2, discusses the prerequisites and procedures for initial award or reestablishment of an instrument qualification. For example: "Applicants for renewal of instrument qualifications are required to complete successfully an instrument flight examination prior to the expiration date" (para 2-8). You no longer have a 60-day grace period after your birth date.

The other regulation, AR 95-1, "General Provisions and Flight Regulations" is perhaps the "bible" of Army aviators. While AR 95-1 contains an enormous amount of Army aviation information, Chapter 4, *Flight Procedures and Rules,* contains information that *must* be considered when filing under IFR, visual flight rules (VFR), and Defense Visual Flight Rule (DVFR).

There is one final publication I feel I must mention in order to make this article complete. It is so comprehensive that discussing one or two chapters would not do justice to it. It is, of course, the Airman's Information Manual (AIM), Part I which should have answers to any questions on aviation procedures.

The information I have discussed in this article, while one might consider it the "meat" of instrument meteorological conditions (IMC) flight, is only a place to start. Flight into IMC demands that the aviator be familiar with all available publications. The safe conduct of any flight is directly proportional to the knowledge of the pilot at the controls.

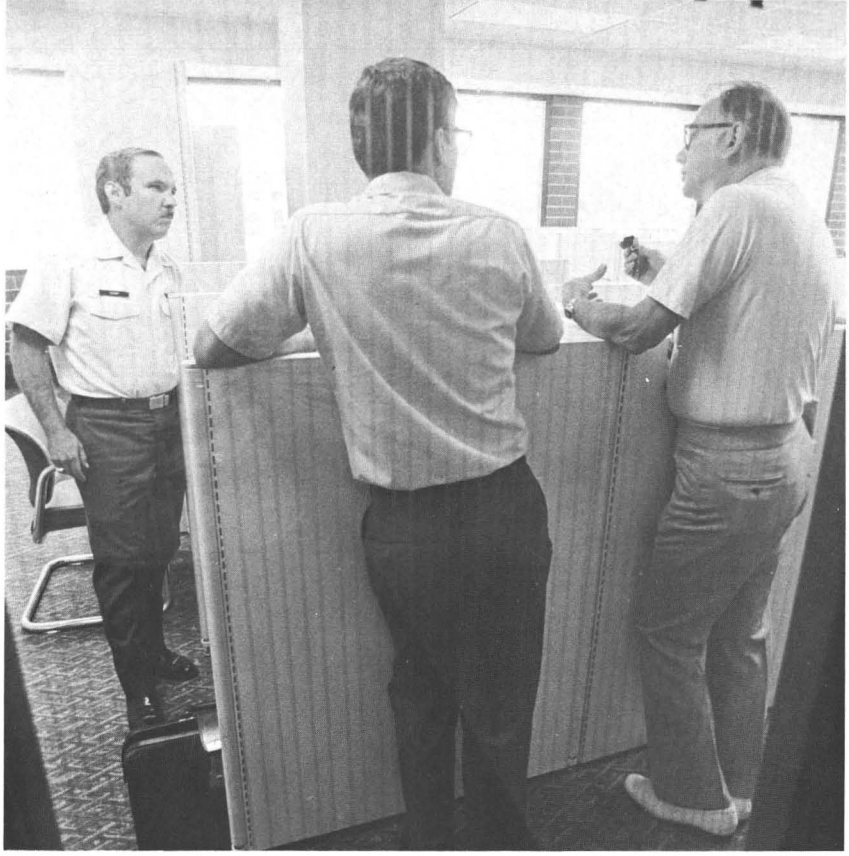
Phillips Army Airfield Seven Years Safe Flying

PHILLIPS ARMY AIRFIELD at Aberdeen Proving Ground, MD has been cited for the seventh consecutive year for its accident-free, safe-flying record.

The Department of the Army (DA) recognized airfield personnel with an Award of Merit for accumulating seven years and 31,068 consecutive hours of flight time without a mishap.

The Award of Merit was the fifth for the airfield, to go along with a Department of the Army Award of Honor and a DA Award of Excellence. the Award of Honor is presented for three consecutive years of accident-free flying, while the Award of Excellence is presented for six consecutive years. As of 20 January, Phillips had surpassed 33,600 hours of flight time without an accident.

SAFETY CITED—Major General Patrick W. Powers, left, commander of the U.S. Army Test and Evaluation Command, presents a Department of the Army Award of Merit to Lieutenant Colonel Edmund B. Bookman Jr., chief of Phillips Army Airfield at Aberdeen Proving Ground, MD. (U.S. Army Photo by Ruth Hawks.)



Students discuss their thesis with Professor Jerry Peppers (R)

Maintenance Management Education

AVIATION AND Dayton, Ohio, have much in common what with the Wright Brothers and the Aviation Hall of Fame. Additionally, Wright-Patterson Air Force Base, and its research, technical and support complex, aid and advance aviation in today's world. So, to mention Wright-Patterson AFB, and the Air Force, in an Army aviation magazine isn't too great a shock for the reader.

But, what may be a shock for many is the statement that on Wright-Patterson there is a school which could be of great value to Army aviation maintenance managers. It is the School of Systems and Logistics—a major element of the Air Force Institute of Technology (AFIT).

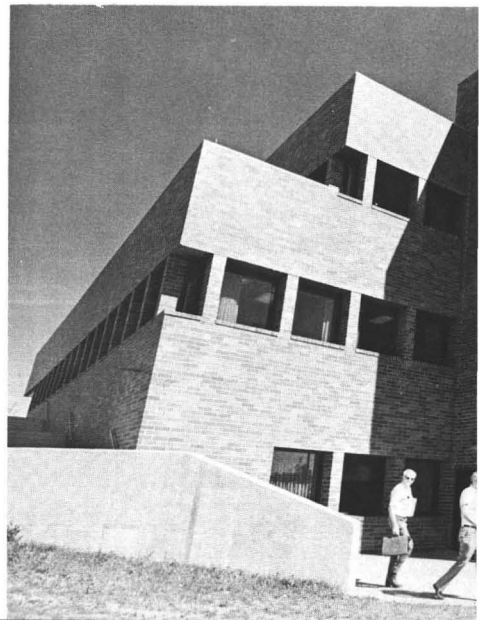
AFIT has existed since the early 1920s for the purpose of educating, in technical fields, the officers of aviation and aeronautical research and development first in the Army, then in the U.S. Army Air Corps, and now in the Air Force. The School of Systems and Logistics has not existed that long. It has been functioning since the 1950s, providing educational programs for logistics managers of all services and the Defense Logistics Agency. More than 4,000 students go through the various short courses each year and the total participants over the years exceed 60,000.

Most of the continuing education (short) courses of the school are directed toward logistics discipline areas other than aviation maintenance. But, there are two courses which Army aviation people should know about for assistance in their professional development. They are: LOG 261, Maintenance Management and Information Systems, and LOG 131, Industrial Maintenance Management. Both of these courses are listed under the Maintenance Management Specialty (91) in DA PAM 600-3, "Officer Professional Development and Utilization," as affording mid-career level instruction. This article briefly describes each so that the readers might make their determination as to potential value in their continued education.

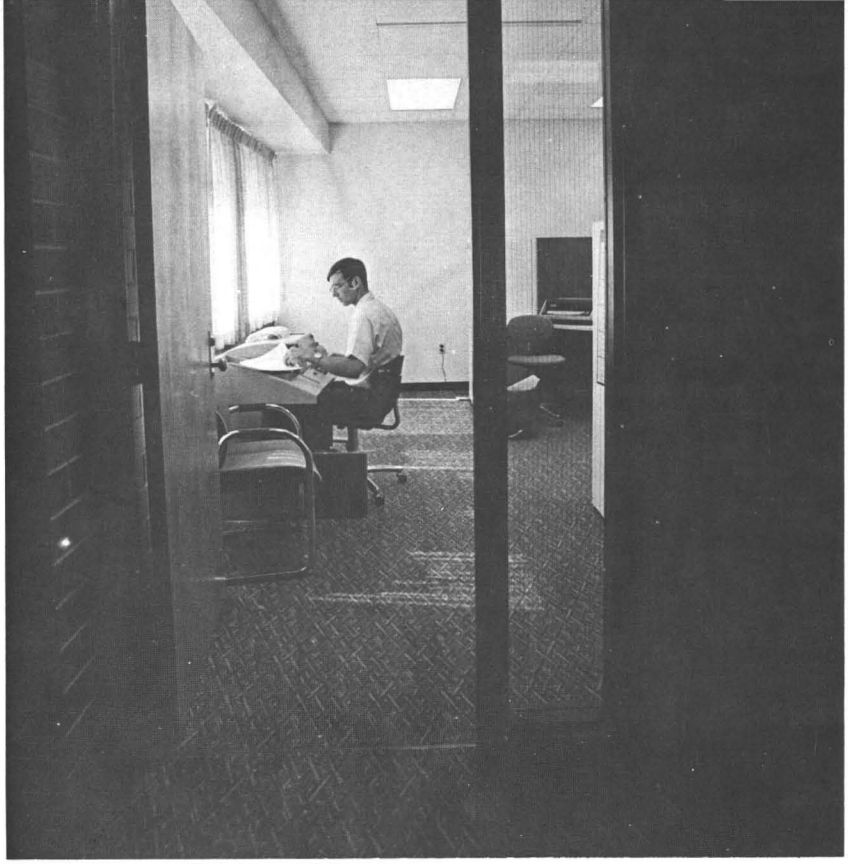
Maintenance Management and Information Systems: This course, LOG 261, runs for 13 class days (about 18 TDY days) and is designed for maintenance management people at the organizational and intermediate levels of maintenance. Military grades E-7 through 0-6, civil service grades GS-7/9 through GS-15, and their equivalents, are eligible. The normal class has representation from all four services, military and civilian, and provides an interactive capability which is not possible in single-service-oriented programs. This makes for an enhanced learning environment of immense value to the individual.

Many offerings are provided throughout the years so participants, with the approval of their unit

Modern educational building at



Jerome G. Peppers Jr.
Professor of Management
Air Force Institute of Technology
Wright-Patterson AFB, OH



Students have frequent use for the school's network of computer terminals

commanders, have a wide choice as to when they want to attend. Army quotas are handled through DARCOM: Personnel Support Activity; ATTENTION: DRXMM-E. Schedules of course offerings, and further student prerequisites, may be obtained from them or through the Defense Management Education Training Catalog, DOD 5010 16C, which should be available in training offices.

This course is designed specifically for maintenance managers responsible for accomplishing post/field Army/ship/base level maintenance. Its purpose is to enhance the on-the-job effectiveness of these personnel to assure accomplishment of the maintenance mission with minimum expenditure of resources.

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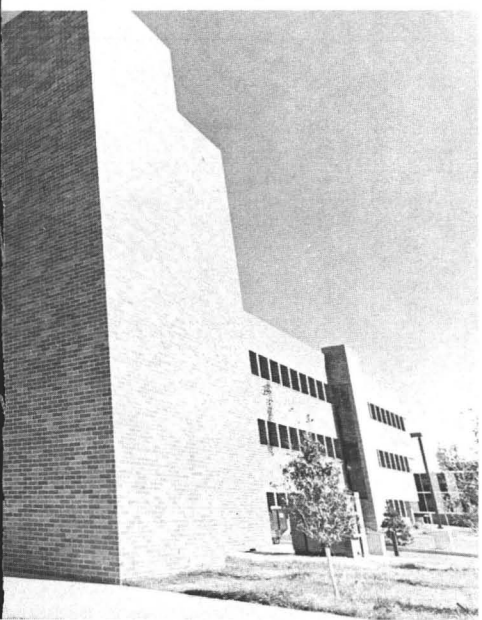


Major emphasis is placed on:

- Determination and understanding of the maintenance mission.
- Understanding the philosophies and concepts of management necessary for mission accomplishment.
- Understanding the role of maintenance management in logistics and the cooperative relationships which must exist with other functional areas.
- Management analysis of and familiarization with maintenance management information.

The objectives of the Maintenance Management and Information System Course are to:

- Provide an understanding of the concepts, philosophies and evolution of maintenance management and maintenance management information systems in the Department of Defense (DOD).
- Improve the management capabilities of participants through exposure to, and discussion of, principles and concepts of modern management as applied to military maintenance management.
- Increase the analytical abilities of key maintenance managers and develop an improved awareness of the management uses of information systems.
- Establish a base of understanding through which management integrity may be improved and intelligent resources management may be applied.

Emphasis is placed upon participative methods of instruction. The course program is presented in:

- Concise, specific lecture-discussion periods in which students are encouraged to participate with pertinent contributions or questions.
- A maintenance management simulation which provides for individual participation in problem identification, problem solution and decisionmaking.
- A management practical exercise to permit self-evaluation of work habits, logic and priority determination.
- An exercise involving a model of inventory management permitting the student to learn the principles and procedures involved in maintaining supply of an item at

the lowest cost possible.

Industrial Maintenance Management: LOG 131 is directed toward the managerial responsibilities found in the depot/industrial rework level of maintenance. It runs for 18 class days (about 24 TDY days) and is designed to further the professional capability of military and civilian personnel assigned as section through division managers within the Department of Defense depot maintenance systems. Industrial engineering and management principles are stressed along with analytical techniques designed to help the participant identify and solve problems and cope with the pressures of complex technology.

The objectives of the Industrial Maintenance Management Course are to:

- Enhance managerial capabilities of personnel managing the DOD depot maintenance activity.
- Improve management practice by evaluating and applying modern management science techniques to industrial maintenance programs.
- Develop aggressive problem analyzers and logical decisionmakers.
- Provide the environment for indepth analysis of modern management techniques and their applicability to the DOD industrial activity.

Four major course elements have been developed to meet these objectives. The first pertains to the analysis of pertinent concepts and techniques of management science applied to the planning, use and control of limited maintenance resources.

The second consists of workshops, exercises and other student centered activities which stress application of theory to actual problems encountered in the industrial maintenance environment. Both group and individual decisionmaking is accomplished together with class presentation, discussion and critique.

The third element provides for a field trip to a commercial private industrial plant to observe the application of production management approaches.

The fourth and culminating element is a 26-hour industrial management simulation. This dynamic exercise allows the student to integrate all facets of the course in a fast paced, demanding support environment requiring small group decisionmaking.

Emphasis is placed upon participative methods of instruction. The course is presented in:

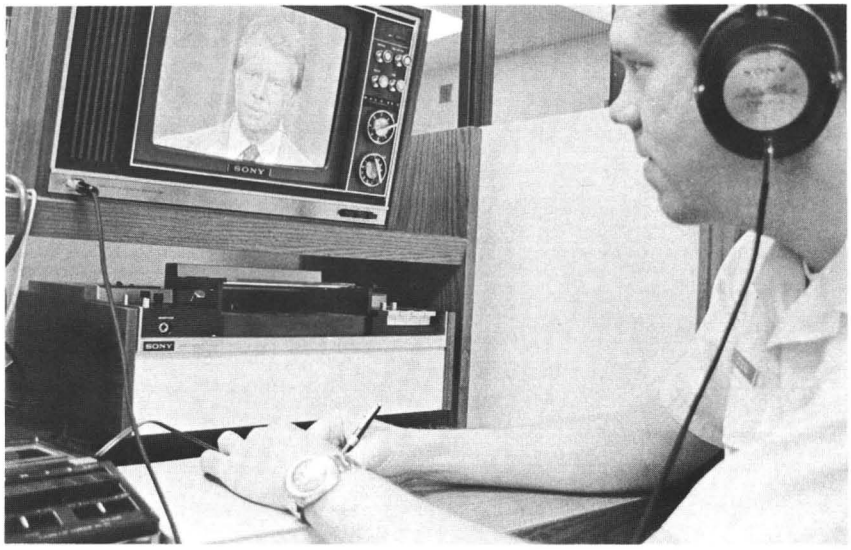
- Concise, specific lecture-discussion periods in which students are encouraged to participate with pertinent contributions or questions.
- A logistics management simulation which provides for individual participation in problem identification, problem solution and decisionmaking.
- A management practical exercise to permit self-evaluation of work habits, logic and priority determination.
- Case situations which permit students to express their decisions and to compare their responses and value judgments to those of others in the class, in previous classes, and responses derived from other sources.
- An exercise involving a model of inventory management permitting the student to learn the principles and procedures involved in maintaining supply of an item at lowest cost.

Additional Information: The Department of Maintenance and Supply in the school is headed by Lieutenant Colonel G. Ford, U.S. Army. He may be contacted by mail (AFIT/LSCM, W-PAFB, OH 45433) or by telephone (area code 513 255-4149) (AUTOVON 785-4149). LTC Ford would be glad to discuss either course with you if you are interested and encourages your letters and/or calls.

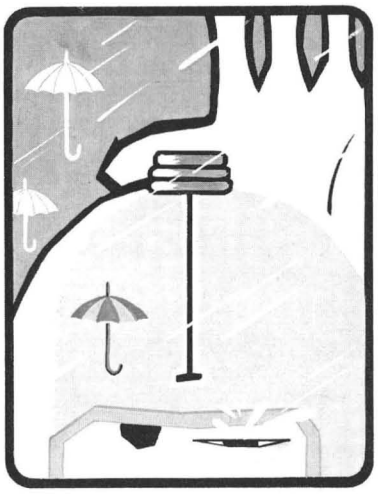
In 1970 the school initiated action which resulted in authority to provide college-level transcript credit for selected courses through the AFIT academic registrar. Both of these courses are accredited at the undergraduate level and the AFIT transcript is available for participants who successfully complete the course of instruction.

This is an educational opportunity for any aviation maintenance manager. The School of Systems and Logistics would like for you to participate and looks forward to that event. Take advantage of the opportunity. You will benefit and so will the school and your fellow students.

Learning Resources Center at the School of Systems and Logistics



VIEWS FROM READERS



Sir:

I'm writing you about an article that was in the *Digest.* It was in one of the copies between 1971 through 1973.

It's an article about a CH-47B and a CH-54. A CH-47B had run off a P.S.P. runway in Vietnam. Another CH-47B picked it up and helped put it back on dry land.

A CH-54 was called in to sling load it out. After it was stripped the CH-54 tried to pick it up, but it was too heavy. They waited for it to drain and tried again. But it was still too heavy. Then a CH-47B picked it up and carried it off.

If possible I would like for you to send me a copy of that article.

I really have enjoyed your articles in the *Digest.* I think it helps enlighten all of the personnel in the aviation field.

SGT Jerry G. Howell
1 Patrick Henry Terrace
Newport News, VA 23602

• The article you requested is entitled "Another First (And We Hope The Last)." It appeared in the June 1971 issue on page 32. A copy is in the mail.

Sir:

This is in response to your request in the October 1977 *Digest* for former Liaison Pilots to write in.

I entered Liaison Pilot training at Sheppard Field, Wichita Falls, TX in December, 1945. I completed this course in early spring 1946. I then proceeded to the Air Training Department (or school) at Ft. Sill, OK for tactics training. Upon completion of tactics I reported to Ft. Riley, KS and was assigned to the Liaison Plane Detachment of the 91st Cavalry Recon Squadron (Mechanized). We had six L-4s and were based on the airfield with an AAF Liaison Squadron of L-5s. The Cavalry school was being converted to the ground general school.

I retired in December 1963 and have been supervisor of the Ft. Lewis, WA Flight Simulator Branch (SFTS) for the past several years as a Department of the Army civilian.

How times and Army aviation have changed!!

LTC John D. Gillespie
AUS, Retired
206 Brandywine Avenue
DuPont, WA 98327

Sir:

This letter is in response to your request in the Jan 78 issue for information regarding the use of blue and amber transparent panels and goggles for simulating IMC flight. This method was used when I was a student in the Instrument MOI course at Ft. Rucker, AL in Apr 68. My instructor was CW3 Roger Gould. Instructors and students alike favored using this system rather than the traditional hood. It improved the IP's ability to see and avoid other aircraft and eliminated the occasional dislodging of the hood which usually occurred, in accordance with Murphy's Law, at the time when it would cause maximum student confusion. Later, when I was commander of the Rotary Wing Instrument Flight Examiner Course, I recommended using the colored panel or polarized panels and goggles in the interest of safety, but nothing came of the idea.

MAJ Hubert J. Bell Jr.
FORSCOM Inspector General
Ft. McPherson, GA 30330

Sir:

Reference letter, CW3 Harold D. Wright, Views From Readers, Jan 78, *Aviation Digest,* subject: IFR practice.

CW3 Wright is correct. This method was used in the L-20 (U-6) aircraft at Ft. Benning, GA in the late 50s and early 60s. It also was used by the Air Force as early as 1948.

Strangely enough, this method was never purchased by the U.S. Army, and therefore was never installed at Government expense, but was jerry-rigged and installed by crewchiefs and/or pilots.

SGM James L. Smith
Office of Senior Army Advisor
(ARNGUS) NH
Concord, NH 03301

Sir:

Regarding the letter (Jan 78 *Digest*) which discussed simulated IFR by use of blue windows and orange goggles. I know that several tests were conducted

at the Naval Air Test Center, Patuxent River, MD around 1974. The tests were performed to simulate night overwater rescues in H-46 helicopters. I do not know if the method became common practice in training squadrons, but perhaps people at HCT-16, Pensacola, FL will know. As I recall, the technique was quite effective and utilized blue plexiglas cut to fit inside the H-46 windshield.

LCDR Dan Welch
Aviation Safety Officer
Naval Station
Mayport, FL 32228

Sir:

This unit is seeking names of deceased personnel who, as former members of the 12th Aviation Group (Combat), had distinguished careers which warrant memorialization. Personnel nominated for this honor must have distinguished themselves by acts of supreme heroism or who held positions of high and extensive responsibility. Further, information is needed on subordinate units which have distinguished combat records associated with battles of geographical locations which have historical meaning.

Request you mention this task appropriately in your magazine to assist us in this endeavor.

Responses should be directed to LTC Ruben M. Pate, 12th Aviation Group (Combat), Ft. Bragg, NC 28307, AUTOVON 236-0808.

LTC Ruben M. Pate
Executive Officer
12th Aviation Group (Combat)
Ft. Bragg, NC 28307

Sir:

Recently, while looking for decorations to hang on our Pilot Ready Room walls, I came across a copy of John Gillespee MaGee Jr's "High Flight." Along with "High Flight," I also found a parody of the same which was published in an Air Force magazine similar to *Aviation Digest* called "Low Flight" signed Anonymous.

Well, I thought both of these verses were a bit inappropriate for today's Army aviation mission. So, keeping both works in mind I attempted to come up with something more suited to our daily missions. Enclosed please find a copy of "NOE Flight," which I hope you will find worthy of publication in the *Aviation Digest.*

NOE Flight

Oh, we have slipped the muddy clutches of earth,
  Suspended, hopelessly, from dented, untracted rotor blades.
Upward we have leaped, and joined the rustling mirth,
  of softwood pines and hundreds of miles of power lines—
    and commenced a game that we all have played.
We all have dreamed—vibrated and shuttered and hung,
  Low in the shaded silence. Hovering there,
We've chased the dancing vortices, and flung,
  Our straining craft through liftless masses of air.
On, on through the unforecast one hundred and one-quarter,
  We've traced the long and winding blue,
Insuring that our machine remained in a fashion of tactical order,
  We remain at an altitude so low,
    that never a self-respecting lark or eagle flew.
While, now with organized thoughts we trod
  The low, untrespassed valleys that we do not know...
Hoping to prevent, this day, our seeing the *FACE OF GOD.*

CW3 Thomas T. Desert
C Co., 8th AVN Bn (CBT)
APO NY 09185

Silver Medals For 'Screaming Eagles'

FOR HEROIC actions in pulling an injured pilot from his burning plane, three crewmembers of a Ft. Campbell, KY 101st Airborne Division helicopter were awarded Federal Aviation Administration's (FAA's) Distinguished Service Awards with silver medals plus the Army's Commendation Medals. Director Phil Swatek flew to the Army post to present personally the FAA awards.

In July 1977, three "Screaming Eagles" were on a routine mission to Nashville, TN when the tower called on them to help find an aircraft they had lost from radar. The crew "scrambled" and, guided by Nashville radar, began an aerial search. They soon observed a column of smoke—the downed aircraft piloted by William Locke.

They landed, saw the plane on fire, and quickly looked for signs of life. They saw the pilot moving but unable to get out alone. The door was jammed partially. Locke freed his seat belt and struggled far enough for CW2 Thomas Potts to grab his hands. Aided by CW2 Steve Robinson, they forced the door open and dragged Locke out and away from the burning plane while SGT Gerald Heitzman held back the flames with a hand extinguisher. Locke was injured, bleeding badly, and in shock. They rendered first aid until the ambulance arrived and transported him to the hospital. The plane was destroyed by fire.

The crew later learned Locke would not have escaped unaided nor survived the trauma of his injuries without their help.

Credit also goes to Nashville Radar Controller Don Smithson; Team Supervisor Bob Sory; and Tower Controller William Duke who scrambled the crew and coordinated flight and ground efforts until the rescue was made.

From *Southern Intercom* (Department of Transportation/Federal Aviation Administrator)

Mountainside Recovery Mission By 4th Infantry Division

A REQUEST FROM the National Transportation Safety Board (NTSB) and the Federal Aviation Administration (FAA) last December sent helicopter crews from Fort Carson scurrying for an area just west of Aspen, Colorado.

A twin engine Cessna 414 which crashed in that area over Thanksgiving weekend, in which one occupant had been killed, had to be removed from a mountainside at the 13,000-foot level.

Earlier forays by the FAA and the NTSB had seen the wings, engines and tail section of the craft removed for investigative purposes, but they had been unable to recover the cabin section of the aircraft due to snow, high winds and frigid temperatures.

A CH-47 Chinook heavy lift helicopter from 179th Aviation Company was dispatched for the lift mission which eventually was scrubbed because of the failure of a steel rigging cable used by the civilian salvage crew. A nylon lifting harness, used frequently by the "hooks" to haul fuel and ammunition remained intact.

Severe cold and the approach of darkness made extending the recovery attempt a poor risk and the crews, which included riggers from Carson's 704th Maintenance Battalion and aircrews from the 179th and 4th Aviation Battalion, returned to the mountain post shortly after dark on the day of the mission.

Plans now call for a renewed attempt at pulling the fuselage out of the snow when the weather proves more hospitable, perhaps this spring.

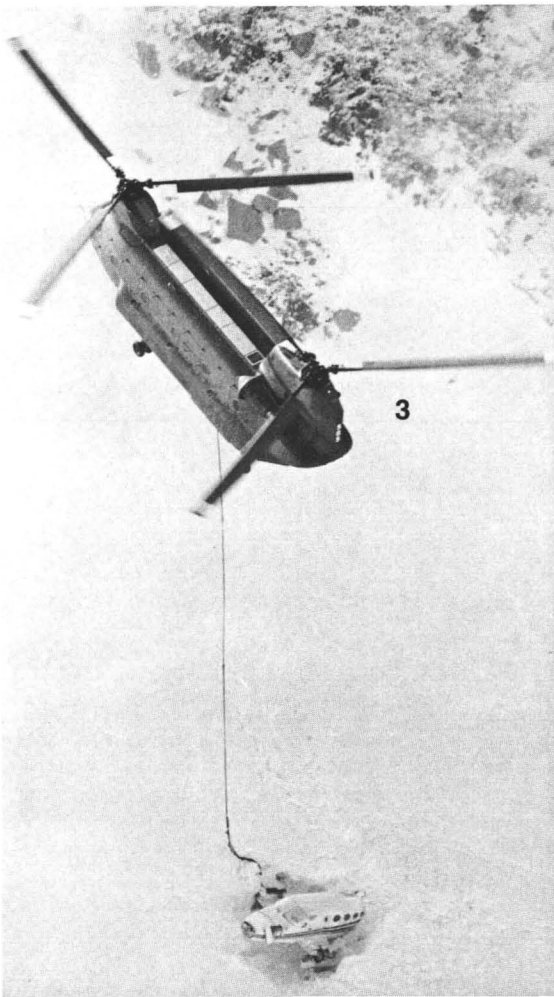
Temperatures at the recovery site were as low as 28 degrees below zero (celsius) at about noon as the Chinook, piloted by CW3 Lynn W. Larsen and CW2 Robert Larsen deftly backed into the rockpile on which the recovery crew was placed more than two hours prior to the attempt to pull the downed craft from the snow.

Not unlike fire base resupply missions conducted by the Chinooks in Vietnam, the "hooks" back end was on the ground while the front of the aircraft was deftly hovered over the edge of the precipitous terrain.

Flight engineers SSG Terry Glasscock and SGT Barbara Bartlett performed their ballet on the loading ramp calling the shots as the "hook" backed into place for the insertion.

Who says aircrews don't earn their pay?

(1) CH-47 enroute to aircraft downed in the Rockies west of Aspen. (2) The Chinook maneuvers into the saddle, site of the crash. (3) Helicopter attempts recovery of the cabin section. Story and photos by Dick Devlin



PEARL'S

Personal Equipment & Rescue/Survival Lowdown

If you have a question about personal equipment or rescue/survival gear, write Pearl, DARCOM, ATTN: DRCPO-ALSE, POB 209, St. Louis, MO 63166

You Want To Make Something Of It?

You people in the field are the experts when it comes to using your aviation life support equipment (ALSE). Those of you who are not proficient in the use of ALSE, ask questions now. You may not survive an actual emergency on-the-job training program. Also, if you have an idea how to improve your ALSE, or an idea for a new item, submit those suggestions if you want to make something of it. And, adopted suggestions could mean money in your pocket.

Protect Thyself—And Others

You have donned your Nomex clothing and have the sleeves rolled down and fastened and the collar turned up. You also have your gloves, helmet, boots, survival kit, radio, etc. (In fact you are the best equipped/dressed Army aviator anywhere.) You have performed a preflight of your aircraft and are ready for your flight. Yes, you have done everything possible to protect thyself, but what of the others?

As the aircraft commander you should assure that your passengers also are equipped/protected. We know that it is impossible to outfit every person who flies as a passenger with a complete survival package of ALSE. However, there are many things you can do toward providing protection/survival. There are flight helmets that can be temporarily borrowed for your passengers. The helmet is considered the most important item of ALSE. You may advise your passengers that nylon or similar materials are less desirable than cotton or wool clothing. Emergency procedures also should be discussed with your passengers. You have an obligation to "Protect not only thyself—and others too."

Do We Make Mistakes?

You bet we do! We earnestly strive to provide you with the best and most accurate information possible regarding your aviation life support equipment. Remember, it is only those who attempt to accomplish something that make mistakes. So when you call in to let us know that we have made an error, it lets us know that you have been reading PEARL, and it helps keep us on our toes.

We certainly do not have the ultimate solution to all the problems we hear about, but we will try to find you one that is acceptable. Also, if you have an item or article of interest that you would like to see appear in PEARL, let us know. We learn from each other.

High Altitude Oxygen

Our aviation unit has a requirement to fly high altitude and rescue/survival missions in which we use the MBU-5/P oxygen mask in conjunction with either the SPH-4 flyer's helmet or the U.S. Air Force SGU-26/P flyer's helmet. When using this mask with "bayonet fittings" we have no problem with the SGU-26/P, but we do have a fitting problem with the SPH-4. Can you tell us how to fit the SPH-4 with bayonet fittings? Will a procedure be published soon in an Army Technical Manual (TM) and if so, which one?

Mask fitting and mounting of the bayonet fittings whether on the SGU-26/P or the SPH-4 helmets should be accomplished only by trained life support personnel. At the present time the Army has very limited capability in this area due to lack of trained ALSE personnel in all Army aviation units. Suggest you contact the nearest U.S. Air Force life support facility for needed assistance. Placement of the bayonet receiver on the SPH-4 helmet may differ on each individual aircrewmember; therefore, it is of prime importance to properly mate and fit the helmet and MBU-5/P oxygen mask to each individual. Bayonet receivers will be attached only to aircrewmembers fitted helmets when they have a specific oxygen requirement. Maintenance, repair and inspection of the MBU-5/P oxygen mask will be accomplished in accordance with USAF Technical Order (TO) 15X4-4-12. Procedures for mounting the bayonet receivers on the SPH-4 helmet are being finalized and will be included in the next change to TM 10-8415-206-13. Should additional information be required, please call Mr. Jim Dittmer, U.S. Army Support and Aviation Readiness Command (USATSARCOM) St. Louis, MO, AUTOVON 693-3715.

SPH-4 Helmet Visors

Aircrewmembers in our unit have been experi-

encing a high rate of SPH-4 helmet visor replacements. Technical Manual 10-8415-206-13 is not quite clear as to what criteria should be used to replace the visors when they are scratched or otherwise defective. Almost all of the mars/scratches have been in the peripheral vision area (next to the tracks). These mars/scratches are caused by the visor housing rubbing against the visor as it is moved up and down. What is considered the critical area of vision? Is there an immediate "fix" to this problem? I believe the TM also could be clearer as to the inspection/replacement intent.

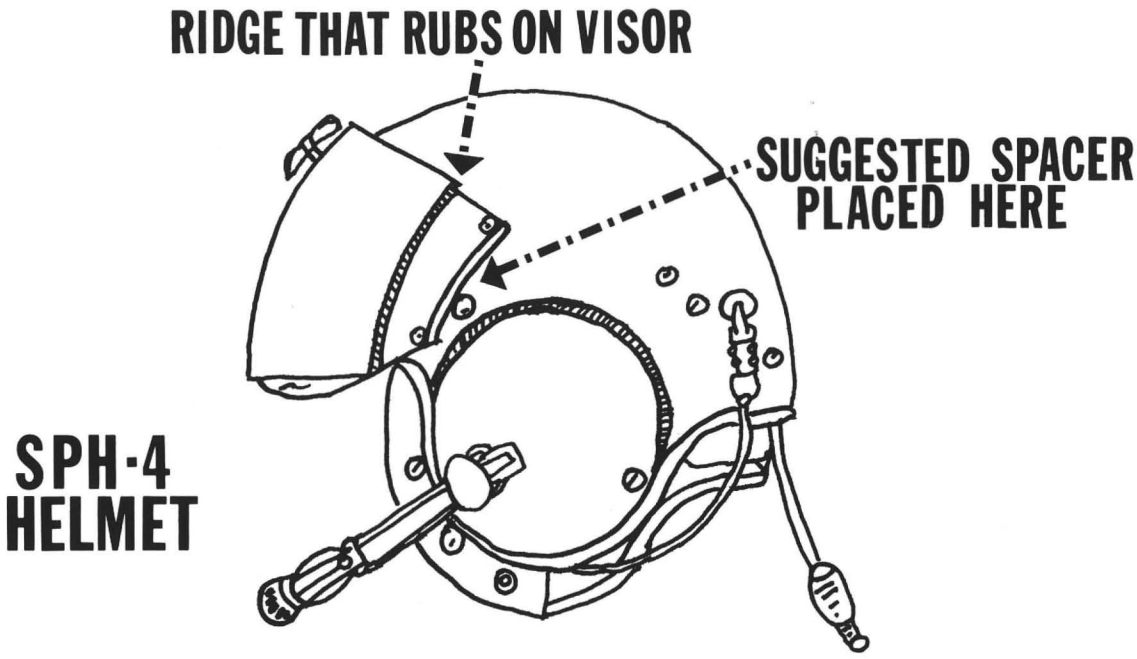
Your letter highlighted the concern of the Department of the Army Research and Development Command (DARCOM) Project Officer for aviation life support equipment. Action currently is being taken to resolve the abnormal use rate of the SPH-4 helmet visor. The U.S. Army Support Center (USASC) and the Defense Personnel Support Center (DPSC) have indicated an average of 10,112 SPH-4 helmet visors were being replaced annually. Inspection requirements in the SPH-4 helmet TM on visor defects are not clear and are open to misinterpretation. The Directorate of Maintenance, TSARCOM, has been tasked to issue a change to TM 10-8415-206-13 clarifying visor inspection criteria and identifying the visor critical vision area. Yes, there is an immediate fix—spacers, NSN 8415-00-410-4666, can be used on each side of the visor housing to raise the housing to minimize the marring/scratching (figure 1). The "joggling"area next to the tracks outside of the "dotted circles" (figure 2) is not in the critical vision area. Therefore, mars/scratches in this area are not viewed as defects for the purpose of visor replacement. As a matter of information, once the inspection requirement is clarified, the savings is estimated at $70,784 annually.

Flight Helmets

I understand that The Surgeon General found the AFH-1 and APH-5 helmets potentially hazardous in that they provided poor sound attenuation for protection against hearing loss. Further, that these helmets were to be turned in as obsolete and the new SPH-4 helmet issued to aircrewmembers. Unfortunately (probably because the helmets are stock funded) some of us are still wearing the old style flyer's helmets. Can you give us any data which will alert our commander to potential hazards of the "old" helmets in order that we can be provided protection against possible hearing loss?

Glad you asked that question. Although I have answered this question several times in my PEARL articles and also in FLIGHT FAX, I feel it worthy of mentioning again. The answer is plain and simple. The Surgeon General did find the AFH-1, APH-5 helmets potentially hazardous and provided poor sound attenuation for protection against hearing loss. U.S. Army Materiel Command Type Classification Meeting 7-72, Agenda Item 9539 officially declared these helmets as obsolete, and they were to be reported in accordance with Army Regulation 755-1. However, it appears that some units have not gotten the word. If you are still wearing either the

Figure 1



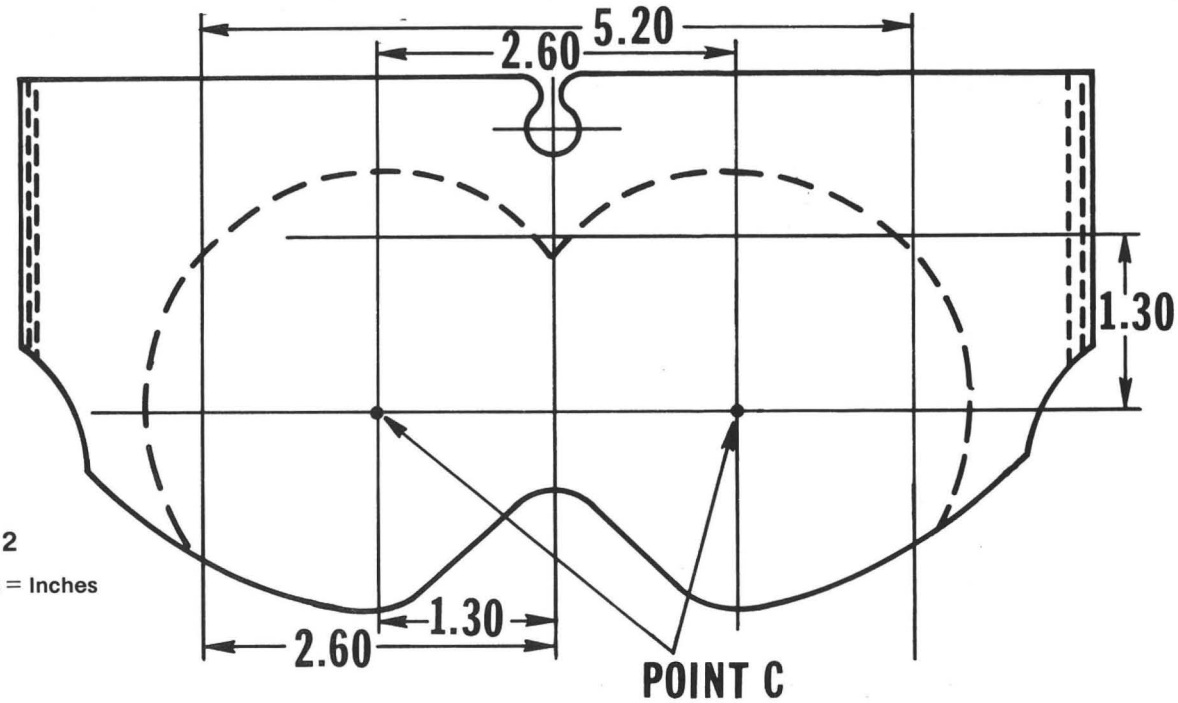


Figure 2

Numbers = Inches

AFH-1 or APH-5 helmet, I would suggest you show your commander this article and get yourself an SPH-4 helmet now.

Oxygen Mask/Helmet Switching Cord Assembly

Aircrewmembers of our aviation unit have voiced their concern that during high altitude missions requiring oxygen, they must make a rapid transition from the helmet boom mike to the MBU-5 or A-13 oxygen mask microphone. This requires the aircrewmembers to unplug one microphone cord assembly and insert the other microphone cord assembly. I believe a simple solution would be to adopt the U.S. Air Force switch and cable assembly which I understand they are using. Can you identify the assembly? Can we get it authorized for Army use? Where can we get it?

This same problem has been surfaced by other aviation units flying high altitude and rescue/survival missions and certainly identifies the need. The assembly you are talking about is made up of the following cord assemblies: NSN 5995-00-296-8037 and 5995-00-816-3657-P/N CX-47081-A1C; the items cost $30.12 and $4.56 respectively and can be procured "off line" to the U.S. Air Force item manager, Kelly AFB, San Antonio, TX. The Technical Order (TO) is USAF TO 14P3-4-112 which can be secured from U.S. Air Force Publications, Tinker AFB, Oklahoma City, OK. Interim approval has been granted for use of these items since there is no major configuration change to the helmet and the Army will be identified as a user.

If additional information is required please call CW2 Dick Wells, AUTOVON 978-8008, Mr. Jim Dittmer, AUTOVON 693-3716 or Mr. Al Hendersen, AUTOVON 698-3241/3291. Keep those questions coming in—they are a benefit to all users of ALSE.

Medical Facts For Pilots

I've heard that the Federal Aviation Administration publishes a pamphlet on medical facts for pilots. Can you identify this pamphlet and where we can get copies?

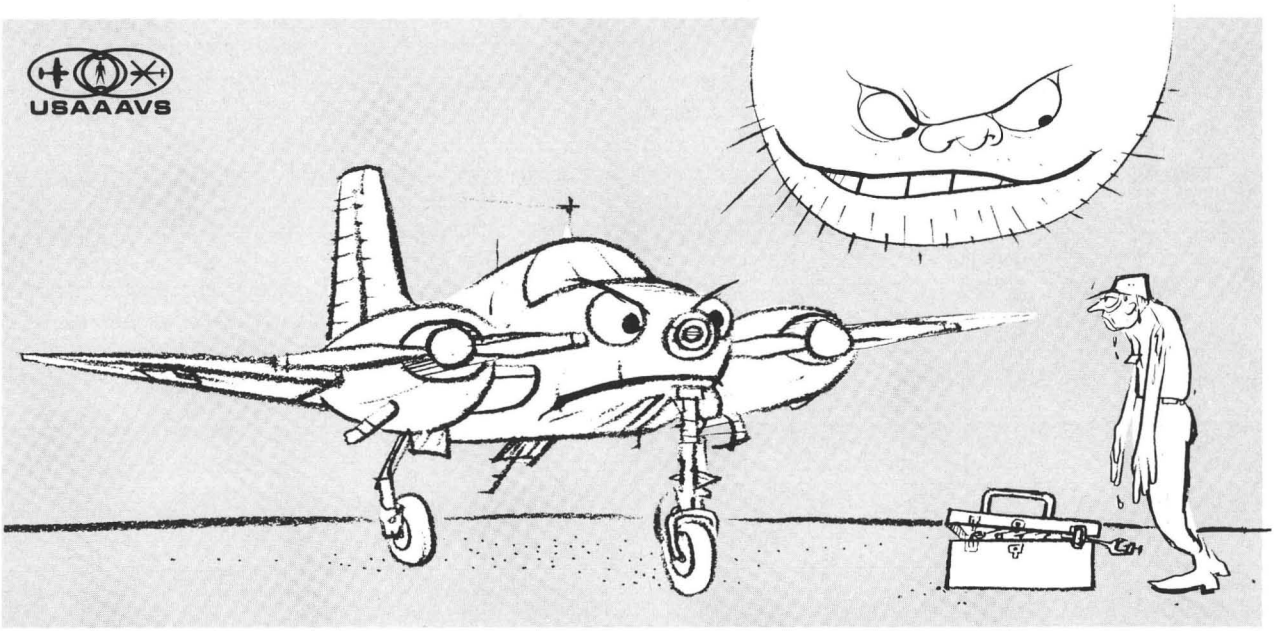
I believe the "pamphlet" you are referring to is actually a booklet titled "Medical Facts For Pilots." It certainly is an excellent publication and contains such items of aircrewmember interest as: fatigue, hypoxia, vertigo, carbon monoxide, middle ear discomfort. Would you believe, mixing scuba diving and flying can cause you to experience "bends" at altitudes of less than 10,000 feet where most of our aircraft fly.

The booklet was prepared cojointly by the Federal Air Surgeon and Aeromedical Applications Division, FAA, and is available from the FAA, Washington DC, 20553 or the Director, Civil Aeromedical Institute, P.O. Box 25082, Oklahoma City, OK 73125.

Flying After Scuba Diving Can Be Dangerous

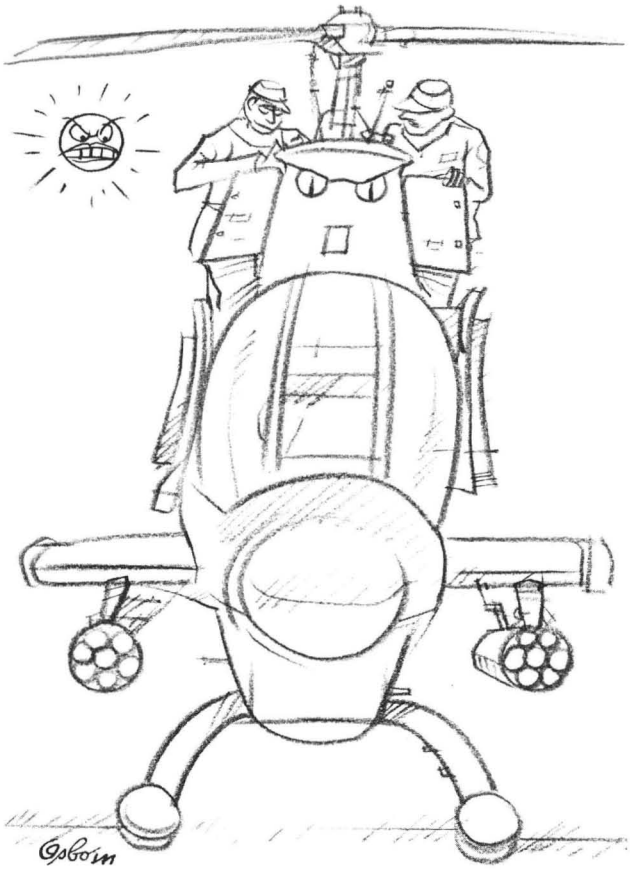
Are you aware that flying your plane for a day of scuba diving at the lake or sea shore and then flying home, all within a few hours time can be dangerous, particularly if you have been diving to depths for any length of time?

Under the increased pressure of the water, excess nitrogen is absorbed into your system. If sufficient time has not lapsed prior to takeoff for your system to rid itself of this excess gas, you may experience the "bends" at altitudes less than 10,000 feet where most of Army aircraft and light planes fly.



Cold weather problems have temporarily vanished, but a new set of hot weather hazards is about to take their place . . .

SUMMER MAINTENANCE TROUBLES



WHILE GOOD maintenance is always demanding, summer heat amplifies these demands, adds to them and strives to sap the strength and energy of personnel, reducing their efficiency to cope with them. Because of the nature of their work, mechanics are much more susceptible to heat exhaustion than are aviators. Even if exhaustion is not extreme, decreased efficiency can lead to mistakes. Therefore, ample supervision is needed not only to ensure that maintenance is properly performed but also to make certain that mechanics are obtaining adequate

rest necessary to maintain peak efficiency.

Aside from the direct effects on the human body, extreme heat poses other safety hazards. If fuel is being used from drums, the drums should be kept covered, and if possible, the temperature kept below 120 degrees F. If drum temperatures rise to 120 degrees F. or more, extreme care must be exercised to prevent sparks and possible fire or explosion. As always, only bronze or nonsparking tools should be used to open gasoline drums, and these drums should be opened with caution to relieve internal pressure and prevent spewing of fuel. Rags saturated with fuel, oil or grease should be disposed of promptly.

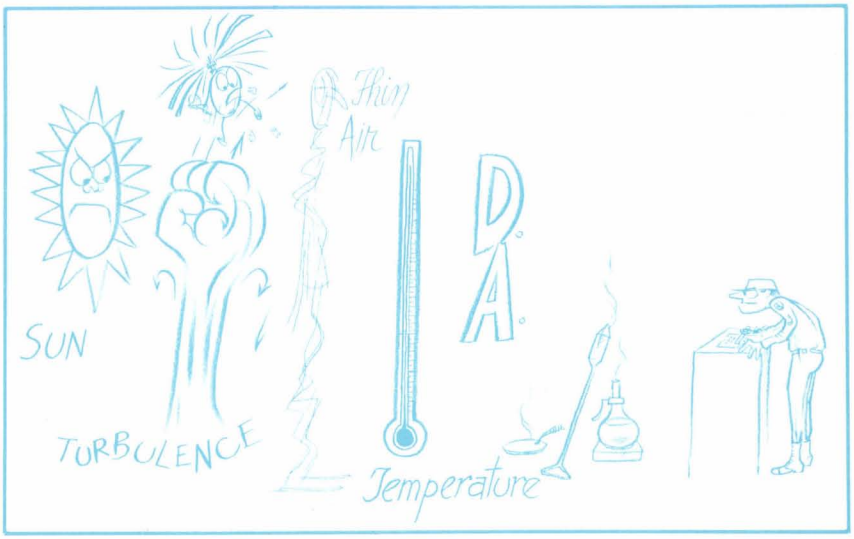
If you happen to be operating in sandy areas, you have additional headaches. The gas turbine engine, for example, easily ingests blowing dust and sand as well as any other particles that may be in the air. This sandblasting effect causes rotating and stationary vanes to change shape. Airflow varies, and the fuel-air ratio is altered. Surge, loss of power, and possible compressor stall, along with a rise in egt, can result. While small changes in the contour of compressor blades due to erosion can be compensated for by readjustment of the fuel control unit, diagnosing the cause is another matter. Other malfunctions can give indications similar to those of sand erosion. But changes in fuel control settings should not be made arbitrarily. Trying to correct an unknown engine deficiency by altering fuel flow is like taking a pain killer without attacking the cause. Be sure before you act!

Sand and dust have equally adverse effects on reciprocating engines. Air filters become clogged, cylinders become scored, compression decreases and loss of power or even engine failure can result. In addition, propeller blades become pitted, fuel, oil and hydraulic fluid become contaminated, and grease fittings and flight control cables become coated with grit. Pitot and static ports become clogged as do instrument air filters. Weight and balance is changed as dead air spaces in wings, fuselage and tail surfaces fill with sand. Both preventive and corrective measures are needed to successfully cope with these problems.

To prevent entry of sand and dust when aircraft are parked, protective covers and dust excluder plugs should be installed on all engine openings, vents, air intakes, exhaust outlets, breathers, over propeller hubs and feathering domes, cowls, and over all other vital components and openings, including pitot and static ports. Similarly, making all possible ground checks before starting engines, and performing runups on hard surfaces when possible will lessen the chances of damage to engines and rotating airfoils, as well as to canopies and surface skin. Care must be exercised when performing all servicing operations to prevent entrance of sand into aircraft and engine systems. When possible, delivery of oil and hydraulic fluid should be directly from can to tank without use of an intermediate container.

Inspections should be frequent and thorough. Filters should be cleaned or replaced at regular intervals, and an adequate reserve stock maintained. Flight controls should be inspected often for freedom of movement, and control cables checked for specified tension. Aircraft and engines should be cleaned as needed. Use of a high pressure spray gun and an appropriate cleaning fluid—not gasoline—is recommended for cleaning engines. But do *not* use steam or a high pressure water hose to clean helicopters.

This is just a token list of maintenance-related troubles you may encounter this summer, along with some recommended preventive and corrective measures. Complete authoritative information is always at your fingertips in the form of appropriate maintenance publications. Use them, and if you should run into a special problem, don't guess—bring it to the attention of your supervisor. With high density altitudes, the possibility of brownouts from blowing dust and sand, sudden and drastic changes in weather, strong gusty winds and all the other flight hazards common to summer operations, your pilot will have enough on his mind. Let's not add mechanical failures to this list.



Coming up this summer...

USAAAVS

Heavyweight Bout With Density Altitude

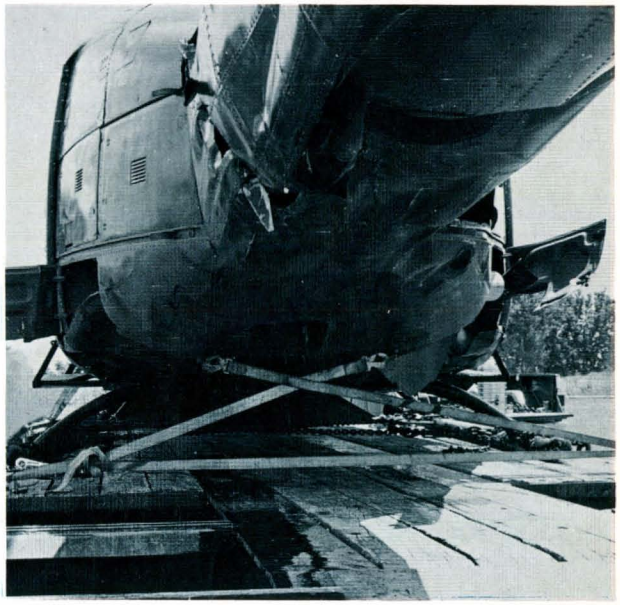
HOT WEATHER IS right around the corner and once again we are faced with that old culprit—high density altitude.

To many aviators density altitude is something which is periodically mentioned in weather briefings that signifies decreased aircraft performance. While most aviators are aware of this fact, few really appreciate the disastrous effects that high density altitudes can have on aircraft performance unless they have encountered the problem in past experience. Yet year after year density altitude is listed as a factor in aircraft accidents.

While technique is important, the only way an aviator can be completely sure his aircraft is capable of performing a mission under high gross weight conditions is to consult the operator's manual performance charts. Often these performance charts, which required a great deal of research, testing and money to compile, go unused because of the time and effort required to check them. As a result, many aviators proceed with a potentially critical mission in high density altitude conditions based on skill alone. This places the aviator in a precarious position which can result in a costly accident. However, it is only through knowledge and its proper application that we can successfully combat the problems of high density altitude.

Air, a mixture of gases, occupies space and has mass; therefore, density. Density, or the concentration of molecules, determines the ability of air to support. The thicker, more dense it is, the greater its support capability. Air density is affected by three main factors: temperature, pressure and humidity. Of these, temperature and pressure have the most adverse effect. When air undergoes a drop in pressure or a rise in temperature, expansion takes place and the air molecules move away from each other. Air density decreases and so does its ability to support. The reverse holds true if pressure rises or temperature decreases. Humidity has a similar effect as moisture displaces air, making humid air lighter or less dense than an equal volume of dry air.

This relationship of pressure, temperature and humidity of air establishes density altitude. For practical purposes, we can express density altitude as the relative altitude or load-lifting ability of air as it expands and contracts. At times, this expansion and contraction seem unbelievable. At one Army post, for example, the actual elevation ranges from 300 to 500 feet above sea level. Depending on weather and time of day, the density altitude may vary from minus 1,000 feet to plus 4,000 feet. Consider that a UH-1H at a gross weight of 9,500 pounds can clear a 50-foot obstacle with a zero ground run (vertical takeoff) under standard (15 degrees C.) sea level



Pilot allowed airspeed to deteriorate to 15 knots while flying low level over water. Density altitude was 3,200 feet and aircraft was 221 pounds over gross weight. Aircraft hit the water and sank. Three crewmembers drowned while trying to swim to shore.

AH-1G on gunnery qualification flight lost antitorque control, struck trees and crashed. Proper preflight was not performed and pilot took off without considering the effects of high gross weight, high density altitude and 5- to 15-knot crosswind.

conditions. With a temperature rise to 35 degrees C. the aircraft will require a takeoff distance of 255 feet and an airspeed of 20 knots to clear the same obstacle.

Since lift is not only dependent on the shape of an airfoil and angle of attack but also on the mass of air causing the lifting force, as density altitude becomes greater, lift decreases. In helicopters, high density altitude has the same effect as loss of rotor rpm. For example, power trains can be overtorqued, reciprocating engines can be overboosted, and autorotations can become especially critical when pilots attempt otherwise normal maneuvers under high density altitude conditions.

Low density air (high density altitude) also affects engine performance. High humidity alone can cause a reciprocating engine to lose as much as 12 percent of its rated brake horsepower. Since the reciprocating engine operates with a fixed displacement, all air processed is directly associated with combustion. If water vapor enters the induction system, the amount of air available for combustion is reduced. Since most carburetors do not distinguish water vapor from air, an enrichment of the fuel-air mixture takes place. Any increase in inlet air temperature permits the carburetor to further enrich this mixture. Since the maximum power output at takeoff requires a fuel-air ratio richer than that for maximum heat release, still more enrichment takes place—and power nosedives. The end result includes high power settings, increased fuel consumption and high cylinder head temperatures.

While the volume of air flowing through a gas turbine engine may remain constant at high density altitudes, this thinner air contains less mass, and thrust (power) is lost. A temperature of 100 degrees F., for example, reduces the efficiency of a gas turbine engine by approximately 15 percent from that under standard conditions of 59 degrees F.

During hot weather, density altitude changes are rapid, frequent and great. The load you take off with at dawn may well be beyond the capability of your aircraft an hour later. Density altitude must not only be computed for takeoffs, but also equally important, for destination landings. This is particularly true if you are taking off from a low altitude and plan to land in high terrain. And, particularly, extra caution is a must for autorotations.

With this in mind, your aircraft will do all it is asked to do and come home safely even on the hottest day if you (1) compute density altitude BEFORE weight and balance, (2) always assume density altitude to be higher than it probably is, (3) study your operator's manual density altitude tables, and (4) act accordingly.

After takeoff from confined area, rpm decayed and UH-1H struck trees. Pilot tried to continue low-level flight but aircraft descended and crashed. Five occupants were killed and five sustained major injuries. Aircraft gross weight was 9,200 pounds and temperature was 26 degrees C. Pilot failed to perform or incorrectly performed a go-no-go check and did not assess density altitude, temperature, or wind conditions.

The M-56 Scatterable Mine System

CW4 Frank W. Kervin
RRD MILPERCEN/K
APO San Francisco 96301

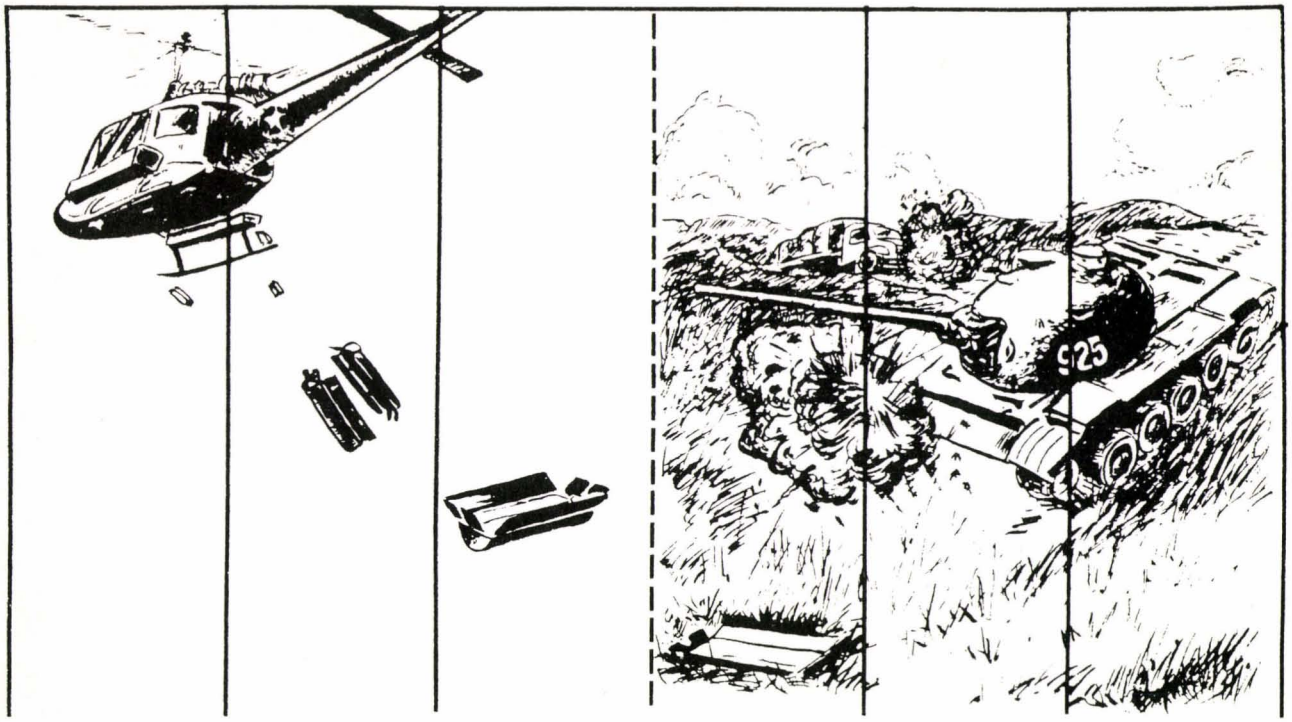
Left: Employment of the M-56 helicopter delivered mine system

THE ENEMY HAS penetrated the forward edge of the battle area (FEBA) with armor spearheads and is threatening our rear areas. How can the commander slow or stop this enemy thrust? Is there a quick, effective weapon which can be used to gain the time needed to organize a counterattack? Yes—employment of the M-56 aerial mine dispensing system is an answer.

The division commander issues the order and another "first ever" combat feat soon is credited to the versatile UH-1 Huey helicopter. The enemy penetration is blunted by the sudden appearance of exposed minefields in front of its tank led mechanized spearheads. Efforts to clear the minefields by roller devices are defeated by an antiroller capability of the mines. The rollers roll over the mines without detonation—yet the mines explode upon contact with the tank tracks. Manual clearing is defeated by unexpected detonation when the mines are handled by clearing parties.

The enemy is forced to shift the main route of attack into a turning movement to less favorable routes of approach. Enemy forces neglect to protect the column flank since the minefield denying the terrain use to them also denies its use to their enemy. Suddenly the minefield self-destructs in a short period of time and a counterattack cuts the columns, closes supply routes, and begins to fragment and isolate forces. The attack slowly disintegrates into isolated wipe-up actions. The M-56 had done its job.

The foregoing scenario can readily become fact should we fight another war. Untested under actual combat conditions, the M-56 scatterable mine system (M-56 SMS)



HELICOPTER DELIVERED DISPENSING ARMING SEQUENCE STARTED

MINES SEPARATE FINS OPEN UP

MINE ORIENTS

GROUND IMPACT DISPENSING SEQUENCE COMPLETED 1-2 MINUTES AFTER GROUND IMPACT

WHEELED VEHICLE

TRACKED VEHICLE

Sequence of operations for M-56 mine dispersing system

promises to be a rapid, flexible and effective weapon. It can be used as either an offensive or defensive weapon and in a combined role. Its development, production and addition to the Army's weapon system inventory provides a much greater versatility to mine warfare than in the past.

Development: Originating as a weapons requirement during the Vietnam conflict, the M-56 SMS was developed by the U.S. Army's Picatinny Arsenal. Following a 4-year development and testing program, the system now is being produced and issued to certain units having high deployability classifications.

The System: The system's basic components are two SUU-13 bomb dispensers, a control panel and an interconnecting wiring harness. The dispensers contain 40 canisters each, each canister contains 2 mines which allows the UH-1 aircraft to emplace 160 mines during each sortie. The dispensers are uploaded and suspended on the standard weapons pylons used extensively for a wide variety of weapons systems throughout the history of the Huey utility aircraft. Each dispenser contains an intervalometer which provides for specific firing intervals to control minefield patterns and mines per meter density. The control panel in the cockpit allows the pilot to control the modes, patterns and minefield density. It also provides control over an electrical jettison feature which will drop both dispensers simultaneously should the need arise. In case of electrical failure, a manual jettison capability is available. The electrical harness is simple and a unique departure from previous standards.

First, it provides a power takeoff from the aircraft's heated blanket receptable which eliminates any modification to the electrical system; second, it is routed over the aircraft floor and taped down. Most previous weapons electrical harnesses were permanently installed under the aircraft floor; a costly, time-consuming modification. These features allow quick, easy transfer of system capability from one aircraft to another.

Operational Sequence: Once the order has been issued for an aircraft emplacement of scatterable mines, the aircraft is armed for the mission. The commander issuing the order determines the location, length, width and mine density per square meter of the minefield. The order will normally prescribe the headings, altitude, airspeed and intervalometer control selection for the aircrew to follow. One aircraft can lay a minefield 100 meters long, 40 meters wide with a .04 mine density per square meter in one sortie. Conversely, 30 sorties can provide a minefield 2,000 meters long, 40 meters wide with a mine density per square meter of .06.

The Mines: The M-56 mine is half round in shape, weighing approximately six pounds and contains three pounds of composition H-6 explosive. The mines are equipped with stabilizing orientation fins which ensure that mines strike the Earth in the correct position to activate a final arming device. Each dispenser contains a variety of three different type mines; antitank/antivehicle, antiroller and antidisturbance. The antitank/antivehicle mine explodes when pressure is applied to the pressure plate on the flat side. The antitank/antiroller mine defeats attempts at roller clearing operations by allowing the rollers to pass over the mine, then exploding under the tank treads. The antidisturbance mine discourages breaching parties from manual clearing by exploding if picked up, jarred, rolled or tampered with by any physical means. (Note: It is possible for rotor wash to detonate an antidisturbance mine.) All mines are identical in shape, size and appearance which prevents detection as to type or capability. Being submerged in water does not decrease the mine functioning or efficiency; therefore, the M-56 SMS can be used to mine shallow fording areas.

	LENGTH OF MINEFIELD IN METERS										
DENSITY/ MINES/ SQ. METER	100	200	300	400	500	600	700	800	900	1000	2000
.01	1	1	1	1	2	2	2	2	3	3	5
.02	1	1	2	2	3	3	4	4	5	5	10
.04	1	2	3	4	5	6	7	8	9	10	20
.06	2	3	5	6	8	9	11	12	14	15	30

Number of Aircraft Sorties Required to Emplace Minefields of Different Lengths and Densities. (One pass lays a strip 20 m wide, two passes, side by side are required to complete a minefield.)

Perhaps the most revolutionary feature of the mines is a self-distruct capability which detonates all three types of mines after a prescribed time of emplacement. This self-clearing feature provides the commander a definite timetable consideration for planning attacks across terrain which has been denied to either force for maneuver space.

Employment: The M-56 SMS can be used offensively to:

- obstruct enemy counterattacks.
- block escape routes.
- protect flanks or a stable front.
- contain the enemy in a certain area.

The M-56 SMS is a defensive weapon that can:

- channelize and restrict enemy movement.
- block avenues of approach.
- reinforce defensive positions.
- blunt or stop enemy penetrations.

Advantages: The M-56 SMS is a superior weapon that can be emplaced rapidly; is very effective against tanks, vehicles and personnel; and is self-clearing within prescribed time limits. It augments the commander's firepower in either an offensive or defensive posture.

Limitations: The prime limitation or disadvantage of employing the M-56 SMS is vulnerability of the aircraft to enemy fire and a required flight altitude of 100 feet above ground level (AGL) to ensure arming upon impact. Secondary disadvantages are system weight of 1,280 pounds and a modification required to the aircraft incorporating shock strut attachment points to the aircraft structure.

The M-56 scatterable mine system is the first of a new family of scatterable mines. It greatly reduces the manpower, time and materiel expended in emplacing and clearing conventional minefields of the past. It is quick and responsive, flexible and deadly. It increases the role of Army aviation in the combat environment and introduces a new dimension to mine warfare. The M-56 is a welcome addition to Army aviation's inventory of weapons systems.

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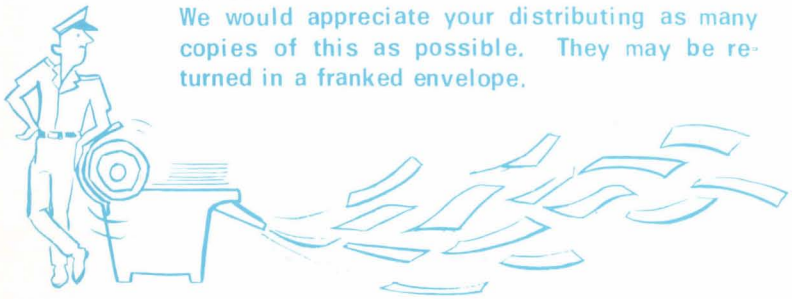
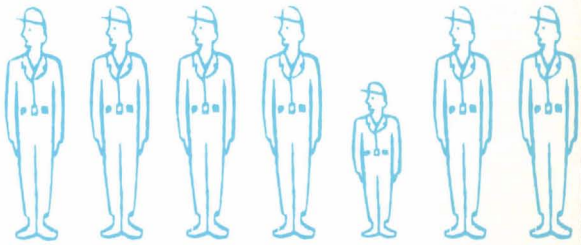
Send us your thoughts today on Attack Helicopter Gunnery Training

WITHIN THE U.S. Army there are many people with invaluable gunnery training ideas. There are untold numbers of practical, simple devices and techniques to teach gunnery on the "Back 40" of every post, camp and station in the active Army and every armory or center in the Reserve and National Guard units.

How did your unit do on its last range firing or qualifications? Share your techniques and ideas! The United States Army Aviation Center welcomes any thoughts that will improve combat-readiness of the force. Take the time to jot them down below. Then tear the page out, fold, staple and mail it as soon as possible. Your help and interest is appreciated.

Attention unit commanders:
We would appreciate your distributing as many copies of this as possible. They may be returned in a franked envelope.





ATC ACTION LINE

UNITED STATES ARMY AIR TRAFFIC CONTROL ACTIVITY

Why do Department of Defense (DOD) Low Altitude Instrument Approach Procedure Books for the conterminous U.S. not include all available instrument approach procedures?

Currently, the nine volumes of DOD Low Altitude Instrument Approach Procedures covering the conterminous U.S. include more than 3,000 instrument approach procedures (IAP). This does not include the radar IAPs which are listed in the Instrument Flight Rules (IFR) Supplement and not charted. All procedures published in the DOD flight information publication (FLIP) have been requested by one of the military departments.

There are about 2,000 other Federal Aviation Administration (FAA) instrument approach procedures not published in the DOD Low Altitude Instrument Approach Procedure Books. If these 2,000 procedures were published, they would increase the size of the instrument approach procedure books by two thirds. The workload for the notice to airmen (NOTAM) system would increase proportionally. Further, no requirement for these 2,000 procedures has been identified by any of the military departments.

Guidelines used to determine which procedures will be included for airfields with multiple IAPs are to publish those procedures which provide best minima, e.g., instrument landing system (ILS), procedures that take advantage of the prevailing winds or runway lengths. Many airfields have little or no military IFR traffic. Airfields depicted in blue symbology on Enroute Low Altitude—U.S. Charts have an instrument procedure capability. Those depicted in dark blue are provided in DOD FLIP. Some of these may be radar procedures with minima only published in the IFR Supplement. Army aviation activities requiring an instrument approach procedure that is not published in the DOD FLIP should justify that requirement to the USAATCA Aeronautical Services Office.

I observe that some approach charts at a given airport state "Radar Vectoring" but some others at the same airport do not. What is the reason for this paradox?

No hidden meaning at all. The note has been appearing on all charts so that pilots may expect vectoring in the terminal area. Many times radar may be out of service or vectoring is not required. The note is misleading and not required. Pilots should file and plan to fly a procedure as published. If service is available, the pilot probably will receive radar vectoring service if necessary or if an operational advantage is involved. The note is being removed from charts on a maintenance basis; i.e., whenever the procedure is changed for some other reason. This technique of removing the information from the chart does not involve any publication cost.

The Morse Code for our VOR identifier is not correct. Will you take care of this?

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(Note: Double slash marks denote end of sentences and single slashes end of words. Slashes are not a part of the code, but are added to help the reader decipher the message.)

Readers are encouraged to send questions to:

Director
USAATCA Aeronautical Services Office
Cameron Station, Alexandria, VA 22314

ASH Survivability Symposium

THE ADVANCED SCOUT Helicopter (ASH) Survivability Symposium held last February at the U.S. Army Aviation Center, Ft. Rucker, AL provided a medium for the exchange of information and ideas among the developer, manufacturer and user.

The selected symposium theme, "ASH Survivability," emphasized the need for an integrated survivability capability in the future scout helicopter to help maximize the combat effectiveness of the artillery, air cavalry and attack helicopter units in which it will be employed. The symposium was structured to meet four primary goals:

- To make the industry participants aware of the air scout concept of operation in the 1980-and-beyond European high threat environment.
- To make those in attenance aware of the anticipated enemy threat in that environment.
- To afford recognized civilian (Department of Defense and industry) experts in various selected categories of aircraft survivability an opportunity to discuss the future development of hardware designed to reduce ASH vulnerability in the stated environment.
- To provide an interface between industry and the Army by promoting discussion of ideas involving hardware development for ASH survivability.

Both industry and Army invitees enthusiastically responded and participated in the symposium. Twenty-eight aircraft, airframe and component companies joined representatives from Training and Doctrine Command; Forces Command; Army Materiel Development and Readiness Command; National Guard Bureau; and Headquarters, Department of the Army in the 2-day event. The Aviation Center, the Aviation Support Equipment Project Manager and the Army Aviation Association of America jointly sponsored the symposium.

Based on discussions among the 140 industry and military participants, and follow-on actions we are now receiving, I am convinced that this symposium was a valuable experience. There should be more opportunities to promote dialogue between the "green suiters" and industry. In this regard I will be inviting representatives from industry to Fort Rucker in the near future to participate in a scout mission orientation.

Digest Proponency At ODCSOPS

As the Army Aviation Officer, I am pleased to announce that effective with this issue, proponency for the *Army Aviation Digest* is changed to Office, Deputy Chief of Staff for Operations and Plans, Headquarters, Department of the Army. Actually, this is a return of proponency since it originally rested with the Director of Army Aviation, ACSFOR until that office was disestablished through reorganization.

Working in concert with the Aviation Center, the USAAAVS, the Armor Center, Infantry Center and all of the other proponents for Army aviation, it is our aim to help make this magazine an even more meaningful professional journal.

Our emphasis will be to orient the magazine toward a broad view of Army aviation and to provide a forum for the ideas and concepts that will help us to optimize our profession. As proponent, we welcome your views and please don't hesitate to call AUTOVON 227-9666 or drop by Room 3A510 at the Pentagon.

BG Charles E. Canedy
Army Aviation Officer
ODCSOPS
Headquarters, Department of the Army