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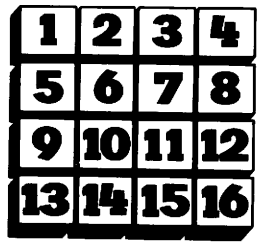

Cover: Photos show night vision goggles research and development:

1. AN/AVS-6 and XM-33 protective mask
2. AN/PVS-5 modified faceplate
3. ground troops use night vision goggles even in arctic conditions
4. AN/PVS-5 with M-24 protective mask
5. greater peripheral field of view is obtained with the modified face plate
6. aircrew passenger using night vision goggles
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13. night vision goggles with M-24 protective mask
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Secretary of the Army

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The mission of the *U.S. Army Aviation Digest (USPS 415-350)* 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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AS I NOW MOVE on to my next assignment as the Deputy Chief of Staff for Combat Developments at HQ, TRADOC, this will be my final column with you as commander of the Aviation Center. But you may be assured that I will look back upon this tour with fond memories and I will miss this monthly opportunity I have had to keep you abreast of aviation developments through the *Aviation Digest.* I will also miss my very close association and involvement with all aviation matters for the past few years, first as Army Aviation officer at HQDA, then as the deputy commander and commander of the Center. I have, however, felt that these last 5 years have been some of the most exciting and challenging in the history of Army Aviation. We can take great pride in the continued growth and progress of Army Aviation; for our contribution to the combined arms team in the AirLand Battle is more critical than ever.

On these *Aviation Digest* pages, we have "witnessed" many exciting events and noted the important milestones achieved by Army Aviation and its people. Perhaps, the most significant in our recent history was last month's announcement that the Secretary of the Army and the Army Chief of Staff had approved the Army Aviation branch. On the back cover of this issue you will find a followup article telling more about the how, why and when of the new branch. In addition, we are preparing additional articles and more details on the branch for future issues: One discussing the impact of the branch decision on training and the Aviation Center; another will examine the Armywide impact; and one will cover the branch in the context of the historical development of Army Aviation.

In earlier issues, we have devoted much coverage to our personnel programs to include the CMF 67 Study for our enlisted and noncommissioned officer force, development of Specialty Code 15 for our commissioned officers and our warrant officer retention initiatives. We also reported in recent months the explosive emergence of Army Aviation as a combat arm with associated articles on "How to Fight." The AirLand Battle broke on the scene in the July 1981 issue, and in October 1981, we followed with perhaps the most potent issue of the *Digest* ever published. It featured air-to-air combat, a bold new concept for our aviation units. In turn, we shared with you an in-depth report on the 1982 Army Aviation Systems Program Review in a series of five articles, and we took you to the 9th Cavalry Brigade (Air Attack) for its activation, training and field tests in the 9th Infantry Division. Next month look for two more 9th CBAA articles.

In the operational world of Army Aviation today, we were distressed over a sudden increase in our accident rate in fiscal year 1982. We vowed to do better—to be "Accident Free In '83." Having thus dedicated ourselves to improve, we are meeting that challenge with the FY 1983 rate running at less than half that of FY 1982. But even this is not good enough. We are still losing too many aircraft, too many crewmembers and sacrificing critical resources in accidents that could have and should have been prevented. We simply *must* work harder at accident prevention, both on and off the job. The price is simply too great to do otherwise.

On the bright side and in the winner's circle for the U.S.A., we were proud to salute our fellow aviators who went to Poland and "took the gold" in the World Helicopter Championships. What a tribute to the skill, training and professionalism of our force to see the U.S. Army lead team take both individual and top team honors in world class competition! Such a feat sends a clear signal about Army Aviation quality talent.

There was both pride and nostalgia in our coverage of "Forty Years of Army Aviation" in 1982. It was an honor to have Brigadier General William W. Ford, the first Army Aviation School commandant, author our lead birthday article in June 1982, and to come "home" to the Aviation Center for the birthday celebrations. It was a warm moment for all of us at the Aviation Center to welcome the "Cub Clubbers" and General Ford for the 40th Birthday troop review at Ft. Rucker.

In my initial column as the Center commander some 34 months ago, I talked about the courage and vision of our predecessors who brought Army Aviation through four decades of challenge and growth—to a position of prominence as a pivotal player on our Nation's defense team. That courage and vision have now intensified even further as we move to full branch status. A renewed spirit of excellence and pride abounds in our Army and in Army Aviation today. And although I relinquish command of the Aviation Center on 17 June, I will never relinquish the spirit of aviation and the great respect which I hold for you, the proud and dedicated members of the Army Aviation team. You have done your job well, and in this, a year dedicated to excellence by our senior leadership, may Army Aviation always add "an extra dimension of excellence." SOLDIER ON!

Major General Carl H. McNair Jr.
Commander, U.S. Army Aviation Center
Fort Rucker, AL

Modified face plate goggles have only been approved for test and training purposes at Ft. Rucker. Units should not further modify the AN/PVS-5 goggles until formal approval is received from HQDA. This authorization and instructions for this modification are expected in a few months. The contents of this article do not necessarily reflect the views of the Department of the Army.

Modified Face Plate goggles

CW2 James A. Gunning
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NIGHT VISION goggles are an unpopular subject with many Army aviators. In the past there has been good reason for this attitude. The AN/PVS-5 goggles are not well suited for use by aviators. This is not surprising since the goggles were developed for use by ground forces and were adopted as an interim system for aviation use with the knowledge they did not meet all aviation-user requirements.

There are a number of problems with the AN/PVS-5s but the most common complaints are: lack of any peripheral vision, inability to read normal maps, monochromatic color, 20/50 visual acuity (under good lighting conditions), eyepieces easily fogged, inability to wear corrective lenses, the need to manually focus to view objects at varying distances and the most often heard complaint, *goggles are uncomfortable to wear and cause fatigue.* Some of these problems will have to wait until the introduction of the Aviation Night Vision Imaging System goggles (see "ANVIS," page 12) or an even more advanced system, but many of the most serious objections can be overcome now.

The modification described in this article is *not* designed to compete with the ANVIS. ANVIS goggles offer improvements that cannot be attained with any type of modification to the AN/PVS-5s so the ANVIS needs to be fielded as soon as possible. My purpose here is to show a change to an existing piece of equipment that greatly enhances its performance.

There have been proposals to modify the AN/PVS-5 goggles to

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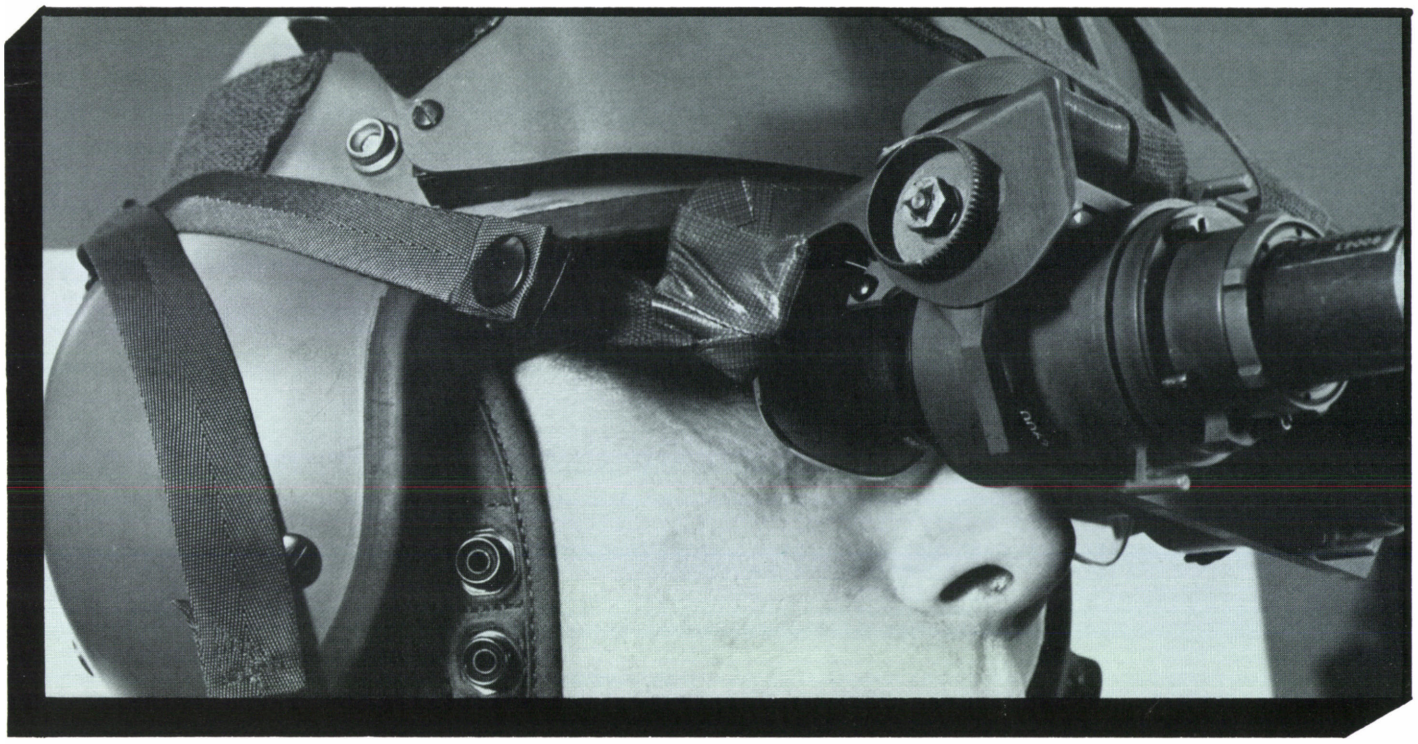


The most important advantage of using MFP goggles is that they allow almost unrestricted viewing in any direction with unaided vision. They also can be worn with eyeglasses. The photo also shows the standard side straps.

more suitable configurations by several groups within the Army, but the most promising is the modified faceplate goggles shown here. They were tested by the U.S. Army Aeromedical Research Laboratory at Ft. Rucker, AL, and Armywide acceptance is being sought.

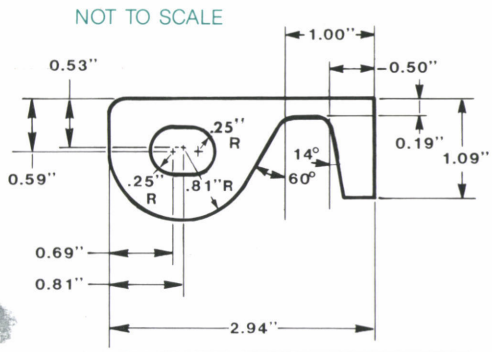
The history behind this particular modification started at the Aviation Center after a midair collision during goggles training occurred in December 1981. One of the possibilities considered was that the lack of peripheral vision with standard goggles may have played a contributing role in the accident. Corrective actions involved reconfiguration of the goggles, air traffic control procedures and stagefield markings. USAARL investigated modifications to the goggles and conducted tests of the modifications to the goggles in a variety of aircraft.

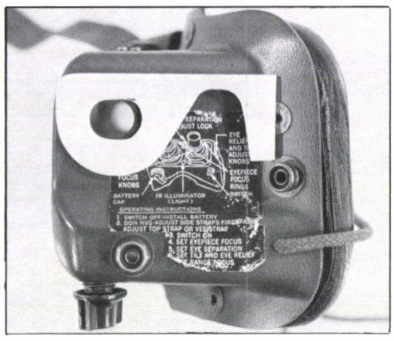
The first MFP goggles (usually referred to as "cutouts" by the Ft. Rucker instructor pilots) were made at USAARL in March 1982 and were released for flight testing in May 1982. Beginning in June, IPs from Lowe, Hanchey and Directorate of Evaluation and Standardization began flight testing. They issued a favorable report in October 1982, and further testing to date has accumulated more than 2,000 hours of MFP use in four types of aircraft involving more than 60 aviators. A few minor problems at the start were solved by design changes, an improved pilot briefing and a familiarization flight before use of the MFPs.

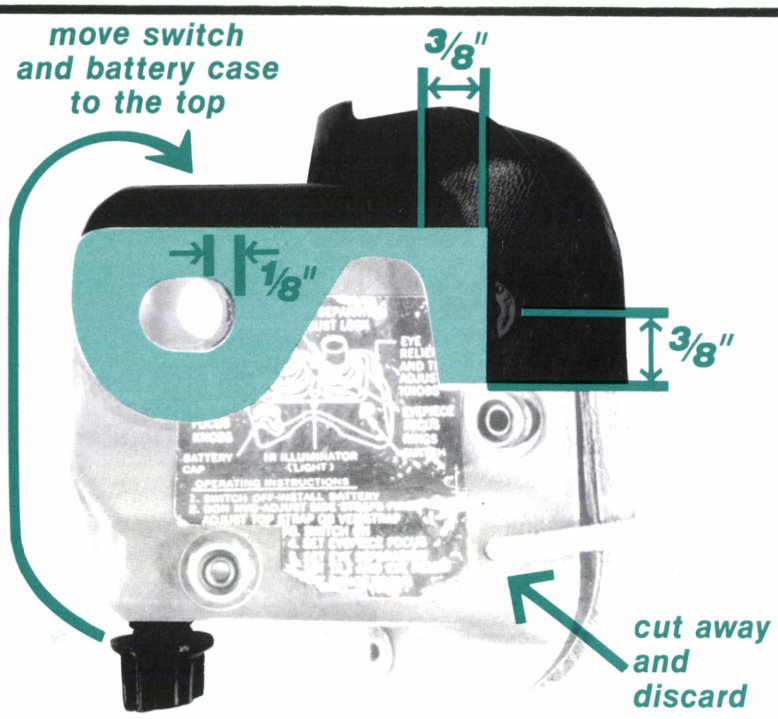
The final design has been highly successful. A recent survey of the night flights at the Aeroscout Branch showed all 29 IPs definitely in favor of MFP goggles while no one preferred the standard goggles. The only complaint voiced regarding the MFP goggles was that there are not currently enough of them at Hanchey for all IPs to wear them.

A discussion of the advantages of MFP goggles would have to start with the most important feature—the ability to use unaided peripheral vision. Primary visual information is still obtained through the goggles tubes; however, the MFP goggles allow almost unrestricted vision to the sides and down. A slight movement of the head is all that is required to view any areas that may be obstructed by the remaining frames. By turning or tilting the head to a greater extent, viewing in any direction including directly to the front is possible using unaided vision. The advantage of this over the standard goggles has to be experienced!

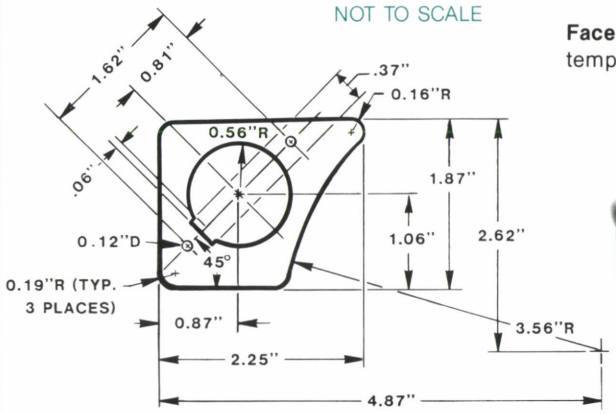
Detection of other aircraft is much easier. In fact, the report by USAARL contains a description of an incident where the MFP goggles



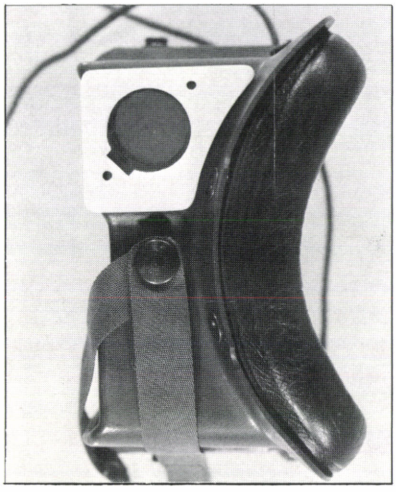


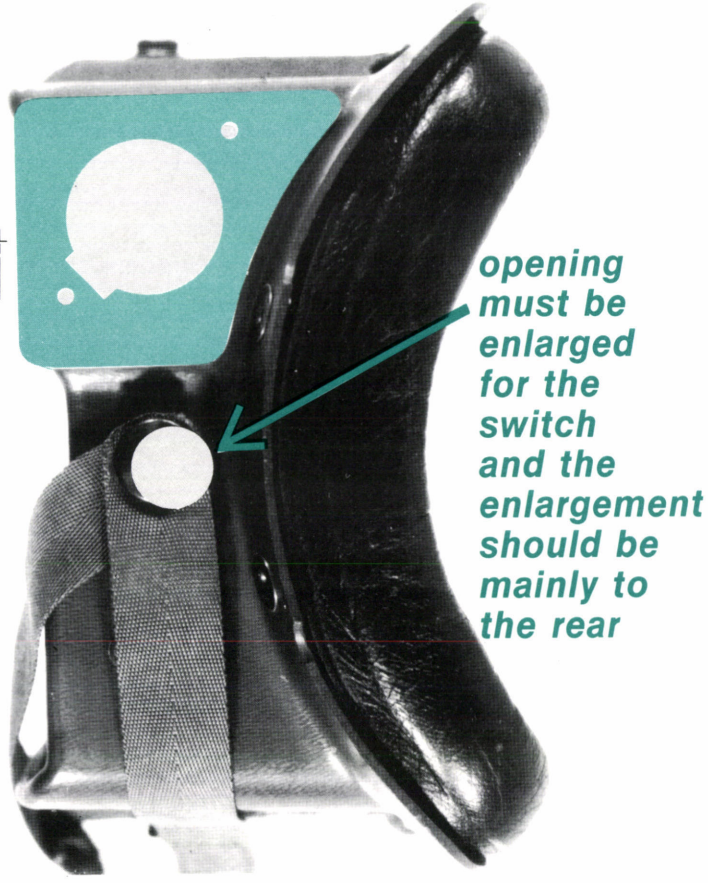


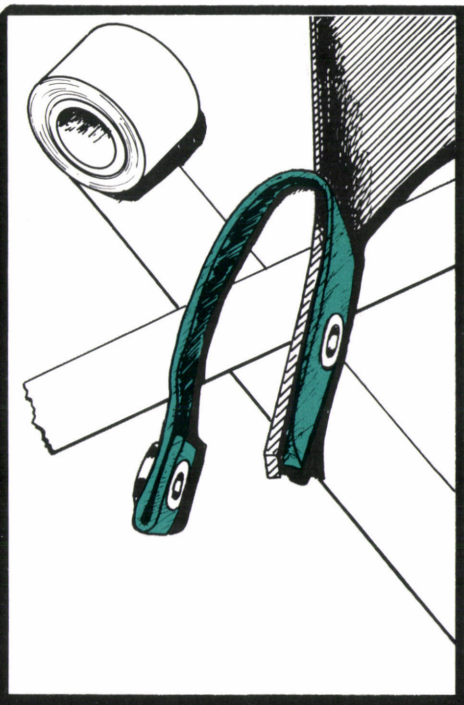
Faceplate Modification (left side view): Shows template in correct position. The back portion of the cutout should be 3/8 inches in front of and 3/8 inches below the face pad snap. The corner below this snap should not be rounded. The clamp knob holes are enlarged 1/8 inch to the rear.

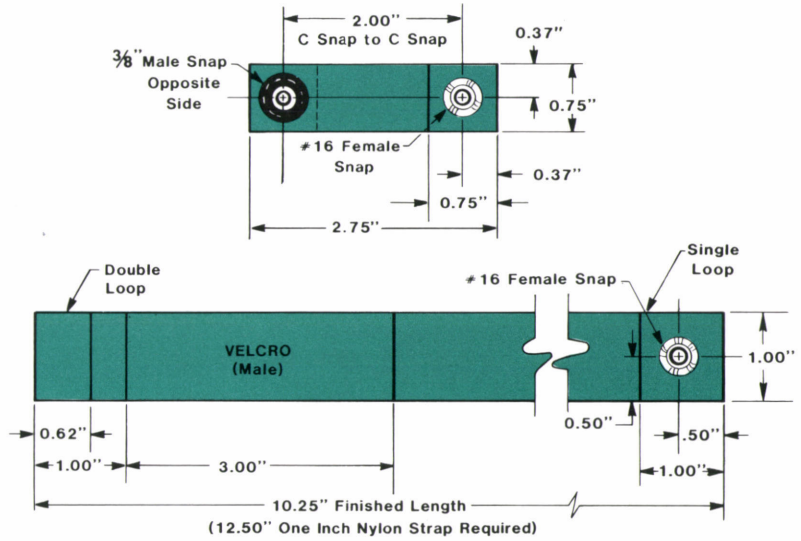


Faceplate Modification (top view): Shows the position of the template for cutting the hole to mount the battery case.



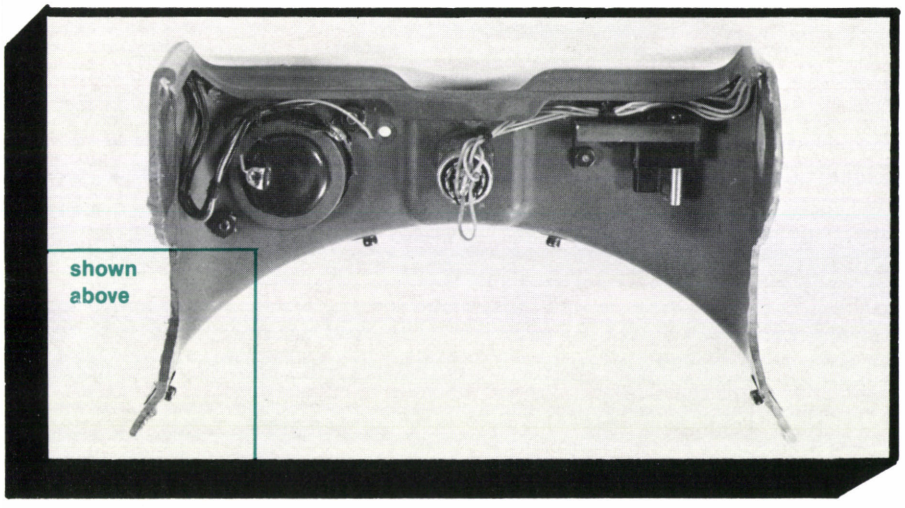






Attachment of short side straps: The female end of the new strap is placed on the male snap on the goggles frames and the strap is wrapped as shown and then taped in place to prevent slippage.

The new straps needed for the MFP conversion: The long straps take the place of the old "V" strap and provide a more secure mounting due to the increased Velcro area. The short straps are to allow attachment of either the standard side straps or the surgical tubing of the counterbalance system.



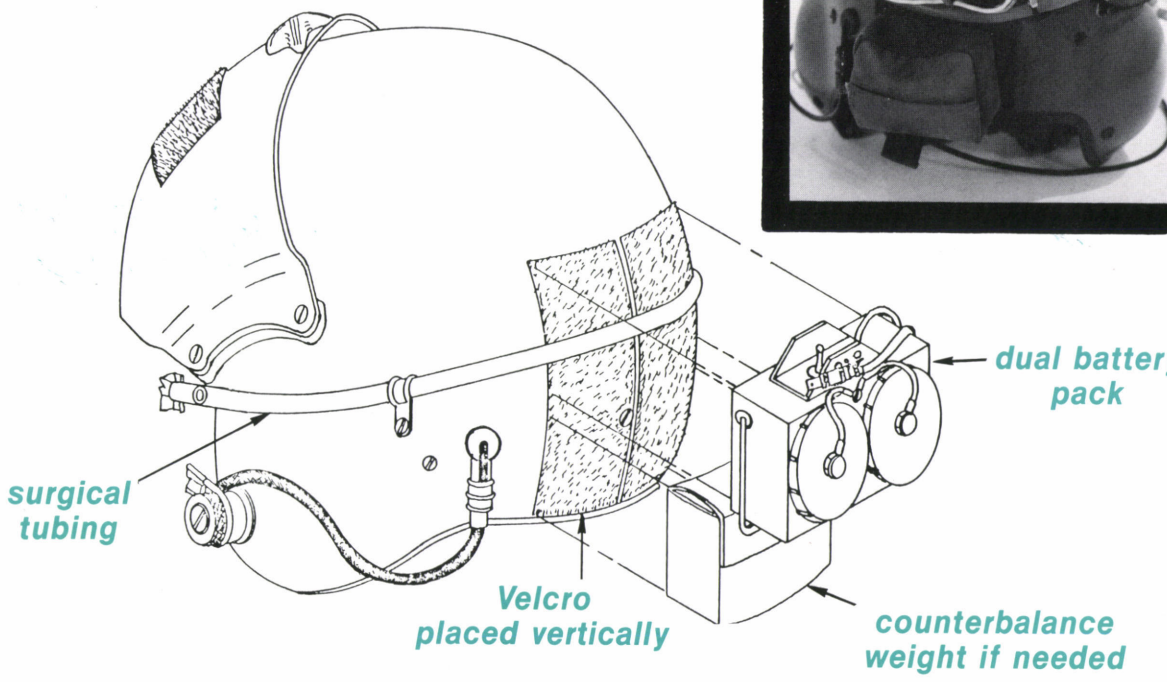
Modified Faceplate (bottom view): Shows rotary switch and battery case installed, and wiring to be taped and glued. (Wire to battery case ground has not been attached in this view but will be in the completed installation.)

surely prevented another accident similar to the December 1981 tragedy. Clearing the aircraft while hovering does not require the neck-wrenching look over the shoulder that the standard goggles do. Unaided vision permits identification of aircraft by the configuration of the anticollision and position lights, something not possible through the goggles tubes. The goggles also distort the apparent distance of objects, particularly light sources, so unaided vision permits more accurate distance estimates.

Maps may be read without the loss of detail when seen through the goggles tubes. Any light source desired may be used for map reading. However, it has been found that blue-green lighting causes the least distortion of colors on conventional maps and the goggles are relatively insensitive to this color; therefore, the interference of the light source in the cockpit is minimal.

A green position light lens from an OH-58 Kiowa will fit a standard Army flashlight, and this combination is commonly used as an illuminator. Blue cockpit lighting as applied to some Army aircraft may allow unaided viewing of the entire instrument display without shutting down the goggles. Almost any cockpit chore can be accomplished faster and more easily using an alter-

Dual Battery Pack: Developed for the AN/AVS-6 ANVIS goggles and eliminates the problem of battery failure and is to be fielded shortly with the existing AN/PVS-5 goggles.



nate light source and unaided vision. The net result is far less pilot workload.

With standard goggles the eyepiece lenses often fog from the pilot's breath within the enclosed space in the faceplate. This results in a serious restriction to vision and is slow to clear. The "open air" position of the MFP tubes has completely eliminated this problem with no instances of fogging reported by MFP users.

AN/PVS-5 goggles provide a diopter correction built into the tubes, but optical problems such as astigmatism cannot be corrected with standard goggles. MFP goggles permit the wear of eyeglasses that could correct these problems.

Finally, the MFP goggles are more comfortable and less fatiguing than standard goggles. MFPs weigh only 4 ounces less than standard goggles, but the design removes the pressure that was exerted on the face by the face cushion and suspends the entire goggles from the helmet. This seems to be the greatest advantage as far as comfort is concerned. When the surgical tubing suspension kit and a counterweight are used, the tendency for the helmet to rotate to the front is eliminated and mounting of the goggles is much easier and more secure (see "NVG Counterbalance System," March 1983 *Aviation Digest*).

MFP goggles have many features that are similar to the ANVIS goggles and would make an excellent training medium until ANVIS are widely distributed. Units that are not slated to receive ANVIS until very late or not at all could benefit from all the improvements previously discussed. Most importantly, the natural resistance that exists in the field to the use of NVG due to the problems with the AN/PVS-5s would be broken down and units would adopt effective night training programs.

The equipment involved is currently in the inventory in large numbers. The modification is very easy, inexpensive and deals with an easily replaceable part of the goggles. If the modification is carried out at the unit level, the improved equipment could be placed in the hands of the user with little or no delay.

MFP goggles if adopted Army-wide could go a long way toward helping upgrade the night fighting capability of our aviation forces to the level we all hope and envision it to be.

AN/PVS-5 Night Vision Goggles

Lieutenant Colonel Roger W. Wiley
Lieutenant Colonel David D. Glick, USAF (Ret)
Major Frank F. Holly

Appreciation is expressed to SP6 Carol Bucha, SP4 Chun Park, SP5 Chris Krzyzek, SP5 Robert Portera and Mr. Simon Grase who assisted in the experiments described in this article.

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What you gain, What you lose

AN/PVS-5 NIGHT vision goggles are being used with increased frequency and are profoundly altering the course of Army Aviation. It is important that we acquire a better understanding of the changes in visual functioning associated with these goggles. A few years ago, many believed that the reduction in acuity to 20/50, the restriction of the visual field to 40 degrees and the loss of color vision produced by the AN/PVS-5 goggles would prevent piloting an aircraft. Yet, these goggles are gaining converts every day; one aviator recently told us "once you get used to them, it's a piece of cake."

Besides the losses mentioned above, what other degradations of visual functioning are produced by the AN/PVS-5 goggles? For example, is there also a loss of depth perception? A few years ago, a couple of us wondered about this question and decided to study it in the field and in the laboratory. While the losses previously mentioned are inevitable due to the physical structure and electro-optical characteristics of the goggles, the question of whether they produce a loss in depth perception is more complicated. There are two classes of cues to depth perception.

The first class is called monocular cues since they do not depend upon the existence of two eyes physically separated in space. These cues consist of such things as linear perspective (e.g. railroad tracks which appear to converge in the distance) and relative size (if two objects have the same size, the one that is closer will produce a larger image on the retina).

The other class is called stereopsis (vision using an optical instrument with two eyeglasses) and these cues do depend upon the existence of two eyes physically separated in space. The most important stereoptic cue is retinal disparity; since each eye views a scene from a slightly different position, the images produced on each retina are somewhat different or disparate. The brain is able to use this information to gauge the relative depth of objects in a scene. One can see that the goggles would seem to preserve, at least in large part, both of these classes of cues; the monocular cues

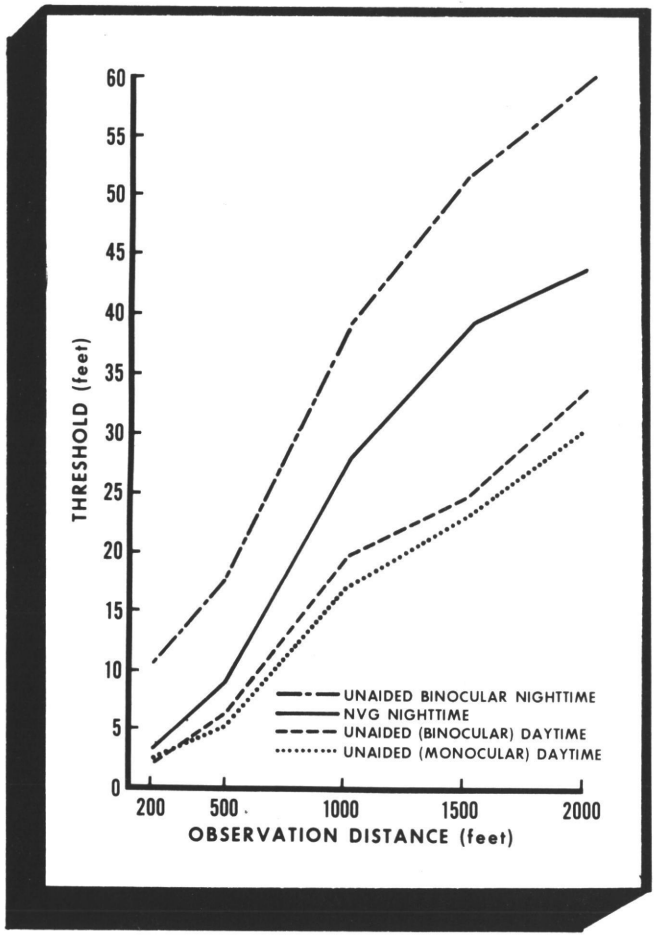

FIGURE 1: Linear thresholds for relative distance discrimination under four viewing conditions. Data points are the average for six observers.

should still be present and the fact that a slightly different image is produced in each eye should preserve retinal disparity. And yet, a loss in depth perception is one of the most common complaints of those using the goggles.

The field study primarily examined monocular cues since the distances used were mostly beyond the range within which stereopsis is very effective. The subjects sat inside the cockpit of a UH-1H Huey aircraft parked on the ground and looked at targets which were placed in pairs at various distances. Targets were moved in relationship one to the other and the subjects' task was to tell when the two targets were at the same distance. The trials using unaided vision were performed in the daytime using one eye, in the daytime using two eyes and at night using two eyes. Trials were also performed with the AN/PVS-5 NVG at night. The daytime trials were performed with a clear sky and the nighttime trials were performed with a clear sky and a full moon. The results are shown in figure 1.

In general the best performance (lowest threshold) was with the monocular observations in the daytime. The next best performance was with binocular observations in daytime, and the poorest peformance was with unaided vision at night. The performance with the NVG was roughly halfway between the unaided daytime performance and the unaided nighttime performance.

Laboratory study of depth perception was performed with an apparatus designed to test primarily stereopsis. This apparatus eliminated most of the monocular cues and measured depth perception at a much closer distance (20 feet) than was done in the field study. The stereopsis test was performed monocularly and binocularly with and without the goggles. The luminance of the apparatus was 6.7 footlamberts with unaided vision and .012 footlamberts with the goggles. (A footlambert is the amount of light produced by one candlepower at a distance of 1 foot.) Figure 2 shows the results. Unlike the results of the field study, performance here was much better using unaided binocular vision than using unaided monocular vision as would be expected in a test of stereopsis. Also, binocular performance with the goggles, although much poorer than unaided monocular performance, is still slightly better than unaided monocular performance. This indicates that the goggles may preserve at least some stereopsis.

Stronger evidence that the goggles preserve some stereopsis is obtained from a comparison of the monocular goggles performance with the binocular goggles performance. Binocular goggles performance is considerably better than monocular performance with the goggles, although it does not approach binocular unaided performance. The reason for the considerable loss of depth perception with the goggles is not known for certain, but there are strong indications that it is due to the poorer resolution associated with the goggles. This could explain not only the field results but also the particular pattern of results obtained in the laboratory.

The big advantage of the NVG is the large amount of light amplification produced which raises the user from scoptopic (rod) vision to photopic (cone) vision. What does this actually mean to the user in terms of ability to see objects of various sizes in the environment? This question also interested us and we decided to employ a comprehensive type of acuity test which

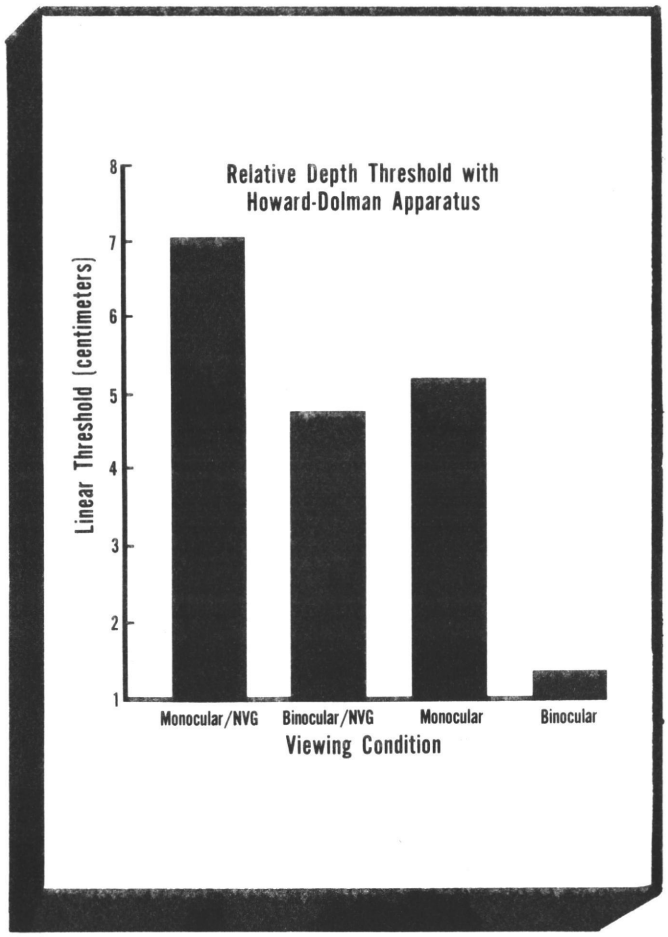

FIGURE 2: Results of stereoptic depth perception study. Shorter bars mean better performance.

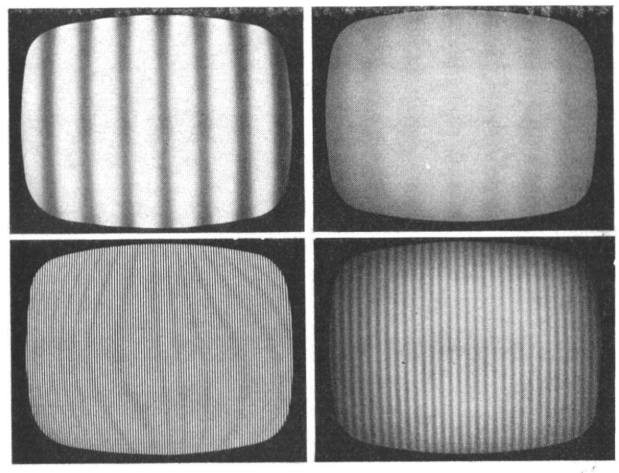

FIGURE 3: A sample of contrast sensitivity bars of various spatial frequencies (widths) and contrast levels.

has recently come into use. In addition to determining the finest detail that an individual can resolve, just as a standard eye chart does, this test also determines the contrast level that an individual requires in order to just *see* targets of many different sizes. Specifically, black and white bars of many different widths are displayed on a television screen. Their initial contrast level is almost zero and the observer has to increase the bar contrast until the threshold level is reached where he can barely see the bars.

Figure 3 shows a sample of four different bar patterns of various widths and contrast levels. The contrast levels have been turned up well above threshold so that you can see them more easily. Figure 4 shows the results of this test both with the unaided eye and the AN/PVS-5 goggles. The bar widths (bar pairs per degree) are shown on the abscissa (the higher the number the narrower the bars) and the modulation (contrast) required is displayed on the ordinate (lower numbers mean better performance). The points where the curves touch the abscissa correspond to the narrowest bars that can be resolved.

Figure 4A displays the results when the average luminance of the TV screen was equal to the luminance of grass on a clear night with a 5 percent moon; figure 4B, 25 percent moon; and figure 4C, 100 percent moon. In figure 4D, the average luminance was much higher, 25 fL or about equal to normal room illumination. The 5 and 25 percent moon illumination (figures 4A and 4B) performance is better with the goggles than with the naked eye at all bar widths. With full moon illumination (figure 4C), however, there is a crossover point at about 8 cycles/degrees; although performance with the goggles is better than or equal to performance with unaided vision for the wide and medium-wide bars, the narrowest bars are seen better with unaided viewing.

This means that on a clear night with a full moon fine detail is seen better with unaided viewing than with the AN/PVS-5 goggles and may be the underlying reason that under these illumination conditions some aviators prefer to fly with unaided vision than with these goggles. In figure 4D (high average luminance), you'll note that the performance with unaided vision is much better than the performance under any of the other luminance levels with or without the goggles.

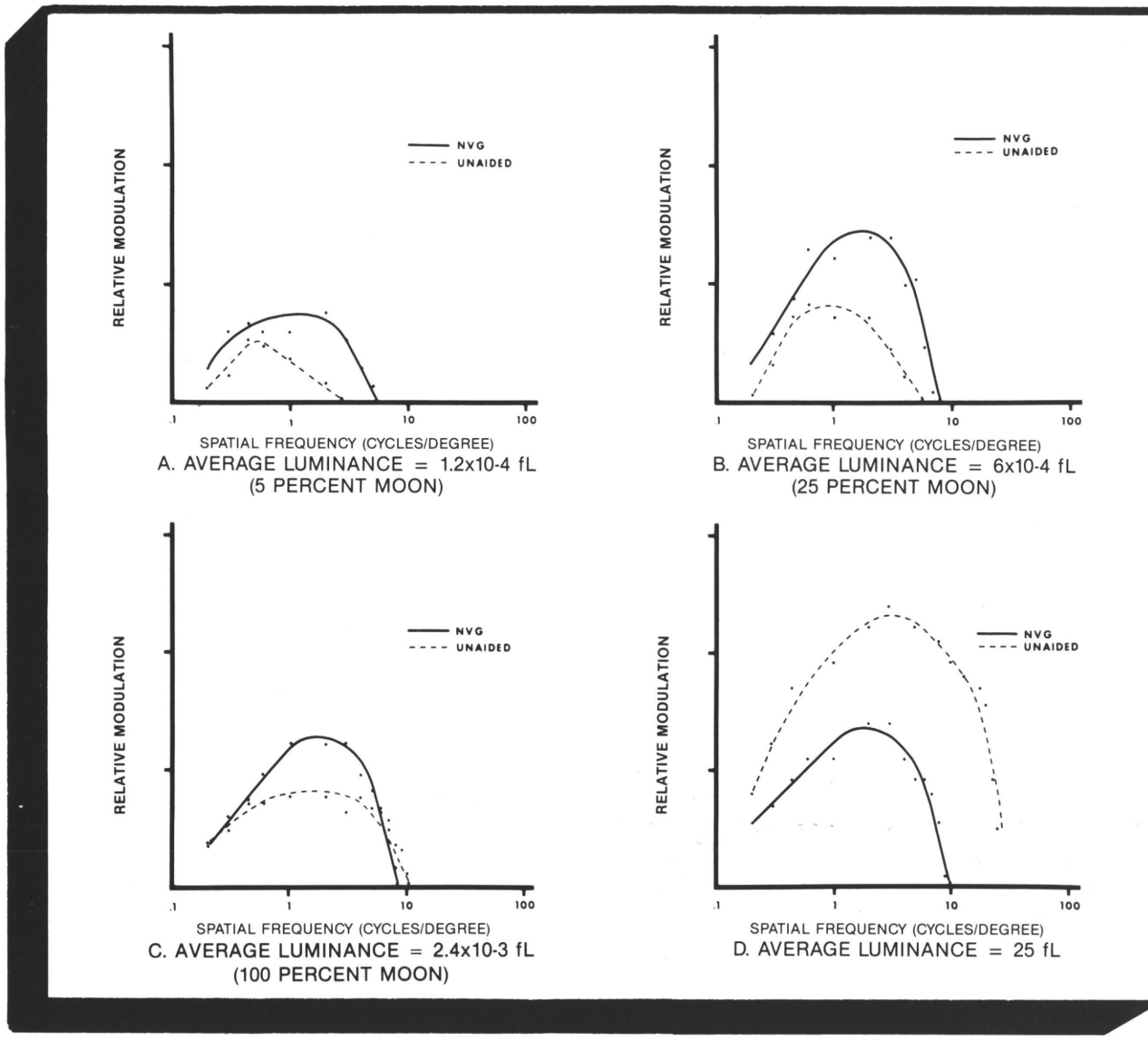

FIGURE 4: Contrast sensitivity functions. The bars become narrower as one moves to the right on the abscissa. The higher the position (the lower the number) on the ordinate, the better the acuity.

Do the night vision goggles destroy dark adaptation? To determine this, we first adapted subjects to a bright light of about 500 fL. The subjects then were placed in total darkness for 30 minutes and their thresholds were repeatedly measured during this time. The results are shown by the solid line in figure 5. Next, the subjects looked into a pair of night vision goggles for 5 minutes after which time they were again placed in total darkness and their thresholds were repeatedly determined for the next 10 minutes. These results are shown by the dotted line in figure 5.

To answer the original question, exposure to the goggles does lower sensitivity by a fairly large amount. However, the recovery time from this exposure is quite rapid, at least when compared to the original curve beginning at the point of intersection. Specifically, the subjects recovered 50 percent of their dark adaptation within 30 seconds and all of it within 2 minutes. Another way to view these results is to point out that looking into the goggles returned the subjects from the 30-minute level of adaptation to the 10-minute level. However, instead of taking 20 minutes to return to full adaptation (30-minute level) it took them only 2 minutes.

Do night vision goggles produce any permanent degradation of one's color vision? The answer to that

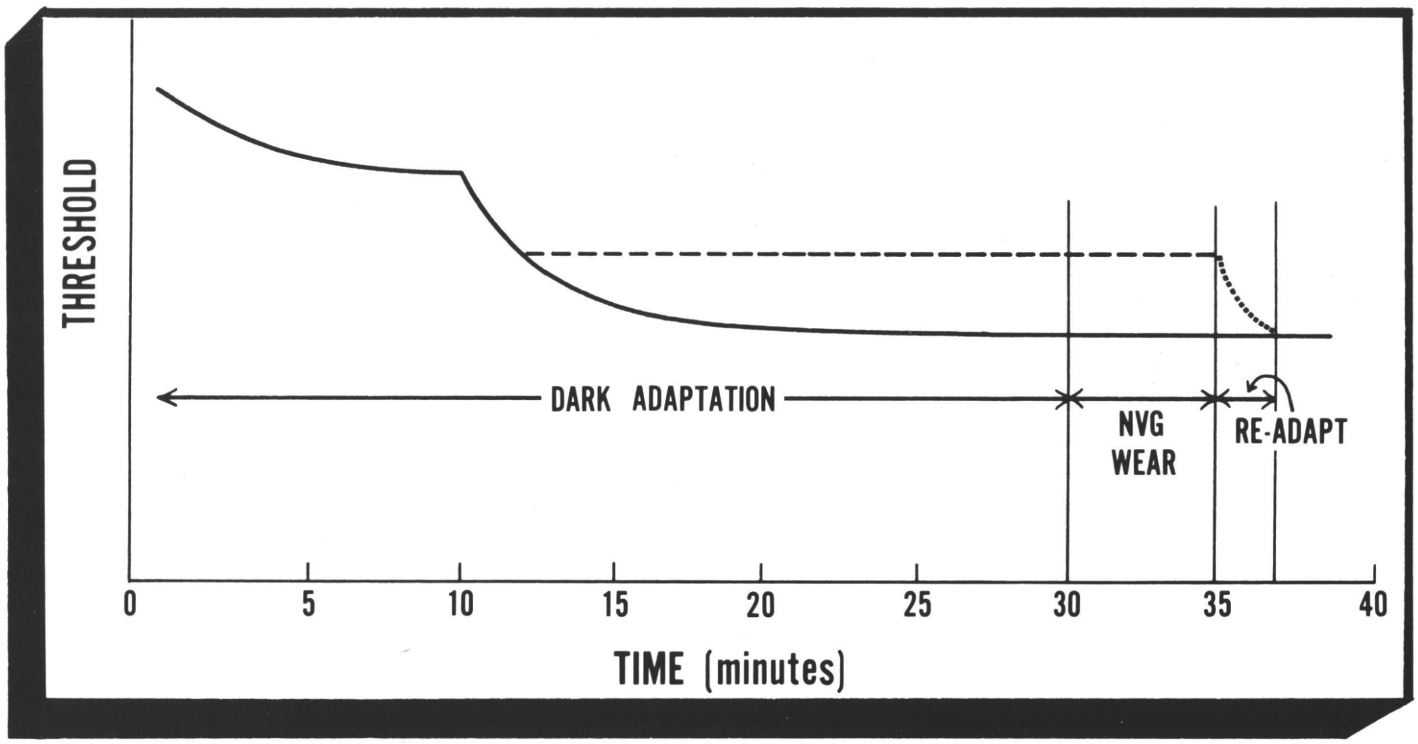

FIGURE 5: Typical curve showing dark adaptation, night vision goggles wearing time and dark adaptation after goggles are removed.

question is no. Since the goggles display only a single color, one can sometimes see an afterimage or discoloration for a while after wearing them, just as occurs normally after staring at a single color long enough. However, this is only a transient effect and does not have any permanent effect on color vision.

We would like to add a note of caution concerning the illusion of false horizon. This can occur when flying over a cloud or cloud bank which is tilted downward relative to the straight-ahead horizontal. It can occur both with unaided and goggles viewing but may be worse with the goggles due to the loss of resolution and the additional loss of external references. If the cloud is low-lying and you're operating near the ground, it obviously becomes very important to closely monitor the attitude indicator.

Contrary to the statement quoted earlier, we do not believe that flying an aircraft with night vision goggles is a "piece of cake." The night vision goggles do produce an enormous increase in the effective light level available to the aviator and thereby greatly improve sharpness over what it would otherwise be at night. We urge every attempt be made to push this technology as has been done in the development of ANVIS, which is described in the following article.

ABOUT THE AUTHORS

LTC Roger Wiley is the deputy commander of the U.S. Army Aeromedical Research Laboratory. He is currently engaged in research in visual neurophysiology.

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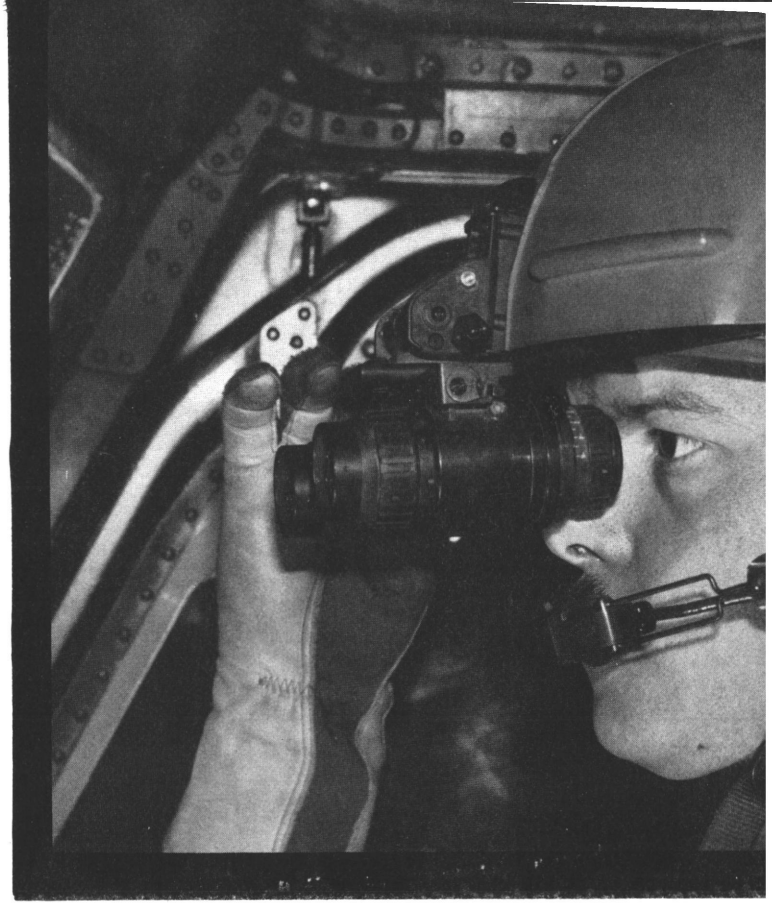
MAJ Frank Holly was a research psychologist specializing in vision at the U.S. Army Aeromedical Research Laboratory at Ft. Rucker, AL. He is currently assigned to the Human Engineering Lab, Aberdeen Proving Ground, MD.

MONTHLY WRITING AWARD

FIGURE 1: ANVIS components as intended to be issued: (From right to left) visor guard and mount; binocular assembly with eye cups and day training filters; dual battery power pack; carrying case.



ANVIS

Mr. Tim Neal
Night Vision Support Detachment
ERADCOM Flight Test Activity
Fort Belvoir, VA

SINCE THE EARLY 1970s we've been conducting helicopter night operations with a device that was designed for ground vehicle driving, the AN/PVS-5 night vision goggles. The PVS-5s extended our night operational mission capability well beyond the limits of the unaided human eye, but they still had low light level limits that were unacceptable from a total night operational viewpoint. The PVS-5s were never intended as anything other than an interim fix until something better could be developed.

That something is here, and is it better! The AN/AVS-6, aviator night vision imaging system, is due to be fielded soon to selected Army units and will be the helicopter pilots' eyes in the dark for some time to come.

If you haven't experienced night nap-of-the-earth flying with PVS-5s already, you've probably discussed it with someone who has. For a number of years the PVS-5s have met with mixed reviews and marginal success in the field. I've never heard anyone comment on how much they *enjoy* flying with PVS-5s. The facts are that they are heavy, ill-fitting, poor performing and give some of us claustrophobia. PVS-5 limitations have been documented precisely, and we must "unlearn" those limitations before we can fully exploit the potential of ANVIS in night flight operations.

The concept of night helicopter operations using night vision goggles was first tested in 1969 by the Project Manager, Southeast Asia Night Operations. At that time, Army doctrine did not call for low

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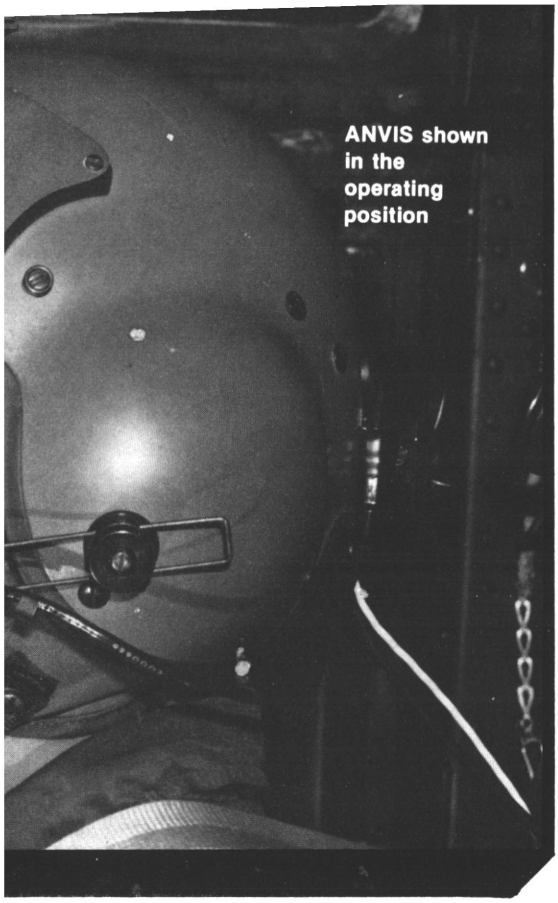


photographs by Ben Boogher

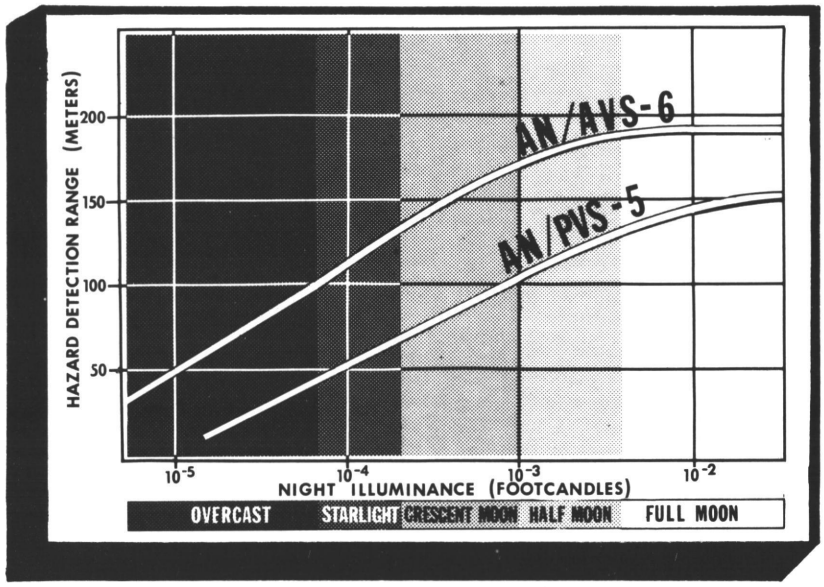


FIGURE 2: The target used to measure hazard detection ranges was a pole 3 meters high, 15 centimeters in diameter and a low surface contrast similar to tree bark. As an example: Under starlight conditions the pole hazard would be seen at about 50 meters with PVS-5s and at about 120 meters with ANVIS.

Now a System designed for Aviators!

level and NOE flight to survive against threat weapons. Although the test successfully demonstrated the concept of pilot-aided NVG flight, further development was not recommended.

In 1971, the Air Force evaluated a similar device for use in search and rescue operations in Southeast Asia where sophisticated air defense weapons had been encountered. About the same time, the Army was reevaluating tactical concepts and considerations of helicopters engaged in midintensity warfare and determined that their survivability required operations to be conducted in the nap-of-the-earth mode during day and night. To provide a "quick-fix" solution to the night side of this new tactical equation, a survey of existing and developmental night vision systems was conducted.

The AN/PVS-5 was under development for the ground soldiers' mission and appeared to be the only suitable night vision device in terms of availability and cost. The PVS-5 was subsequently tested and recommended for Armywide pilot use. It was adopted as an interim pilot system without formal DT/OT testing, with the full understanding that it did not fully satisfy aviation requirements. The known shortcomings included:

- Poor low light level performance.
- Narrow field of view (40 degrees).
- Required to refocus the system to read cockpit instruments.
- Frequent battery failures.
- Inability to read maps.
- Total system weight and forward center of gravity of NVG/helmet.

In an effort to overcome these shortcomings the Night Vision and Electro-Optics Laboratory initiated an advanced development effort for an NVG type device specifically for aviation. The result of this effort is ANVIS, which officially entered production on 30 September 1982 and is scheduled to be fielded around November 1983.

ANVIS consists of a binocular assembly, visor guard and a power pack (figure 1). Of the many new features provided by ANVIS, the third generation image intensifier tube is the most significant. The new

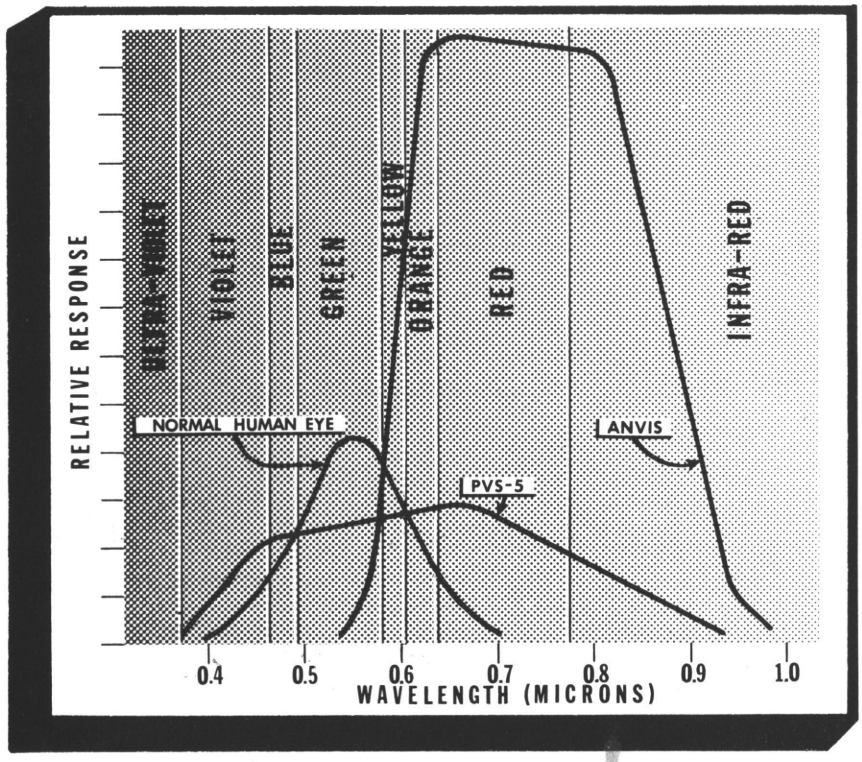


FIGURE 3: Graph shows the visible spectrum of light and the portion of the near infrared that is appropriate to goggles operation. Key points depicted are the much greater sensitivity of ANVIS in the red and near infrared region as compared to PVS-5s and the human eye sensitivity to blue-green light.

tube provides a low light level performance potential unavailable to us with the PVS-5 (second generation tube). The new tube so profoundly outperforms the PVS-5 tube that we are going to have to reevaluate the way we currently employ NVGs, both in the operational and training environment.

In the past, we've never been able to fully actualize night flight doctrine because of the poor low light level performance of the PVS-5 and other shortcomings. Test data reported by the Aviation Test Board during ANVIS OT II indicates that on missions at starlight conditions an ANVIS mission success rate of 83.3 percent was recorded while the mission success rate for PVS-5s was zero (figure 2).

The greater performance of the new tube is due to an improved operational efficiency in the .6 to .9 micron region of the electromagnetic spectrum (which includes portions of visible light and near infrared). The end result of this increased operational efficiency is much greater contrast when viewing a scene illuminated by starlight and a much higher system resolution. For the same reasons, ANVIS also provides much better performance in poor visibility conditions such as rain, fog and haze.

The technical enhancements featured in the third generation tube add up to a significant operational improvement. Very low light levels and many of the effects of weather can be overcome by properly trained ANVIS equipped pilots. Note that a difference between ANVIS and PVS-5s is not always obvious at high light levels. However, when light levels drop below what is comfortable and/or possible with PVS-5s, the ANVIS continues to perform and it doesn't require experience or expertise to readily see the difference between second and third generation tube performance.

Greater low light level performance is the single most important technical feature of ANVIS. The most significant nontechnical feature is a design that allows pilots to see their cockpits nearly as well as they do in day VFR flight. If you have flown with PVS-5s, you will remember fumbling for switches and having to refocus a tube to read aircraft instruments. ANVIS doesn't have the plastic frame used to mount PVS-5s to the face and helmet. ANVIS mounts to a single point on the helmet visor guard. In eliminating the plastic frame or face mask from the ANVIS design, near normal peripheral vision is possible.

The addition of compatible cockpit lighting allows ANVIS users full advantage of their direct eye contact with the cockpit environment. The color blue-green was ultimately selected for cockpit lighting for a number of reasons (see "Cockpit Lighting" on page 42). Figure 3 shows that ANVIS responds poorly to blue-green light. By adding a minus blue filter to the ANVIS optical path, the device becomes virtually blind to blue-green light. Note also that the response of the human eye is greatest in the blue-green area, making instruments easy to read at very low intensities in that color. ANVIS responds best in the red region of visible light and in the near infrared. By mixing ANVIS and the blue-green cockpit lighting, we achieve the best of both worlds in terms of system/lighting compatibility. The cockpit and instrument panel can be easily seen by the unaided eye, under or around ANVIS, while ANVIS is unaffected by glare and wind screen reflection.

An unexpected benefit of blue-green cockpit lighting is a significant

FIGURE 4: A UH-1 Huey photographed through a PVS-5 (from left to right) shows the cockpit lights completely extinguished; the cockpit lighted with blue-green light at a level where the instruments could easily be read; and the cockpit illuminated with standard red light at a high intensity setting.

reduction in the external cockpit light signature (figure 4). On the other hand, red lights in the cockpit stand out like a beacon when observed through the PVS-5s. It's logical to assume that threat forces employ image intensifiers which respond in the same spectral regions as ours.

The ANVIS design did not change the system field of view; it remains 40 degrees. Further increasing the FOV would result in a corresponding reduction in system resolution. However, the removal of the face mask did more for the pilot than provide direct eye contact with the cockpit. When ambient light levels are high enough, a tremendous amount of visual cueing is available outside the cockpit with unaided peripheral vision. Being able to see the external lights of another aircraft in a congested training area (with the peripheral vision afforded by the new design) will greatly enhance training safety.

Flying with PVS-5s is similar to flying with an instrument hood; ANVIS flight is similar to flying daytime VFR with a thick rimmed pair of glasses. Overall pilot effectiveness is significantly increased due to the availability of cues previously denied by the older device. Crew integration tasks will not require the compensations or limitations adopted for PVS-5 flight (i.e., assignment of instrument and radio monitoring to the copilot; assignment of map reading to a third crewmember when available). Crew integration requirements should nearly parallel day flight when using ANVIS.

The author wearing compatible ANVIS goggles and helmet sighting system.

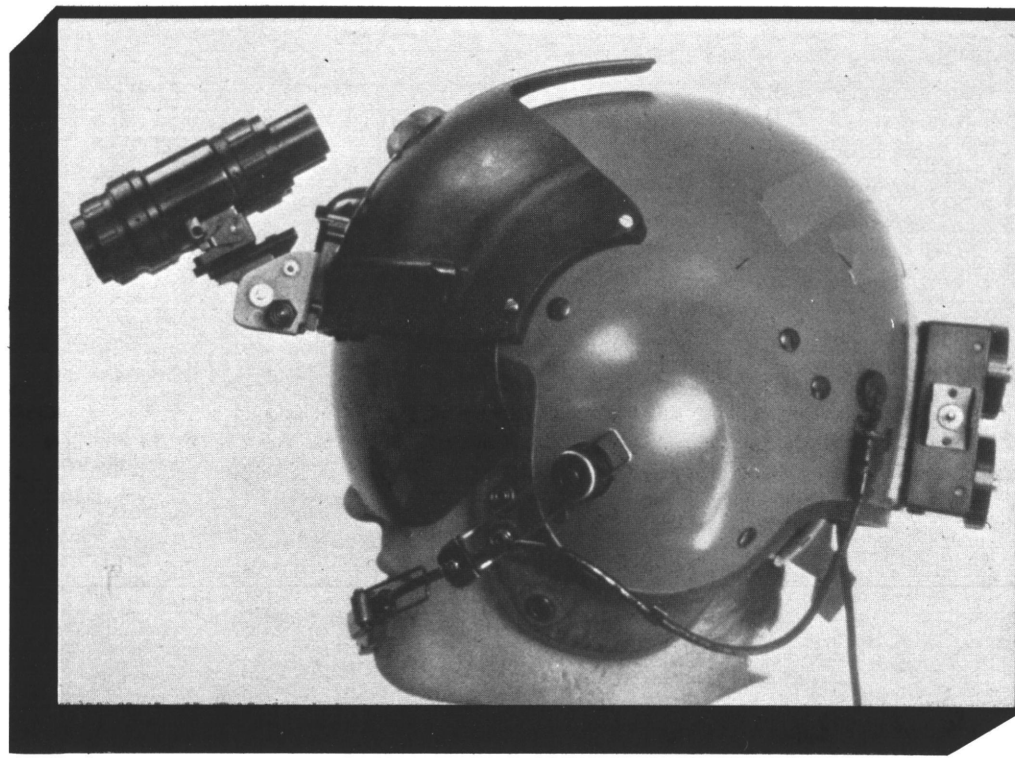


FIGURE5: ANVIS binocular assembly in the stowed position; the visor remains operational; the power pack helps to counterbalance the helmet.

The removal of the face mask in the ANVIS design goes subtly beyond providing pilots more information. Allowing them to move a few steps closer to the environment they are familiar with in day VFR flight adds significantly to their physical and mental comfort. Given that the pilots are more comfortable with ANVIS, they then will perform better, train more effectively and fly more safely.

Other areas that are refined by the design of ANVIS are map reading, weapons firing and transition to instrument flight.

Map reading with the PVS-5s was difficult at best. ANVIS permits near normal access to map and real world environment. Those who have tried to place an AH-1S in TOW prelaunch constraints while wearing PVS-5s will certainly appreciate the look-under feature of ANVIS. ANVIS DT/OT II reports the new device compatible with all AH-1S Cobra weapons systems.

Those of you who have gone inadvertant IMC while wearing PVS-5s will appreciate that the transition to instrument flight with ANVIS is virtually instantaneous because of your direct eye contact with the instrument panel. Once the transition to IMC flight is made, the device can be flipped up and locked or removed with one hand (figure 5).

ANVIS was designed so that all essential adjustments could be made with the left hand. Adjustments exist to provide vertical, tilt, fore-aft (distance from eye to end of tube) and interpupillary distance (IPD—distance between the eyes). Only the IPD is a right-handed adjustment and once set prior to flight it should not have to be readjusted. Once the final adjustments are made, the system could be flipped up and locked or removed and reinstalled with no readjustment required.

The visor guard, which will be issued with the ANVIS system, provides the mounting point for ANVIS as well as the electrical interface between the powerpack and the binocular assembly. The visor guard, mount and wiring are issued already assembled. The only procedure to be performed by the user is the removal of the old visor guard and the installation of the new visor guard in its place. The visor remains fully operational for day or night flight (figure 5).

There are two slightly different mounts for the ANVIS. The standard version, V1, will be used in all aircraft except the AH-1. The V2 version was developed to provide compatability with the Sperry Helmet Sight System in use with the AH-1S. The mount is offset so that during all missions the ANVIS and the HSS are fully functional. At night the ANVIS can become a nighttime HSS.

Both mounts contain on their undersides a small light emitting diode that is clearly visible to the pilot. When illuminated, the diode provides a warning that there is about 30 minutes of life remaining in the battery being used.

ANVIS features a dual battery powerpack, located on the rear of the helmet (figure 5). Either battery can be selected by the pilot through a toggle switch located on the left side of the powerpack. This allows for left handed operation. When the LED illuminates, pilots simply select the opposite battery and continue to fly. They can change dead batteries at their convenience without having experienced a power loss.

If you have had a battery failure with PVS-5s, you'll remember that there was little warning and it required precious seconds to replace the defective battery. The dual battery powerpack of ANVIS provides a significant margin of safety over the single battery PVS-5s.

The ANVIS powerpack is also adaptable to aircraft power through a DC to DC transformer. If the appropriate transformer is installed in your aircraft and a loss of aircraft DC power is experienced, the powerpack will automatically switch to ANVIS battery power and the ANVIS will continue to operate.

The powerpack also serves another important purpose. It is remoted to the rear of the helmet to assist in overcoming an uncomfortable forward helmet CG problem experienced with the PVS-5s. The redistribution of the ANVIS components over the entire helmet reduces neck fatigue. In addition to the improved helmet CG, the ANVIS is lighter overall and will allow for greater pilot comfort during missions of much longer duration than previously experienced.

Although ANVIS will rarely be limited by light level, it does retain the potential to be used for training in the daytime. Daylight filters are provided to simulate various nighttime light levels. In addition, eye cups are required for daylight training and are designed to allow trainees to look under the binocular assembly to read their instruments. The eye cups are much more restrictive in terms of peripheral vision than ANVIS in its normal configuration.

The real beauty of ANVIS in the training environment is that there will be few nights when training cannot be conducted. Experience has shown that for pilots already PVS-5 qualified, the transition to ANVIS is short. With only a little ANVIS experience these same pilots are performing well beyond any level of proficiency demonstrated with PVS-5s. ANVIS qualification for pilots with no goggles experience should require less time than the standard PVS-5 qualification as a result of the new design features.

When was the last time you had your PVS-5s tested for serviceability? Probably never. A very important item of equipment to be fielded with the ANVIS is its self-contained test set. The test set is lightweight, portable and provides the following capabilities:

- Checks to ensure that the ANVIS is operating at or above specification limits.
- Fast fault isolation of failures for powerpack and binocular assembly on AN/AVS-6 and on AN/PVS-5 goggles.
- Go/no-go visual signal checks for powerpack, batteries and binocular assembly on AN/AVS-6 and on AN/PVS-5 goggles.
- Built-in self-test feature.
- Operates off 110 vac, 220 vac or 28 vdc power sources.

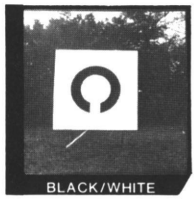
One test set will be issued to each AVUM maintenance organization along with the recommendation that each ANVIS be tested once every 6 months or 100 hours of use, whichever comes first. The unit maintenance concept is repair by replacement. Your unit 35K will be authorized to fault isolate down to the three basic ANVIS components: the binocular assembly; visor mount; and powerpack. AVUM level maintenance is authorized to replace any of the three major components. Defective assemblies are forwarded to AVIM for repair. Defective powerpacks and visor mounts are considered disposable. This maintenance concept will be much more responsive to the individual aviator than the untested concept that existed during the era of the PVS-5s and operational availability is maximized.

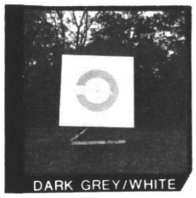
General John J. Hennessy summed up the thoughts of many Army aviators regarding the PVS-5s by saying, "Too often we discover that the success of the tactical system is the result of our dedicated men and women overcoming rather than being aided by their equipment" (*Signal* magazine, March 1977). It is unlikely that you will be hearing comments of this nature concerning ANVIS.

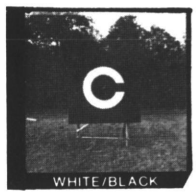
ANVIS was designed for aviation use with full participation by aviators in its development. It is a vast improvement over the many systems seen by the development community in years past, and you can be sure that development of aviator night vision systems won't end here. The ultimate night vision device will allow aviators to feel as comfortable flying night NOE as they are when flying the same mission in the daytime.

Other *Aviation Digest* Night Vision Articles

- "Helicopter Low Level Night Operations," LTC George W. Moses, May 1973, page 2
- "How Night Becomes Day," MAJ Charles D. James, May 1973, page 26
- "NOE At Night," March 1974, page 2
- "ACTAAT: NVG Qualification," July 1982, page 21
- "Knights Train For The Night," MAJ Frank L. Carson and CW3 Owen D. Scruggs, September 1982, page 3
- "NVG Counterbalance System," MAJ Vincent P. Jones, March 1983, page 26







WEATHER & LIGHTING TESTS

FOR NIGHT VISION GOGGLES

CW3 Ray E. Stanton
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Fort Rucker, AL

USING USAREUR aviators, the U.S. Army Aviation Board in the fall of 1982 conducted a test in Germany to determine the minimum weather and light conditions for which night training/night vision goggles training could be conducted in the NOE flight mode. This information was needed so that the Army could revise its weather minima for night vision goggles training. UH-1, OH-58A and AH-1S aircraft were flown at night under various weather and light conditions using the naked eye, the AN/PVS-5 and then the AN/AVS-6 NVG.

The aviators flew a prescribed course representative of NOE courses in Germany—over flat, open, forested and rolling terrain. Rigid testing methodology practices (formal test scenario, data collection/analysis) were applied. The Landolt Ring, an accepted range/light intensity "tool" was used to determine distances at which objects could be discriminated. Aviators began at 400 meters from the rings and slowly hovered toward them until they could correctly identify the orientation of the ring gap. Each ring was rotatable to one of four different positions and represented one of six different contrast ratios (see photo of Landolt Rings). As an aviator was able to correctly identify each ring's orientation, the distance was measured.

A masking/unmasking event followed where time to execute the maneuver and skid height were measured. After masking/unmasking, aviators continued on the open NOE course and into the forested course (contour). Again, time to complete the course was measured. This completed the course, and the aviators returned to a refueling point and prepared for flight with the next visual system.

The Aviation Board spent 4 months in Germany addressing the issues. The jury is still out as to how the findings will be applied for night and night vision goggles training. Listed below are some of the more interesting findings of this test. **But, remember, they are not law yet so adhere to current regulations.**

- Ceiling and visibility are not relevant to pilot performance in the NOE flight mode. They are necessary to preclude inadvertent IMC and to transition to the training area, but not for performance of NT/NVG duties NOE.
- The amount of ambient and artificial light and pilot experience, coupled with the meterological conditions, are the major contributing factors to pilot performance. Aviators with less than 500 hours are most affected by these conditions.
- NVG qualified pilots can generally fly at lower light levels, but definitive minimums could not be established, since none of the test subjects failed.
- The method used in FM 1-51, Appendix D, is inadequate. The method overestimates light levels by 300 to 400 percent and does not account for the effects of meterology.
- The Landolt Ring is a feasible method of onsite measurement of conditions. It translates light into ring distance, but requires validation at each proposed training site.

If interested in learning more about this effort, write the U.S. Army Aviation Board, Ft. Rucker, AL 36362. We'll send a Summary of Test Results. There is still much to be learned in the realm of night flight. This effort is only a start.

photo by SP4 Gary Dahn

Safe mission completion using AN/PVS-5 Night Vision Goggles

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Fort Rucker, AL

NIGHT VISION goggles have some limitations which are outweighed by one significant fact. That is, if used with respect, night vision goggles will dramatically increase the number of night missions completed. Although the PVS-5s can be improved upon, see "Modified Face Plate Goggles," page 2 and "ANVIS," page 12, the PVS-5s are with us now and will be for years to come. When MFPs *are* approved and the ANVIS goggles are in the inventory, there will still be many units that will have to rely on the already fielded PVS-5s.

In my opinion, flying with night vision goggles should be handled similarly to flying with a newly assigned pilot who has certain limitations. What preparations would you take if you had to fly with a pilot who scares older pilots, intrigues younger pilots and has not flown very much in certain units? He can see hundreds of times better at night than you can, but has certain unique limitations. At best, he only has 20/50 vision; has poor depth perception; is able to see from 10 inches to infinity (but has to take one hand off the controls to change his focus); can only see 20 degrees either side of his nose; is colorblind; has periods of total blindness if worked for 10 to 12 hours without refreshments; and suffers neck fatigue within an hour or less. This is a description of the night vision goggles. From now on, consider the night vision goggles as a person—your copilot.

With limitations such as these, you would not assume your copilot is capable of doing anything right. This would force you to increase your mission planning to handle the whole mission as if it were a single pilot mission. Frequencies would be looked up in advance, routes would be committed to short-term memory and the crew would be thoroughly briefed. The urgency of the mission would be considered to see if it could be delayed until conditions would be more favorable. Plan ahead and you'll be able to complete the mission in spite of your copilot's restrictions!

The same logic can be applied to a night vision goggles mission. Now is the time to mentally fly the mission and attempt to anticipate situations that will be difficult or hazardous because of the night vision goggles. Once you are flying the mission, looking up frequencies and map reading are extremely difficult. Anticipate these problems during your mission planning; then brief your crew—the whole crew. *Increased crew coordination leads to increased safety.* For the sake of safety, you must plan your night vision goggles mission completely.

Consider the urgency of the mission. In a training environment common sense should prevail. Just as certain day training flights are postponed because of inclement weather, so should certain night training flights be postponed. If you question a day training flight in the fog, then question a night training flight if there is little illumination. In both cases, limited visibility makes the mission more hazardous to complete. Night vision goggles flight can be safe, but you need all the factors in your favor.

A night vision goggles flight has its problems, as would a flight with the handicapped pilot used in the example. Most of the limitations are due to decreased resolution and a lack of visual cues. The point is—the mission can be completed with an excellent degree of safety if you respect the imposed limitations and plan ahead to compensate for night vision goggles.

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PEARL'S
Personal Equipment And Rescue/survival Lowdown

Suzy Rabren photo courtesy of AIR CAV Store

ALSE...Where To Store It?

Have you ever wondered what causes the wear and tear on ALSE? You know—the gouged helmet liner, all the scuff marks on the vest, the dents on the flares, etc., etc. (ad nauseum). Well, if you think about it, you'll realize that ALSE is usually the last thing a crewmember dons before flight, and it begins coming off before the rotor stops. An exact correlation exists between flight time crewmembers have logged and how much time their personal ALSE was in use. So why is the crewmember looking so grand (sparkling sunglasses, nonregulation mustache, smile and spitshine) and his ALSE is looking like it barely survived a limited nuclear war? Well...

Out of sight, out of mind, as the old saying goes. ALSE can be found in a variety of places—under desks (covered with black scuff marks), in car trunks (light coat of oil), bottoms of wall lockers (under 50 pounds of TA-50) and probably in some places you never imagined. Even the so called "helmet bag"—generally confused with a kit bag—is a major offender. Inside you'll find enough flight publications for the entire western hemisphere, a kneeboard or two, a flashlight (with extra batteries, of course), an emergency box of C-rations, elements of a general mechanic's toolbox, and yes, even a helmet. All this abuse adds up to: 1) a helmet and vest that may fail miserably when needed, and 2) lots of work for you, the ALSE technician.

So, let's look at some solutions to the problem of ALSE storage. Probably the ideal situation is an ALSE shop that encompasses a storage area. The ALSE is issued on a mission basis, and the crewmembers return it to the ALSE shop when the mission is complete. Each crewmember's ALSE is preflighted and postflighted by a trained technician; discrepancies are noted and repaired. Calendar inspections do not entail chasing down crewchiefs, maintenance officers and technical inspectors, since all the equipment is stored in the shop. The environment is controlled and the ALSE is stored in an optimum manner.

By now, about 70 percent of you are telling me to go join the Air Force. Well, it's true, manpower and space requirements can render this operation unworkable. But, you can modify it to work around your particular limitations.

If, for instance, manpower unavailability limits the time the ALSE shop is open for business, the issue of ALSE can be shared by operations personnel, handled in the same way aircraft keys are issued. Storage areas can be accessible by combination lock, with either rear access available to the ALSE technician or a list of combinations available. At any rate, the storage system must be standardized and limited to ALSE only.

If space is the limiting factor, that is, if all the unit's ALSE cannot be gathered into the cubbyhole known as the ALSE shop, then at least standardize the storage system. Have wall lockers that are limited to ALSE and ensure that storage guidelines (detailed in your standing operating procedure) are followed.

Education is a big factor. Instruct the crewmembers in the proper storage of ALSE and the hazards and consequences of improper storage. Have the unit safety officer, platoon leaders and platoon sergeants spot check crewmembers for proper storage techniques.

The bottom line is that ALSE is personal *survival* equipment, and must be cared for as if it would save your life....The above article was submitted by CW2 Charles L. Gibson, chief, USAREUR ALSE Program.

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Adventure/Survival Training

The Aviation Division, U.S. Army Electronic Proving Ground, Ft. Huachuca, AZ, has just finished its first annual survival training exercise. Involved in the exercise were 2 UH-1H helicopters and 21 people; 2 captains, 2 aviation warrant officers, 1 GS-12, 2 E-7s, 6 E-6s, 5 E-5s, 2 E-4s, 1 E-3. Prior to the actual exercise, classes were given to all personnel on first aid, escape and evasion, use of the PRC-90 survival radio, aircraft rescue procedures, land navigation, Arizona state fish and game laws and survival equipment and its use. All participants fired the emergency flares for familiarization and were shown how to use the day/night marine smoke/flare.

The training area was in the rugged mountainous terrain of the White Mountains in northcentral Arizona and had an abundance of natural resources. Day temperatures were in the 60s, night temperatures dropped to the low 20s and teens. Base camp was set up at Big Lake, which is about 30 miles west of Alpine, AZ.

Those attending were organized into 4 groups and were dropped off by UH-1 about 20 nautical miles south of the base camp. Each group had one SRU-21/P survival vest and an individual survival kit. Each individual was issued one emergency food packet and two cans of emergency water. The groups had 3 days and 2 nights to travel from the dropoff point to the base camp. They were to use, to the best of their ability, the resources at their disposal, relying on the emergency rations only when necessary. Groups were instructed to stop early enough in the evenings to be able to use the survival equipment for snares, fishing and building shelters. Each group received four practical exercises in contacting the "rescue" aircraft and directing it to their location through use of the PRC-90, the emergency mirror, flares and marker panels. Each group made several successful contacts during the exercises.

Overall, the survival training was highly successful. The major objectives were met, familiarizing people with the hardships of a survival situation and with the contents and use of the survival kits. Many valuable lessons were learned. Some groups concentrated too much on rapid movement, resulting in several minor foot injuries, which could be disasterous in an actual emergency. Two people were evacuated from the field, one for a sprained ankle and the other for severe allergic reaction. Cross-country navigation is very difficult with aviation maps as all groups learned. A careful study of the situation and proper route selection were a must. Due to the short duration of the exercise, the full value of having individual survival skills wasn't recognized by many individuals. An extended exercise, understanding that an actual survival situation could last weeks or much longer, would reinforce the need for those skills.

All in all, the training and experience received were excellent. Those attending learned how demanding a survival situation could be and how to handle the hardships while tired, hungry and isolated. Though not easy training, it could save a life someday. This article was submitted by SSG James Allen, USAEPG ALSE NCO.

Canned Survival Water Expired?

Inquiries from the field indicate that case lots of water, canned, survival, NSN 8960-00-916-4201, are being received with expiration dates on the cartons.

Disregard these expiration dates; they are used at depot level to keep stock flowing properly.

Continue to use the "slap test" on the water cans. This test is still valid. If you feel that canned water 5 or more years old needs further testing, take a sample to your post veterinarian or bacteriological lab for confirmation. But remember, do a slap test first and keep a record of the lot number.

Thanks to Norm Harris at Natick Labs for settling this question. This article submitted by Jim Angelos, TSARCOM, St. Louis.

Suspended Issue Items

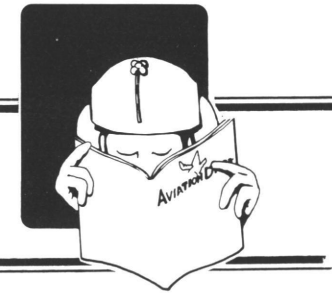
The medical materiel listed below has been suspended from issue due to noncompliance with specifications.

NSN	NOMENCLATURE	MANUFACTURE CONTRACT/LOT NO.
6540-01-099-2321	Frame, Spectacle, Bayonet Temples, 42 by 52 eye, 20 bridge	Norton Co. DLA 120-81-C-4657 All lots

U.S. Army Medical Materiel Activity, Ft. Detrick, MD, will confirm this information in DA SB 8-75 series.

If you have a question about personal equipment or rescue/survival gear, write *PEARL, DARCOM, ATTN: DRCPO-ALSE, 4300 Goodfellow Blvd., St. Louis, MO 63120, or call AUTOVON 693-3307 or Commercial 314-263-3307.*

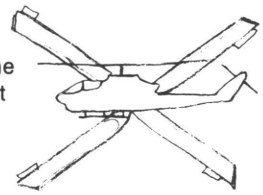
VIEWS FROM READERS



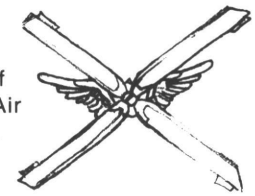
Editor:

I agree wholeheartedly with MAJ Robert P. Fallis' letter concerning aviation branch status (January 1983 *Aviation Digest).* I, as a first lieutenant, hope to be among the first to attend an Army Aviation Advance Course at Ft. Rucker. As did MAJ Fallis, I offer two additional possible designs for consideration as a branch insignia.

1LT David H. Richards
CH-47 Student, 63d Company
Ft. Rucker, AL



AH-1 facing the wearer's heart over crossed rotorblades.



A variation of the old Army Air Corps brass.

Editor:

My idea is to combine all aviation abbreviations and terms in one dictionary. I understand some monthly publications contain this information. Some aviation terms differ from those in a regular dictionary. Combining all this information in one book would, I feel, allow those soldiers and civilian personnel who are not familiar with aviation terminology the opportunity to have a ready access to aviation abbreviations, definitions and terminology.

SP4 Carol A. Seymour
Flight Operations Coordinator
Ft. Drum, NY

Editor:

The November 1982 issue of the *Aviation Digest* contained a listing of all Missouri Army National Guard aviation units. However, our largest and most modern installation was not included in the listing.

Missouri is fortunate to have one of four Aviation Classification Repair Activity Depots in the United States. This ultramodern facility performs intermediate and depot level aircraft maintenance, component repair/overhaul and AIMI-DX supply functions to support Army National Guard aircraft from 14 states in mid-America.

Please include this listing in a future issue of your fine magazine:

MISSOURI AVCRAD
1502 Lester Jones Avenue
Springfield Regional Airport
Springfield, MO 65802
Comm: (417) 862-0738
AV: 581-1292

COL Willard L. Bean
State Army Aviation Officer
MOARNG

• The *Aviation Digest* has carried listings of Army Aviation National Guard units in Illinois, Iowa, Kentucky, Minnesota, New York, Pennsylvania, South Carolina, Texas and Wisconsin. Also, a list of Reserve units, by state, is available. The *Digest* will be happy to publish listings of other National Guard units not previously printed.

Editor:

I request your assistance in identifying the author of the attached masterpiece, "Because I Fly." I have asked many of my fellow aviators here at Ft. Lewis the name of the author with negative results. I think aviators worldwide relate very closely to what the author is saying. I would only like to give credit to its fine author and learn something about him.

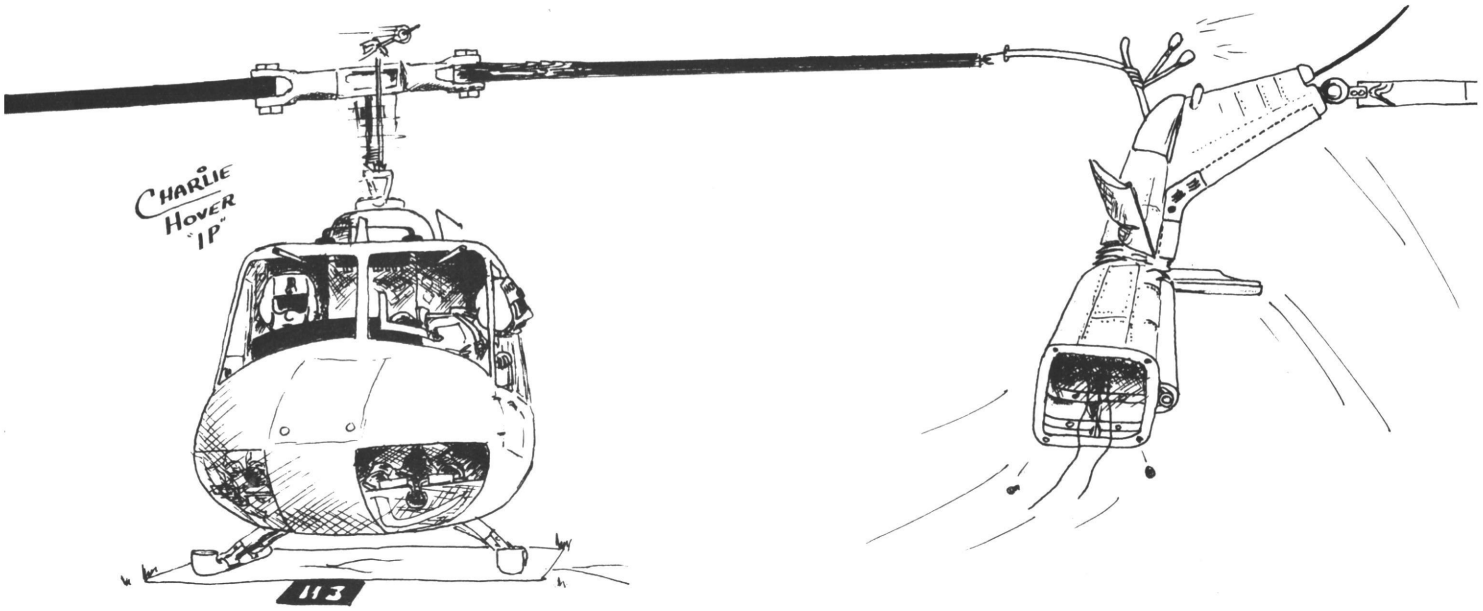
BECAUSE I FLY

I laugh more than other men,
I look up and see
more than they.
I know how clouds feel,
what it's like to have
the blue in my lap,
to look down on birds,
to feel the freedom in
a thing called a stick.
Who but I can slice between
God's billowed legs,
and feel them laugh and
crash with His every step.
Who else but I have seen
the unclaimed peaks,
the rainbow's secret,
the real reason birds sing.
BECAUSE I FLY
I ENVY NO MAN ON EARTH.

CPT Garry P. McNiesh
CDR, 243d Avn Co (ASH)
FREIGHT TRAINS
Ft. Lewis, WA

• Editor's Note: If anyone knows the author of "Because I Fly" please write Editor, *Aviation Digest,* P.O. Drawer P, Ft. Rucker, AL 36362. We will share the information in print.

Articles from the *Aviation Digest* requested in these letters have been mailed. Readers can obtain copies of material printed in any issue by writing to: Editor, *U.S. Army Aviation Digest,* P.O. Drawer P, Ft. Rucker, AL 36362



Mr Hover, I think I just remembered what I forgot to do.

ATC Conference

MORE THAN 35 Army air traffic control commanders and representatives gathered at Ft. Ritchie, MD, from 25 through 29 April for the 7th Signal Command Air Traffic Control Conference. The conferees took a hard look at all aspects of 7th Signal Command's air traffic control throughout the continental United States, Alaska and Panama.

During a joint combat support and fixed air traffic control session, the major topics were training, personnel and doctrine.

Among some of the topics addressed by Lieutenant Colonel Charles Brockway, chief of the Combat Support Branch, were issues of cross training of fixed and tactical controllers, and ATC support of annual training.

Representatives from 7th Signal Command's Personnel and Administration Office and Department of the Army MILPERCEN representatives joined in discussions about personnel, including critical military occupational specialty and officer distribution plan support plans, and the warrant officer technician/aviator status.

A Fixed and ATC Combat Support Workshop brought up additional topics such as logistics, ATC training proficiency and training support to the National Guard. These key ATC personnel also planned and scheduled major field training exercises.

According to Colonel Paul F. Burke, commander of the U.S. Army Air Traffic Control Combat Support Activity, the conference served to define problem areas requiring resolution at various levels within the command. "The positive approach taken by all participants was most refreshing," said Colonel Burke.

The 7th Signal Command is responsible for air traffic control at more than 40 Army airfields and heliports throughout the country.

Directorate of Evaluation/Standardization

REPORT TO THE FIELD

U.S. ARMY
AVIATION STANDARDIZATION

ASTS IS THE acronym that will be used to describe a new program established by the Directorate of Evaluation and Standardization. It stands for Aviation Standardization and Training Seminar. This new program is solely an *assistance oriented* effort to improve safety, standardization and training in Army Aviation. Although this new program will not eliminate DES' role as evaluator for the Department of the Army, it will significantly expand its mission to one of assistance and training as well.

Since 1979, DES has been conducting Aviation Center Training Analysis and Assistance Team visits to Active Army and Reserve Component Aviation units worldwide. The ACTAAT was established to meet the requirements of the TRADOC directed Branch Training Team Program. Its primary mission was "to establish and maintain a meaningful productive dialogue between TRADOC schools and field units and to collect data pertaining to the effectiveness of training at TRADOC institutions."

Through the ACTAAT visits, Aviation units had an opportunity to provide input into Aviation training programs established at TRADOC schools. This input was used to increase the training effectiveness of TRADOC courses and enhanced TRADOC's ability to better serve the training needs of field units. The ACTAAT also provided the U.S. Army Aviation Center at Ft. Rucker, AL, with a forum for the mutual exchange of doctrinal, combat development, and training ideas and concepts. This information was used to increase the effectiveness of Aviation publications, policies and procedures.

In addition to the ACTAAT, DES initiated assistance visits to Reserve Component Army Aviation units in 1975. These visits were in the form of IP/SIP seminars and conducted by DES SIPs and Aviation Center subject-matter experts. The seminars proved beneficial, enhancing Aviation training and standardization in the Reserve Components. The success of the Reserve Component seminars prompted the expansion of the program to Active Army units.

The Aviation Standardization and Training Seminars are designed to combine the ACTAAT with the IP/SIP seminars. This will reduce the frequency of DES visits to field units, thereby minimizing disruptions of visited units' activities while increasing each visit's productivity. The ASTS provides the Aviation Center with a true Branch Training Team that will be tailored to meet the needs of the visited unit. It is designed to accomplish the following goals:

- *Facilitate an exchange of information* between the Aviation Center and Aviation unit trainers and commanders which will enhance Army Aviation safety, standardization and training.
- *Provide requested assistance* to field units in Aviation related subjects.
- *Collect feedback* from field units to upgrade institutional training programs.

To accomplish these goals, the ASTS will be conducted in a training assistance format and will draw on assets from throughout the Aviation Center. The composition of the team and the duration of each visit will depend upon the visited unit's requirements. A typical ASTS visit to a major Army Aviation installation will normally last 4 to 5 training days and be composed of the following team members:

- **Team Chief:** Provides an initial inbrief and conducts seminars and discussions with unit commanders.
- **Team Coordinator:** Coordinates training assistance requirements with the visited unit's point of contact, and develops the itinerary and schedule for team members.
- **SIPs:** Conduct training flights, academic classes and provide other assistance as requested.
- **Subject-Matter Experts:** Conduct hands-on training, provide classroom instruction, answer questions and provide other assistance as requested.
- **Instructional System Evaluators:** Collect data pertaining to the quality of training at TRADOC schools.

The subject-matter expert and SIP requirements will depend upon the assistance requested by the unit. Possible areas of interest that may be requested include:

- *Flight Training:* Conducted in fixed or rotary wing aircraft and may cover areas such as night vision goggles, tactics or instrument flight. Instruction will normally be oriented toward unit IPs and SIPs.
- *Academic Instruction:* Oriented toward any individual in the command and may be in the form of

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question and answer periods or formal instructional periods. Training may cover any Aviation related subject requested by the unit. Possible subject areas might include:

- ☐ Performance planning
- ☐ IFR and VFR flight planning
- ☐ Aerodynamics
- ☐ Instructor pilot fundamentals
- ☐ Aviation regulations (i.e., AR 95-1)
- ☐ Aircrew training manuals
- ☐ Test flight procedures
- ☐ Threat briefing
- ☐ Courtesy ATM and flight records checks
- ☐ Briefing and demonstration of tactical evaluations administered by DES during standardization visits

This list is not intended to be all inclusive. Units will have an opportunity to request any assistance required through precoordination with the ASTS coordinator. Assistance requested will be provided if assets are available.

The Aviation Standardization and Training Seminars are intended to be *assistance only.* Team members will *not be evaluators* but will act as trainers and instructors in their respective areas. A report on the unit will not be written and gradeslips will not be issued for training flights unless requested by the unit. Training feedback in the form of questions that cannot be answered during the ASTS will be researched at the Aviation Center and answers forwarded directly to the unit for its information. An *internal* DES after-action report will be written and used *only* to improve future ASTS visits. The after-action report will contain only administrative and logistical comments concerning the trip and will not be forwarded to any other organization.

Implementation of the ASTS is scheduled to begin next month at Ft. Campbell, KY. The availability of funds and assets will dictate the frequency of future Aviation Standardization and Training Seminars. Current plans call for ASTS visits to installations with major Aviation assets every 36 months. Ideally, that visit will be conducted about 6 months prior to the unit's Aviation Resources Management Survey.

The ASTS is a new approach toward the Directorate of Evaluation and Standardization's role in Aviation training and standardization. Although DES will still conduct evaluation visits for the Department of the Army, its mission will be expanded to include that of a true Branch Training Team for Army Aviation. It will aid in bridging the communication gap between field units and TRADOC installations. Its success depends upon coordination prior to the team's arrival and an understanding of its functions and goals. Any questions or requests concerning the ASTS may be made by calling AUTOVON 558-4691/2501 or writing DES, ATTN: ATZQ-ES-E, Ft. Rucker, AL 36362.

Safe Single Engine Airspeed

Aircraft	Gross Wt.	Configuration	Vs	Vmc	5%	Vsse
C-12A	12,500 lbs	flaps up	99	84	5	104
U-21A	9,000 lbs	flaps down	75	90	4.5	95
T-42A	5,100 lbs	flaps up	80	76	4	84
U-8F	7,700 lbs	flaps up	85	85	4.3	90
U-3B	4,990 lbs	flaps up	82	88	4.4	93

A NEW TERM to Army aviators used in the utility and surveillance airplane ATM, and which is due to appear in the forthcoming change to AR 95-1, is Vsse. It stands for safe single engine airspeed and denotes an airspeed used during fixed wing multiengine training below which an instructor shall not intentionally cut an engine.

The use of this airspeed is an industry concept and most manufacturers of civil aircraft are including this new number in civil aircraft operators' manuals. The number is selected by the manufacturer based on his own data (not an FAA computation) and is published to support the theory that little can happen to the crew in the way of control difficulty if the airplane is always above Vmc or Vs during dynamic engine cuts required during training.

Adoption of this speed (Vsse) by Army Aviation should provide a reasonable margin against the occurrence of unintentional stalls or spins when instructors perform intentional dynamic engine cuts during training. This minimum speed will be published in Army aircraft operators' manuals (dash 10s) as they are revised. In the interim, if Vsse is not listed in your dash 10, it will be computed by using the greater of Vs or Vmc plus 5 percent. The above chart is an example of Vsse computation.

AVIATION PERSONNEL NOTES

Command Selections

Headquarters, MILPERCEN, announced the names of officers selected for lieutenant colonel-level command assignments in fiscal year 1984. The following aviators have been named to command battalions and squadrons throughout the Army:

Charles M. Burke*
Christopher D. Calhoon*
Frank L. Carson*
Edward D. Chandler*
Kenneth J. Gingras*
David H. Hicks*
Charles R. Huggins
Kenneth R. McGinty*
Dean H. Nichols
Billy H. Pearson*
Palmer J. Penny III*
James M. Pulliam*
Samuel C. Raines
David L. Richey
Johnny M. Riggs*
Everette L. Roper Jr.*
Barry H. Semon*
Theodore T. Sendak*
Peter S. Shockley*
Immanuel C. Sieving III*
Alfred G. Snelgrove*
Kief S. Tackaberry*
Samuel S. Thompson III
Donald L. Trent*
William R. Vincent Jr.
Michael W. Ackerman
James E. Dooley III*
Richard E. Ferguson*
Ronnie B. Gipson*
Orville B. Smidt*
Paul K. Tanguay*
Thomas E. Bruns*
Guy E. Champlin
Stuart W. Gerald
Rondle L. Nelson
John A. Otis*
Thomas M. Schwartz
Edward J. Shannon
Julian A. Sullivan Jr.*

*These officers have been selected to command aviation-related battalions and squadrons.

DA Pamphlets for Officer Specialty Codes

In April 1982, a series of DA pamphlets was published which describe the specialty codes for commissioned officers. The series is numbered DA Pamphlet 600-3-11 through 600-3-97. There is a pamphlet for 35 of the 36 officer specialty codes.

The pamphlets are designed to be used by career managers, trainers, instructors, field commanders and individual soldiers for recruiting, professional development and counseling. They describe the duties officers perform in each specialty and the types of training offered at service schools.

The pamphlets also discuss career progression and list the types of assignments that officers can expect to receive. Each pamphlet is illustrated with color photographs of officers performing typical duties in their specialties.

In May and June 1982, the pamphlets were distributed worldwide to all Active Army units, Reserve Component headquarters, the U.S. Military Academy, all ROTC regional headquarters, the Branch Immaterial Officer Candidate Course and MILPERCEN.

Additional copies of the pamphlets can be ordered through local AG publications channels by specialty; e.g., the pamphlet for Infantry Specialty Code 11 can be ordered as DA PAM 600-3-11.

For more information concerning the pamphlets, contact MILPERCEN, DAPC-OPA-C, AUTOVON 221-0250.

CAS³ Mandatory For All Captains in Year Group 1976 and Later

All captains, who are in year groups 1976 or later, will be required to attend the Combined Arms and Services Staff School at Ft. Leavenworth, KS. The CAS³ course provides formal schooling for brigade, divisional and installation level staff positions. It consists of two phases: Phase I consists of 120 hours of nonresident instruction ending with a 6-hour qualifying exam; Phase II is the 9-week resident course at Ft. Leavenworth.

Selection for attendance to the resident course is based upon the officer's date of availability, the number of seats available and the following prerequisites:

- year group 76, 77 or 78,
- have between 6 and 9 years AFCS,
- be an advanced course graduate,
- successfully complete Phase I and pass qualifying examination.

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Twelve months prior to the start date of CAS³ (classes are currently held in January, April, July and October) officers are selected by their professional development officer. A letter of notification is forwarded to the officer at this time and Phase I packets will be forwarded by Ft. Leavenworth within 4 to 8 weeks of notification. It is important that all eligible officers keep files updated with a current address to expedite the Phase I mailout.

Officers may attend CAS³ either TDY en route to their next duty assignment or attend TDY and return to currently assigned unit. Officers who want to attend CAS³ TDY and return must obtain formal command approval. TDY and return is DA funded and must be coordinated with the officer's professional development officer.

All officers in year group 1976 to 1978 who will have availability dates between April 1983 and April 1984 should contact their professional development officer to discuss CAS³ programing.

Schedule for CAS³ fiscal year 1984:

84-1	3 October 1983—9 December 1983
84-2	5 January 1984—9 March 1984
84-3	15 March 1984—18 May 1984
84-4	24 May 1984—27 July 1984
84-5	2 August 1984—5 October 1984

Command and General Staff College (Nonresident)

Since the number of officers who can attend the resident course is limited, not everyone is going to be selected. Officers who are not selected by the 12th year of active federal commissioned service should enroll in the nonresident course. Recent lieutenant colonel selection board statistics indicate the importance selection boards place on CGSC completion. This course provides an alternate method to resident course attendance for attaining Command and General Staff College credit. Nonresident course graduates remain eligible for resident course selection within the constraints of resident course eligibility criteria.

Criteria for Enrollment. Personnel eligible for enrollment in both USAR school and correspondence course options are as follows:

- A commissioned officer of any component of the Army.
- Demonstrated potential for assignment to high level staff positions.
- Completed a minimum of 8 years commissioned service as of enrollment date (Active Army only).
- Received credit for an officer advanced course before enrollment date (concurrent enrollment in an OAC and the nonresident course is not authorized).
- Not completed 18 years commissioned service as of enrollment date.
- Not completed or received credit for the CGSO Course resulting in the award of a diploma.

Waivers. The Commandant, CGSC, is authorized to grant waivers in exceptional cases. Requests for waiver with complete justification will be forwarded through enrollment channels to the Commandant, USACGSC, ATTN: ATZL-SWE-TM, Ft. Leavenworth, KS 66027.

Description of the Course.

- The nonresident course parallels the professional development curriculum of the Command and General Staff Officer Course taught at Ft. Leavenworth.
- The nonresident course can be completed under the following programs by:
  - (1) Completing correspondence subcourse.
  - (2) Attending instruction presented by a USAR school.
  - (3) A combination of (1) and (2).
  - (4) A diploma from the CGSC awarded following satisfactory completion under any of the above programs.

Application Procedures. Officers interested in applying for any option for nonresident CGSC completion should request an Application Enrollment Packet from the Commandant, USACGSC, ATTN: ATZL-SWE-TM, Ft. Leavenworth, KS 66027. Command and General Staff College credit and award of military education level 4 is not given for completion of the nonresident program of other services. The curricula of the other services' intermediate level staff college nonresident programs are not considered suitable substitutes for the training Army officers receive in either the resident or nonresident Command and General Staff College Program.

CONSOLIDATED GLOSSARY

AAF	Army airfield
AAMAA	Army Aviation Mission Area Analysis
AAPART	annual aviator proficiency and readiness test
ACTAAT	Aviation Center Training and Analysis Team
AASPR	Army Aviation Systems Program Review
AFCS	active federal commissioned service
AG	Adjutant General
AIMI-DX	aviation intensive management items—direct exchange
ALSE	aviation life support equipment
ANVIS	aviation night vision imaging system
AR	Army regulation
ARTEP	Army Training and Evaluation Program
ASTS	Aviation Standardization and Training Seminar
ATC	air traffic control
ATM	aircrew training manual
AVCRAD	Aviation Classification Repair Acivity Depot
AVIM	aviation intermediate maintenance
AVN	aviation
AVUM	aviation unit maintenance
AWO	aviation warrant officer
CAS^3	Combined Arms and Services Staff School
CG	center of gravity
CGSC	Command and General Staff College
CGSO	Command and General Staff Officer
COMM CARDS	communication cards
DA	Department of the Army
DARCOM	Development and Readiness Command
DC	direct current
DES	Directorate of Evaluation and Standardization
DIO	Directorate of Industrial Operations
DOD	Department of Defense
DT	development testing
ERADCOM	(U.S. Army) Electronics Research and Development Command
ESSS	External Stores Support System
FAA	Federal Aviation Administration
FAC	forward air controller
FIB	flight information bulletin
FLIP	flight information publication
FM	field manual
FM	frequency modulated
FOV	field of view
fL	footlambert
HB	handbook
HQ	Headquarters
HSS	helmet sight system
IR	infrared
IFF	identification friend or foe
IFR	instrument flight rules
IMC	instrument meteorological conditions
IP	instructor pilot
IPD	interpupillary distance
JTA	Joint Table of Allowance
LED	light emitting diode
MFP	modified faceplate
MHz	megahertz
MILPERCEN	Military Personnel Center
mm	millimeter
MOARNG	Missouri Army National Guard
MOS	military occupational specialty
NBC	nuclear, biological and chemical
NCO	noncommissioned officer
NOE	nap-of-the-earth
NOTAM	notice to airmen
NSN	national stock number
NVG	night vision goggles
NT	night training
OAC	officer advanced course
OT	operational test
PAM	pamphlet
ROTC	Reserve Officers' Training Corps
SIP	standardization instructor pilot
SSC-NCR	Soldier Support Center-National Capital Region
TAC	tactical
TB	technical bulletin
TC	training circular
TDY	temporary duty
TOW	tube-launched, optically-tracked, wire-guided
TM	technical manual
TRADOC	Training and Doctrine Command
TRANSCOM	Transportation Command
TROAA	TRADOC Review of Army Aviation
TSARCOM	(U.S. Army) Troop Support and Aviation Materiel Readiness Command
TV	television
USAARL	U.S. Army Aeromedical Research Laboratory
USAAVNDTA	U.S. Army Aviation Development Test Activity
USAATCA-ASO	U.S. Army Air Traffic Control Activity-Aeronautical Services Office
USAEPG	U.S. Army Electronic Proving Grounds
USAF	U.S. Air Force
USAR	U.S. Army Reserve
USAREUR	U.S. Army, Europe
vac	volts, alternate current
vdc	volts, direct current
VFR	visual flight rules
VHF	very high frequency
Vmc	velocity of minimum control
Vs	power of stalling speed
Vsse	safe single engine airspeed

REPORTING FINAL

Late News From Army Aviation Activities

Outstanding Aviator. **CW3 Mark E. Metzger adjusts some instruments in his AH-1S Cobra prior to takeoff. CW3 Metzger was selected as the 1982 USAREUR Outstanding Aviator of the Year.**

photo by SP4 Gary E. Lindsley

FROM FORT RUCKER

Attention MOS 71Ps, 93Hs And 93Js And Supervisors! The extension training materials catalog, DA Pamphlet 350-101-3 (February 1983), has been published with a new look. The new version is bright red in color and titled "Air Traffic Control Battalion (CORPS), ARTEP 1-225." Its improved design provides a valuable and ready reference of materials needed to train common tasks, military subjects and MOS technical tasks, plus guidance on "how-to" obtain the materials. Copies of the new catalog may be requisitioned from the U.S. Army Adjutant General Publications Center, 2800 Eastern Boulevard, Baltimore, MD 21220.

AWO Job And Task Analysis Effort. The Review of Education and Training for Officers is a study that was directed by the Army Chief of Staff in 1977 and implemented in 1979. It recognizes a need to design a total officer training system to provide continuing education and professional development throughout the careers of commissioned and warrant officers to better prepare them for future challenges.

As part of this continuing study, the U.S. Army Aviation Center is conducting a job and task analysis of all rated aviation warrant officer duty positions. The JTA is a critical phase which will provide the base data for developing training strategies. The data will be gathered with an AWO survey administered to AWOs and supervisors. The survey will be administered worldwide by the Soldier Support Center-National Capital Region, Alexandria, VA.

Surveys are unique management tools. This one enables AWOs and supervisors to provide training developers with personal views of AWO requirements throughout the Army. The AWO survey was developed as a joint effort by the Aviation Center and SSC-NCR. It will be sent to all rated AWOs in authorized duty positions. And, attuned to the "total force" concept, it also will be distributed to Reserve Component AWOs.

The Background Information section of the survey is used to collect data about job incumbents, their duty assignments and their organizations. The Activity Section gives job incumbents an opportunity to describe the jobs they do. The Position Responsibilities Section is used to collect data about skills, knowledge and responsibilities required to perform AWO jobs, and questions about areas of interest within the warrant officer specialty. Incumbents determine if each task is performed in their *current duty position.* The Additional Skills and Duties Section is divided into two groups: Group A lists additional skill identifiers associated with the surveyed specialty; Group B lists additional duties AWOs can be expected to perform. Data

collected may be used to determine the additional requiements placed on the AWO. The requirements will serve as the basis of additional training needed to perform those missions. The Equipment Section will collect data from incumbents on the types of equipment (such as weapons, vehicles and communication items) AWOs use and maintain. It also includes particular equipment for which AWOs may have responsibility at particular times. In the Personal Comments Section, the AWO is asked to provide handwritten comments or respond to multiple choice questions about training (received or required), duties, career mangement, and the adequacy and accuracy of the survey itself.

The opportunity to participate in an Armywide occupational survey provides the AWO an opportunity to describe training requirements. The survey is both an opportunity and professional responsibility. Seldom is the entire AWO population offered the chance to make a direct and meaningful contribution to the development or revision of aviation training. Your input is necessary if the results are to be meaningful. You *will* be affected by the outcome; therefore, you owe it to yourself to participate.

In 1977 the Department of the Army conducted a survey of both commissioned and warrant officers to obtain their attitudes and perceptions on Army education and training policies. This survey was mailed to about 14,500 officers, with only 7,800 responding. And, of that 7,800 only 2,400 commissioned and 1,100 warrant officers responded with additional comments. Those officers that didn't reply left a large portion of their Army careers in the hands of others. Don't let that happen on this extremely significant aviation warrant officer survey. Remember, the results of this survey will ultimately be used to design, develop and implement improved instruction that will benefit AWOs and the Army Aviation Branch. Look for the survey early this summer—and remember, if you are an AWO—be professional and do *your* part!

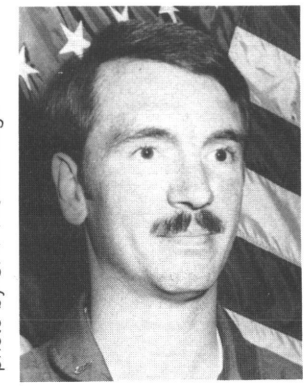


photo by SP4 Yvonne Lugo

Aviator Excellence. Chief Warrant Officer, CW2, Richard G. Gers received the Army's Broken Wing Award for landing a badly crippled helicopter at Ft. Rucker, AL, 11 March 1983.

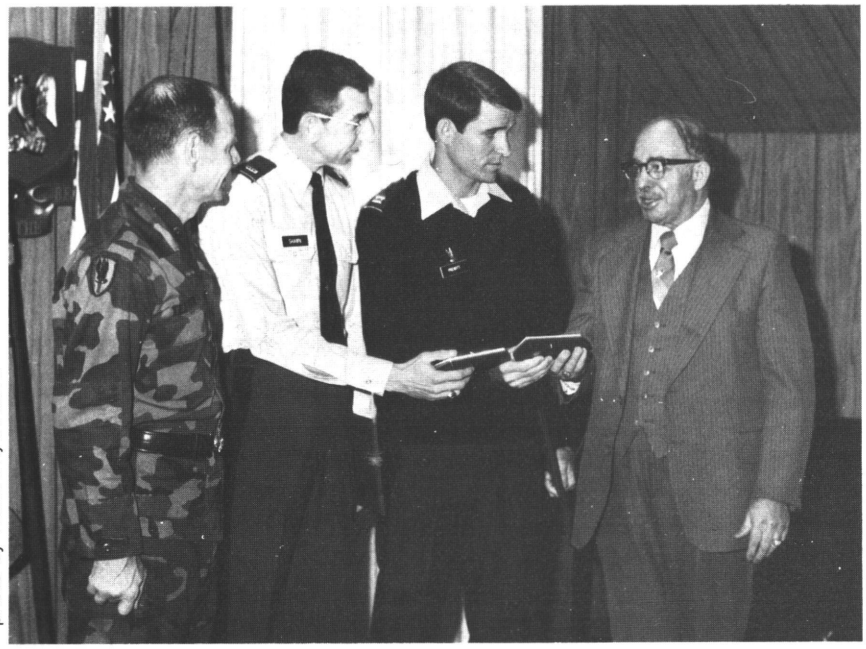


photo by NoelKenya Atkins

Best Writers. BG Charles E. Teeter, left, Ft. Rucker deputy commanding general, looks on as CW3 (now MAJ) William W. Shawn, second from left, and CPT David S. Prewitt, second from right, accept inscribed pens from Nick Saad, president of the Bogardus S. Cairns Chapter of the AUSA, for winning *Aviation Digest* magazine's monthly writing awards. MAJ Shawn, who is with the Army National Guard Multi-Media Training Group on post, received an award for his story, "Who Needs It Anyway," which appeared in the December 1982 Issue of the *Aviation Digest.* CPT Prewitt, who is commander of 11th Company, 1st Battalion, 1st Aviation Brigade, Ft. Rucker, was recognized for his story, "JAAT: A Present Concept," which won the *Aviation Digest* monthly writing award for November 1982.

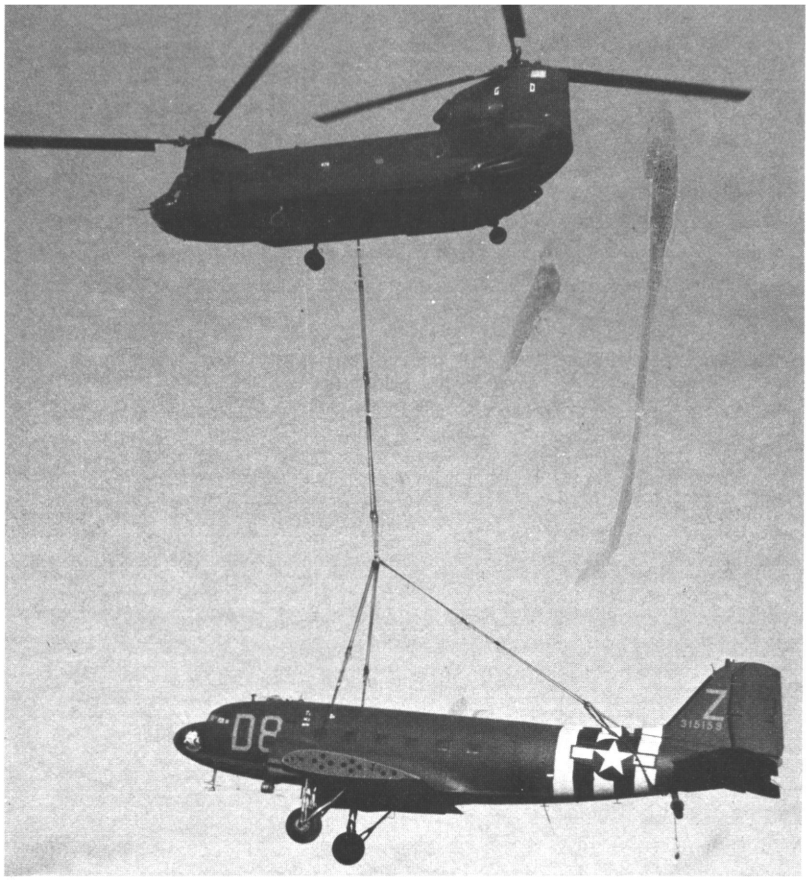


photo by PFC Michael Schmidt

Easy Does It. The Argonia, a C-47 of World War II fame that airdropped paratroopers at Normandy on 6 June 1944, is given a lift by an Army CH-47 Chinook of the 205th Aviation Company. The Chinook slingloaded the plane 30 nautical miles to its final resting place at the Airborne Museum in Sainte-Mere-Eglise, France.

FROM FRANCE

CH-47 Lifts C-47. There wasn't any runway nor was there an airstrip, but members of the 205th Aviation Company of the 4th Transportation Command managed to land the C-47 (DC-3) troop carrier without a scratch. The fact that the aircraft didn't happen to have any wings or engine didn't bother the 205th pilots at all.

The Argonia, an airplane of World War II fame that airdropped paratroopers during the Normandy Invasion on D-Day, 6 June 1944, was itself on the other end of a drop on 14 January 1983. The Argonia was slingloaded onto a CH-47 Chinook helicopter at Cherbourg Airport in France and then transported 30 nautical miles along Normandy Beach, being lowered into its final resting place at the Airborne Museum in Sainte-Mere-Eglise.

The 205th Aviation Company commander, Major Robert D. Penwell, described the mission to be difficult with the potential to be hazardous if not done correctly. "We've moved planes before, but never quite this big. The Argonia is longer and wider than the Chinook," explained MAJ Penwell. "The wings were removed to reduce weight and to create drag. If you carry a plane with wings, it wants to fly on its own."

Robert W. Kurowsky, project officer, deputy assistant chief of staff, movements, Headquarters, 4th TRANSCOM, said, "We made a reconnaissance, figuring we'd move it by highway. The survey results showed there were four major obstructions which would not allow transport by road." After conferring with MAJ Penwell, it was decided that it would be airlifted (slingloaded) using the Chinook.

SSG Felix R. Carrera, flight engineer said, "The mission went well. I never rigged an airplane before, and anytime you learn by experience it helps in the total mission training."

MAJ Penwell said, "It was an excellent operation. Although we planned the operation it was unique and a lot of improvising was needed. It was a team effort, everyone worked together and combined ideas."

The 205th Aviation Company had some of their best working on this unusual mission: SSG Ignacio Mejia, SSG Felix R. Carrera and SGT Glenn Turner, Flight engineers; SGT Billy W. Butterworth technical inspector; MAJ Penwell, CW3 John E. Roberts, CW3 George D. Conaway, CW3 Bill Dixon, pilots; and SGT David N. Lewis, pathfinder/rigger with the Combat Aviation Group, V Corps. **(Toni Christiano)**

ZAP- It's lightning time

IN 1752 BENJAMIN FRANKLIN attached a key to a kite string during a thunderstorm and drew electrical sparks. Thanks to Ben we know that lightning is an electrical discharge but much about it still remains a mystery.

• *What is lightning?* A lightning flash is a very long electrical spark which extends between one center of electrical charge in a cloud and another center of opposite polarity charge in the ground, in another cloud or sometimes even in the same cloud. The energy that produces lightning is provided by warm air rising upward into a developing cloud. As the air cools, water droplets condense and form the cloud. When the rising air reaches a temperature of approximately minus 40 degrees C. the water droplets freeze and some of the ice crystals form hailstones which fall through the cloud. As they fall, small positively charged splinters separate, leaving the hailstone negatively charged. Vertical currents within the cloud cell carry the positively charged ice splinters upward, making the top of the cloud positively charged. When the potential near one of the charged areas exceeds the threshold for atmospheric breakdown, lightning results.

Cloud-to-ground lightning occurs when the potential between a positively charged spot on the ground and the negatively charged cloudbase exceeds the threshold for atmospheric breakdown. A stepped leader is formed when the intense electrical field ionizes the air surrounding it and the conducting path leaps outward towards uncharged or oppositely charged air. With each step the cloud charge is lowered, increasing the strength of the electric field between the leader and the ground. This greatly intensified field causes streamers of positive ions to spring from trees or other tall projections on the ground and travel upward to meet the downcoming leader. When the leader and streamers meet the leader is neutralized, and the ground charge flows back

to the cloud. The resulting current is called the return stroke. This return stroke is responsible for the brilliant flash and noise we associate with lightning and it is the prime factor in lightning damage to aircraft.

• *Where does lightning occur?* Statistics on lightning strikes seem to show that altitude plays a minor role in determining the likelihood of being struck. Reports show lightning strikes to fixed-wing aircraft as high as 37,000 feet with most occurring below 20,000 feet. Reports on rotary wing aircraft show strikes from a height of 9,000 feet to as low as 100 feet, with the majority occurring below 6,000 feet. Since helicopters operate at lower altitudes the greatest danger to them is from cloud-to-ground strokes.

Although height and temperature are naturally correlated, studies of lightning frequency as a function of temperature and height show a strong tendency for strikes to occur in the 0 degrees C. zone. The preponderance of strikes near the freezing level must be related to the fact that the negative charge center is also found near this temperature and altitude. Another important reason for the greatest number of strokes near the freezing level is that the negative charge is not located at a single point, but is spread out with varying densities over a large volume. Indications are that lightning strokes do not follow a simple straight line vertical path from the negative region to ground or between the negative and positive areas. Instead, the discharge travels more-or-less horizontally through much of the negatively charged region before turning up or down. Thus, an aircraft flying near the freezing level would be more likely to intercept a stroke than would an aircraft operating well above or below the 0 degrees C. isotherm.

Strikes occur most frequently within a cloud where there is rain and light turbulence, but strikes to aircraft can and do occur under many combinations of circumstances.

A C-12C was flying in the clear at 25,000 feet approximately 25 miles from a large thunderstorm when it was struck by lightning. Nothing unusual was noted in the aircraft systems or instruments but inspection after landing revealed a break in the radome, burn marks on glidescope antenna two, prop blades and right outboard static dissipator. This "bolt from the blue" did $40,000 in damages.

• *When do lightning strikes most often occur?* Aviators have been warned that April, May and June are the worst months for lightning strikes; however, data collected by the U.S. Air Force from April 1977 until August 1978 failed to show any correlation between months and number of strikes. This is surprising in that the period between May and September is normally considered the peak thunderstorm season. Of the 14 Army aircraft accidents attributed to lightning from 1 Jan 80 thru 31 Dec 82, all but 2 occurred during this period.

• *What happens when*

LIGHTNING STRIKES ON ARMY AIRCRAFT
1 Jan 80 thru 31 Dec 82

Month	Location	Altitude	Type Aircraft	Class Accident	Damage Costs
Mar	Michigan	10,000	U-21A	C	$ 6,630
May	Maryland	15,800	C-12A	C	4,640
May	Florida	17,000	C-12A	C	2,400
May	Virginia	25,000	C-12C	C	40,000
Jun	England	Unknown[1]	CH-47C	B	69,028
Jun	Kansas	23,000	C-12A	C	25,000
Jul	New Jersey	27,000	C-12A	C	39,177
Jul	Kentucky	21,000	C-12A	C	28,924
Jul	Netherlands	16,000	C-12C	C	4,088
Aug	New Mexico	22,000	C-12A	E	46
Aug	Germany	Unknown	U-21H	E	none
Aug	Florida	23,000	C-12A	C	3,329
Sep	Illinois	2,000	C-12C	C	300
Nov	Pennsylvania	16,000	C-12C	C	33,500

[1]*Strike discovered during postflight inspection*

lightning strikes an aircraft? When an aircraft passes near the stroke path of lightning it becomes a part of the conductive path. The electrical field induced around the aircraft can become intense enough for streamers to form and travel out towards the leader. The leader advances toward the aircraft and joins a streamer emanating from an extremity. The stroke joins the ground streamers and the aircraft remains a link until the charge dissipates.

Although currents of as much as 200 thousand amperes may flow through your aircraft, most of it will remain in the skin. There is enough aluminum in most aircraft to conduct even such high current. Small pit marks may be the only indication that the aircraft was struck, but holes are sometimes melted in trailing edges. Points most likely to be struck on helicopters are the tip of the main rotor and the tail rotor pylon with an occasional ground strike through the landing gear (figure 1). The design and strength of the rotor blades minimize the danger of catastrophic failure from lightning strikes. Structural integrity and control will normally remain even if there is partial skin separation of damaged areas and burns to blade surfaces. As a rule rotating controls and bearings will continue to function even though they have been subjected to pitting and burns.

During a flight over England, the pilots of a CH-47C had observed cloud-to-cloud lightning within one nautical mile of their flight path but neither of them was aware that their aircraft had been struck. A routine postflight inspection revealed damage to the forward and aft rotor blades which was typical of that caused by a lightning strike. Both blades showed burned areas on the top and bottom. Damage was over $69,000.

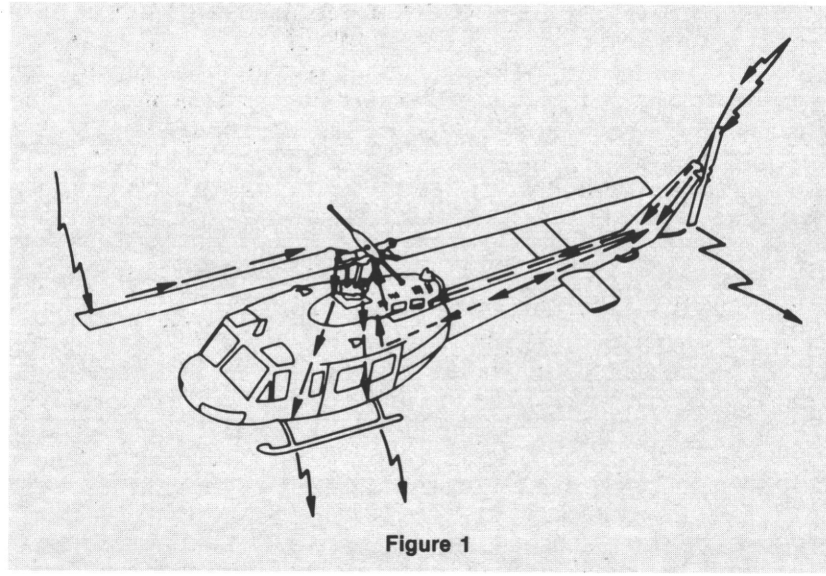


Figure 1

A more extreme example of what lightning can do to an aircraft is that of a B-52G which was flying low level bombing missions where other aircraft had aborted due to thunderstorms. Within 3 degrees C. of the freezing level the radar had discovered only wispy remnants of rain showers. Nor were there any of the normal warnings that come when aircraft pass in the proximity of thunderstorms: static on the radio, rain, St. Elmo's fire, or exceptional buffeting or turbulence. The safety observer noticed a glow on the radome and the copilot saw some lightning above the aircraft just before a bolt of lightning struck the radome below the pilot's window. A fireball approximately 3 feet in diameter blinded all three crewmembers for 5- to 10-seconds. The only damage the crew could identify was a difference in the compass reading at the pilot's station and readings in the rest of the aircraft. However, a later inspection disclosed that the fiberglass wingtip trailing edge had been blown off and the bolt had run down the fuselage to the wing struts where it split into two parts, one exiting left and the other exiting right. The right wing bore three char marks about 1 foot aft of the number three main fuel tank and 2 feet from the fuselage; a 6-inch circle with a 3-inch skin crack; a 3-inch circle with a ½-inch crack; and a 1-inch crack around a rivet where the lightning exited the aircraft. If the lightning had departed the aircraft just 1 foot forward, the aircraft and aircrew would have been lost due to explosion of fuel vapors in the number three tank. There was only a two-tenths of a percent chance for any aircraft to be struck by lightning that night—but it happened.

Lightning strike damage can be more severe than it appears. If a strike has occurred, or is suspected, a thorough examination should

be made by following the special inspection requirements; e.g., for the UH-1 series TM 55-1520-210-23, pages 17-20.

• *What happens to aircrews when lightning strikes?* There is no danger of electrocution but the strong electric fields which can pass through the windows as the leader approaches may cause streamers from aircrewmembers' heads or shoulders causing a slight shock as the minute currents which feed these streamers pass through the body. Temporary blindness from the bright flash is a more common effect on crews. Such blindness usually occurs at night and lasts for up to 30 seconds.

Things to remember about lightning

• A clear radar picture doesn't guarantee there are no thunderstorms in your vicinity. Radar attenuation, mountain shadows and range limitations make thunderstorms difficult to identify on radar when you are flying low level. Inclement weather may not be apparent if the thunderstorm is above the aircraft. One crew had performed adequate flight planning and coordination both prior to and during the flight and the aircraft was operating within the limits of all manuals and regulations. The onboard radar indicated no weather buildups in the route of flight and center radar indicated the closest buildup was 25 miles away. The C-12A was in cruise flight when the crew heard a "poof" sound over the radios and the VOR went off for approximately 5 seconds. There was no visual damage or indication of instrument damage and the flight continued but a postflight inspection revealed damage to the engine nose section at a cost of $25,000.

• Avoid climbing into any rain cloud, no matter how innocent it appears to be. Aircraft have been struck during level cruise and during descent, but twice as many have been struck while climbing. You are just as likely to be struck in the vicinity of cirrus or stratus cloud formations as you are in the vicinity of cumulus or cumulo-nimbus formations.

• While lightning strikes are more probable where there is precipitation and turbulence, they are not reliable indicators of impending strikes. Radio static and St. Elmo's fire (a bluish glow visible at night which results from ionization of the air around the electric field) may warn you of lightning conditions, but their absence doesn't ensure that lightning won't occur.

• Electrical potentials which generate lightning strikes build up wherever windshear exists in the presence of water ice particles on which charge concentrations can build. In more concise terms, turbulence plus clouds may equal the potential for an aircraft lightning strike.

• External inspection of aircraft which have been struck by lightning may show no visible damage even though electrical systems have failed, or have been damaged so that they provide inaccurate information.

There are two trends in aircraft design which may aggravate the problem of lightning strikes in the future unless positive protective measures are taken.

First, increased use of miniaturized, solid-state components in aircraft electronics and electric power control systems will make them more efficient, lighter in weight, and more functionally powerful than their predecessors. But they operate at much lower voltage levels and are inherently more sensitive to overvoltage transients such as those induced by lightning.

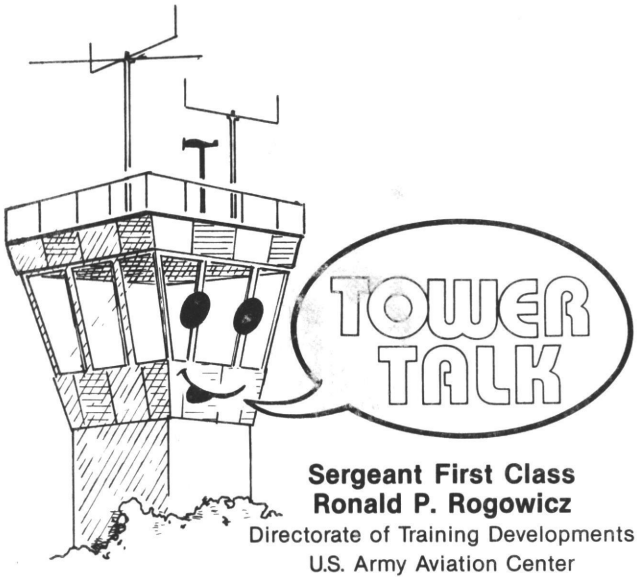
The other trend is toward the use of nonmetallic materials in place of aluminum in aircraft skins and structures. This reduces the amount of electromagnetic shielding which the airframe provides and increases the exposure of wiring to electromagnetic fields. Nonmetallic materials may also aggravate such problems as streamers drawn from conducting objects inside plastic wingtips or radomes, puncturing them on their way out to meet an oncoming leader. Extensive damage to plastic sections can result.

These trends present a challenge to designers of lightning protection for the aircraft of the future. The challenge can be met with proper design, testing, and construction to minimize the impact of lightning strikes on an aircraft's ability to safely perform its mission.

While there is no way to ensure that you and your aircraft won't be struck by lightning, your awareness of where it happens, and how it happens, may help you avoid conditions where you are most likely to be zapped.

REFERENCES

"Lightning and Aircraft," May 1981, *Flying Safety*
"Lightning Strike," March 1982, *Combat Crew*
"Aircraft Lightning Strikes—An Unavoidable Phenomena?", January 1982, *Flying Safety*
"Lightning Time Again," May 1982, *Flying Safety*



Sergeant First Class
Ronald P. Rogowicz
Directorate of Training Developments
U.S. Army Aviation Center
Fort Rucker, AL

Radio and Interphone Communications

FAA HB 7110.65c and FM 1-200

1. The VHF frequency 135.275 MHz should be spoken as:
- a. One three five point two seven five
- b. One three five decimal two seven five
- c. One three five point two seven
- d. One three five decimal two seven

2. Which position frequency is not used for airborne communications during periods when tower operating positions are combined?
- a. Ground control
- b. Local control
- c. Departure control
- d. Approach control

3. What is the proper way to issue traffic information to an aircraft following a heavy jet?
- a. Lockheed ten eleven heavy (position)
- b. Heavy Boeing seven forty seven (position)
- c. Lockheed heavy ten eleven (position)
- d. Heavy jet (position)

4. When may you use the pilot's name in the identification of an aircraft?
- a. During periods of light traffic
- b. You may never use the pilot's name
- c. When you personally know the pilot
- d. In special or emergency situations

5. Which frequencies are normally used to issue *Non-ATC* instructions to organizationally assigned aircraft?
- a. Tactical
- b. Nontactical
- c. Tower
- d. Approach

6. Who is responsible for all communications emanating from a facility?
- a. ATC/facility chief
- b. Controller on duty
- c. Shift supervisor on duty
- d. Position qualified controller for that position

7. A civilian aircraft using the call sign "Executive Two Foxtrot" will have onboard:
- a. The Speaker of the House
- b. A member of the President's family
- c. The Vice President
- d. A member of the Vice President's family

8. When may the facility's name be omitted on an interphone line?
- a. When relaying a VFR progress report
- b. During busy IFR operations
- c. When there are only two facilities on the line
- d. If both controllers know each other and no confusion is likely

9. Who is onboard an aircraft using the call sign "Safe Air One"?
- a. Administrator of the National Transportation Safety Board
- b. Secretary of Transportation
- c. Deputy FAA Administrator
- d. FAA Administrator

10. Non-ATC personnel may be given access to ATC radio communications channels when messages pertaining to the safety of aircraft operation or preservation of life or property are necessary, provided such transmissions can be interrupted when required to continue ATC services and—
- a. The recorders for that position are operating
- b. Control instructions are not issued
- c. The ATC/facility chief has authorized the message
- d. The emergency frequency 121.5 or 243.0 is used

11. What word or words are used to interrupt lower priority interphone messages?
- a. Mayday
- b. Flash
- c. Emergency or Control
- d. Immediate or Priority

ANSWERS

1. C, .65c, para 85K (1), pg 25
2. A, .65c, para 70, pg 22
3. B, .65c, para 88d, pg 28
4. D, .65c, para 87h, pg 28
5. A, FM 1-200, para 462.2, pg 400-7
6. C, FM 1-200, para 461.1, pg 400-7
7. D, .65c, para 87F (3), pg 28
8. A, .65c, para 86a, pg 26
9. D, .65c, para 74b note a, pg 22
10. B, FM 1-200, para 462.1, pg 400-7
11. C, .65c, para 78, pg 23

THREAT

Major Bronislaw R. Maca
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Soviet Mi-8 helicopter pilots discuss their mission.

Soviet Aviation
A fly-by-night operation

DO SOVIET helicopter pilots fly at night? How much flying do they do? What type of flying do they do?

These are the questions frequently asked by today's Army aviators. We can't help but compare "their" training to "ours." It gives us the warm and comfortable feeling of knowing that "we" do it better, or that "they" don't do it at all. I think everyone will agree that the Soviets do very little night flying (in helicopters), or at least we hear very little about them doing any. Let's see how much we can find out, and perhaps you can draw your own conclusions as to *their* night fighting capability.

First, let's review some of the Soviet principles of operational art and tactics for the sole purpose of establishing a need for night combat capability for helicopter units. Their principles are:

- Perform a thorough estimate of the situation and

CONSOLIDATED GLOSSARY—Page 28

make timely, analytical decisions. Be realistic. Consider the mission, enemy, your own combat power, terrain, *weather and light conditions and time.*

- *Fully orchestrate all available combat means in a coordinated, cooperative, combined arms effort.*
- Deceive the enemy. Attack from an unexpected direction at an *unexpected time. Use terrain and weather to your advantage.*
- Attack the enemy violently and simultaneously throughout his depth. Carry the battle to the enemy rear with swift penetrations by maneuver units, fires, *aviation,* airborne and *helicopter assaults* and by unconventional warfare means.
- Keep the enemy under constant pressure and off balance. Don't allow him to effectively react.
- Employ radio-electronic combat to deprive the enemy of effective command and control of his combat forces.
- Adhere to the spirit and letter of the plan. If the plan fails, use initiative to accomplish the mission.

Although these principles are idealistic, they are what the Soviets strive to achieve. They show what the Soviets would like to do, but do not show in all cases what they may be capable of doing. However, they do serve as a basis from which any examination of Soviet operations and tactics must start. Generally speaking, these same principles apply throughout the Warsaw Pact forces.

It would be a mistake to "mirror-image" Soviet tactics and techniques with ours. Unfortunately, when we see a Hind-E anywhere near the trees on a picture, we tell ourselves that the Soviets are doing nap-of-the-earth operations. Nothing could be further from the truth!

Analyzing these principles, it is clear that the Soviets *intend* to use night to their advantage. Who wouldn't want to? In the offense, night is a combat force multiplier. Although night's effects are the same on both sides, the attacker is the one who can maximize the effects to his advantage by picking the time and the place. Attacking at night puts the defender at a psychological disadvantage: It narrows his perspective; it reduces his depth and field of view; he feels very lost and confused; and he can be easily overwhelmed. One of the best examples in the recent history of the Soviet night capability was the "reinvasion" of Czechoslovakia in 1968. During the night of 20-21 August, the Soviets conducted night air transport operations of great efficiency, setting down troops throughout Czechoslovakia to put a stop to Dubcek's liberalization tendencies.

Soviet tactical forces are all night-equipped. The vehicles have night-driving devices, infrared searchlights, thermal imagers and automatic navigation systems.

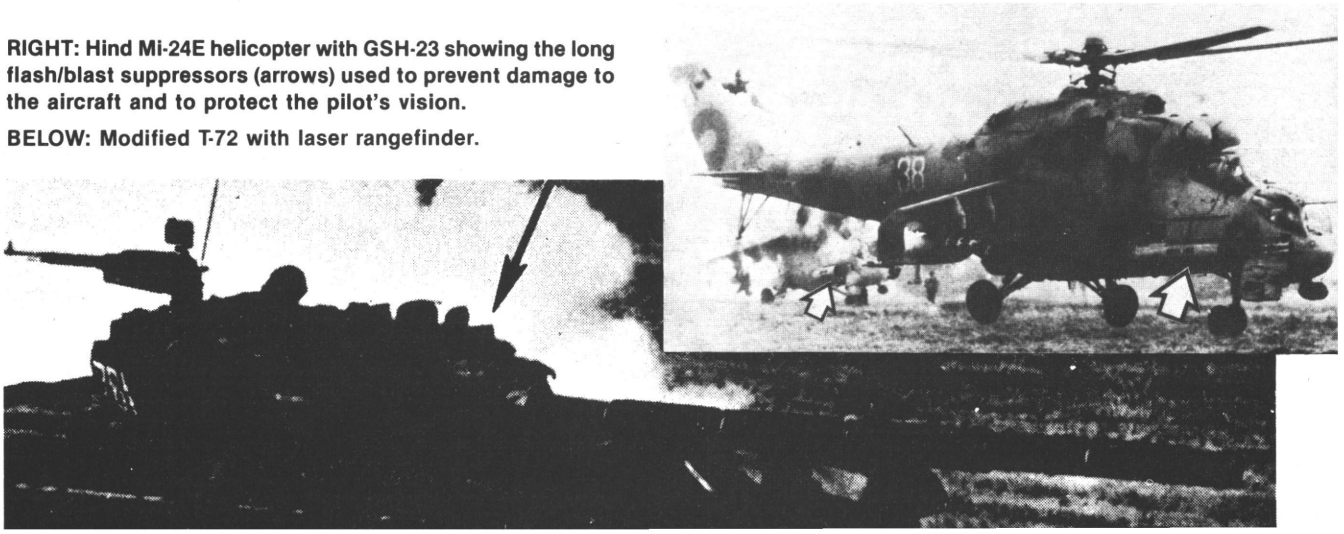
The aircraft, both fixed and rotary wing, are fully IFR-equipped, and the new generation of aircraft possesses good nighttime capability. Since both types of aircraft belong to and are maintained by the Soviet Air Force, maximum effort is made to use the same components/subsystems (i.e., radios, control heads, weapons, etc.). This holds true throughout the Soviet inventory.

The most recently observed modification of the Hind-E features a side-mounted GSH-23 which, by the way, is also used on the MiG-23 Flogger B all-weather interceptor, MiG-21 Fishbed limited all-weather interceptor and SU-19 Fencer all-weather multirole. This modification to the Hind frees the nose section for possible installation of sensor packages.

When we assess the capability of the Mi-24 Hind, we must consider the Soviet Air Force's capability as a whole. If the fixed wing aircraft have all-weather capability as ground attackers, we *must* acknowledge the same capability to the Hind.

RIGHT: Hind Mi-24E helicopter with GSH-23 showing the long flash/blast suppressors (arrows) used to prevent damage to the aircraft and to protect the pilot's vision.

BELOW: Modified T-72 with laser rangefinder.

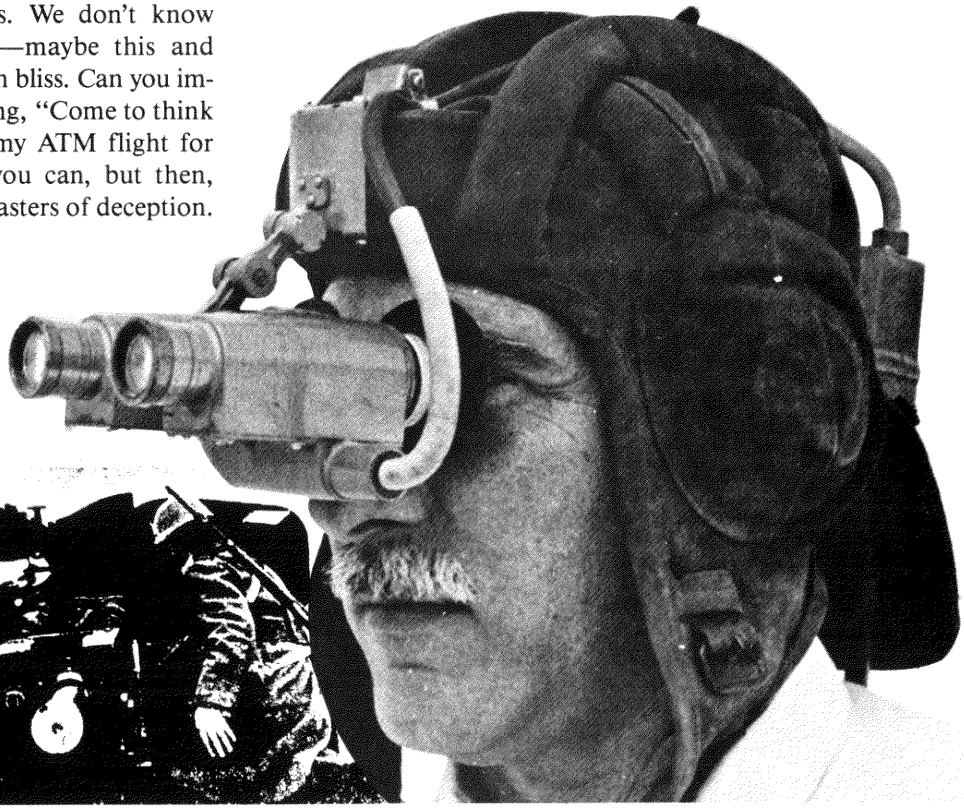


Generally speaking, the Soviets fly no less than we do in support of ground forces at night. Exercises can be used as an "indicator." However, keep in mind that it is a lot easier to make a *pass* in an exercise than to *hit* a target during the war (the difference being that you can't pretend you've destroyed the target during the war).

A typical helicopter regiment allocates about 10 to 15 percent of all training time to night training. It includes local flying, traffic pattern work, cross-country flights, formation flights and some night firing. Soviet air forces rely on regimental training; pilots stay with their regiments much longer than is usual in Western forces. This regimental system is partially responsible for the traditional, repetitious training that has been observed. It is a common occurrence to see a string of aircraft going cross-country much like the students do in flight school. The price they pay for the centralized, standardized, routine training is obvious. The primary goals of this training, keep in mind, are the maintenance and improvement of flight and combat skills of the crews.

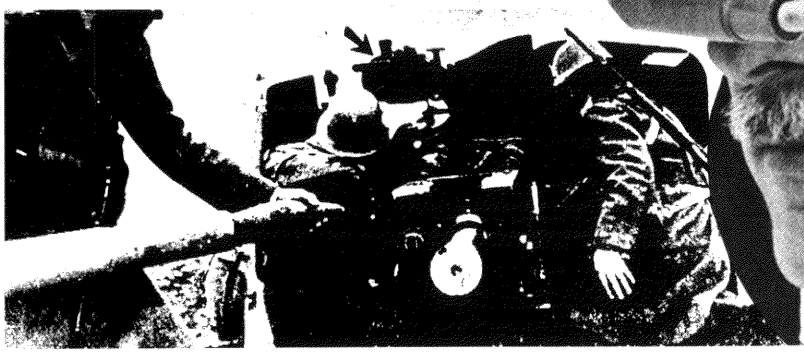
The bottom line? The Soviets have established the need for night capability, and they have fielded the equipment to support it. However, it *appears* that they are not very serious about training to reach their full capability under night conditions. We don't know much about their night training—maybe this and that—but ignorance has always been bliss. Can you imagine a Soviet helicopter pilot saying, "Come to think of it, I would not mind at all if my ATM flight for tonight was cancelled"? Maybe you can, but then, remember they always have been masters of deception.

ABOVE: Soviet PGN-9 passive weapon sight.



RIGHT: Soviet PNV-57 IR driving binoculars.

BELOW: Soviet 1PN21 crew-served passive weapon sight.



1982 Army Aviation

Training Symposium/ Policy Committee Meeting

Major Mark Kresho
Directorate of Training Developments
and
Captain (P) Bryan C. Fluke
Directorate of Evaluation and Standardization
U.S. Army Aviation Center
Fort Rucker, AL

CAN AN ARMY Aviation crewmember stationed at Camp Zama, Japan, question Department of the Army officials about a training issue?

Yes—as can aviation personnel the world over through the annual Army Aviation Training Symposium/Policy Committee Meeting. The last one was 15 to 19 November 1982 at Ft. Rucker, AL; and 140 representatives of DA agencies, major Army commands and the combined arms integrating centers attended. They addressed 81 issues—26 of which dealt with aircrew training manuals—that had come through channels from the field.

Issue topics included various aspects of aviation training, standardization, equipment, maintenance, technical and training publications, air traffic control and tactical instrument training, aviation safety and individual/unit aviation requirements.

The training symposium occupied the first 2½ days of the week; subject matter experts, unit representatives and other interested individuals discussed the issues in four work groups and came up with recommendations that were presented for consideration to the Policy Committee Meeting.

Mandated and outlined in AR 95-1, the Policy Committee is a DA-level forum to resolve aviation standardization issues. Its executive chairman is Brigadier General Ellis D. Parker, Army Aviation officer.

Each issue was considered and the committee members voted on the resulting recommendations. Approved recommendations that could be implemented immediately were transmitted to all Active Army and Reserve Component aviation units. (Message HQDA (DAMO-RQ) DTG 211532Z January 1983, subject: Army Aviation Policy Changes.)

Some of those changes are:

- ☐ The term "night hawk" is deleted from the ATMs. All iterations have been transferred

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The Aviation Training Symposium/Policy Committee, made up of 140 DA representatives, addressed 81 issues (26 of which dealt with ATMs) that came in through channels from the field.

to the night FAC column in the ATM task list, so night hawk qualification is no longer needed for night vision goggles qualification.

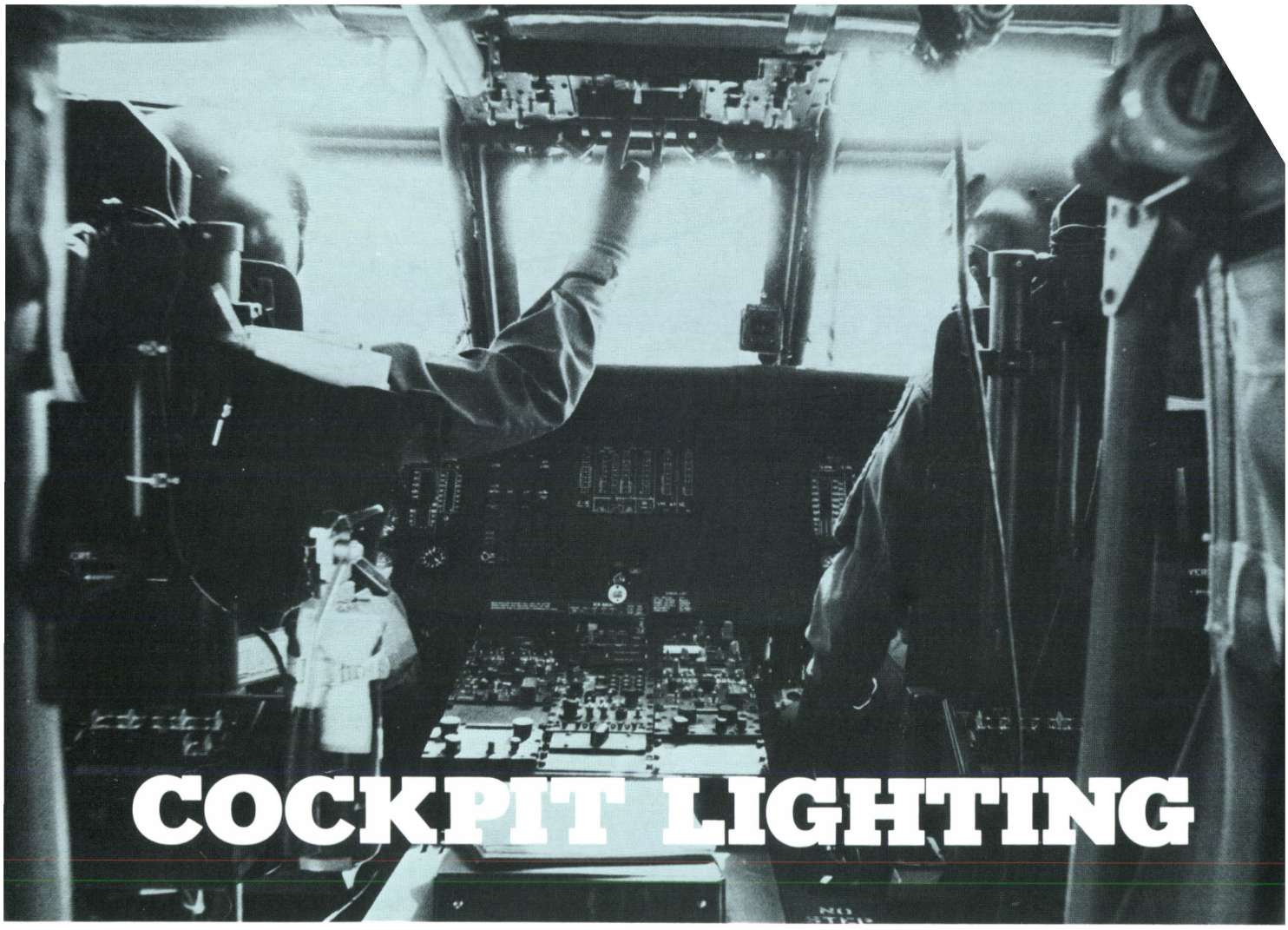
- ☐ NBC tasks may be accomplished annually without regard to an aviator's AAPART cycle.
- ☐ Task 4035 (perform simulated loss of tail rotor effectiveness at a hover) is added to TC 1-137.
- ☐ Common tasks 1001, 1002, 3010, 3506, 4503, 4506 and 5002 have to be accomplished in the primary aircraft only.
- ☐ Instrument flight evaluations consist of all items identified by "I" in the ATM task list and a minimum of two approaches, one precision and one nonprecision.
- ☐ Instrument flight evaluation requirements for alternate aircraft may be completed by an IP/SIP during the first flight evaluation in an aircraft of that category following the annual instrument flight evaluation in the other category. At least one instrument approach must be included in the evaluation.

Other recommendations from the Policy Committee require additional study and consideration. The Army Chief of Staff will task outside agencies with those studies. Included are:

- ☐ Consolidation of crash rescue/fire regulations into one document.
- ☐ Identification of a small portable piece of firefighting equipment that can be operated by unit personnel.
- ☐ Development of an officer/NCO technician/supervisor ALSE course.
- ☐ Identification of aviation flight surgeon responsibilities at the local level.
- ☐ Simplification and standardization of normal and emergency procedures in all Army aircraft operator manuals and checklists.

The next Training Symposium/Policy Committee Meeting will be 14 to 18 November 1983, again at Ft. Rucker.

Sponsoring agencies from the Army Aviation Center are the Directorate of Evaluation and Standardization for the Policy Committee and the Directorate of Training Developments for the Training Symposium.



COCKPIT LIGHTING

Mr. Alan M. Poston
Major Frank F. Holly

HAVE YOU EVER wondered why the instruments and panels in your UH-1 Huey, AH-1 Cobra, CH-47 Chinook, etc., are lit with red lighting rather than with some other color or even white? The use of red lighting in Army aircraft cockpits was started before World War II, and its adoption was based upon sound physiological principles. When tested in a totally dark laboratory, red lighting preserves dark adaptation much better than does blue-green lighting (however, as we shall see later, when tested under real-world nighttime conditions where there are other light sources such as sky light, star light, ground lights, etc., the difference becomes much smaller).

More than 100 years ago it was discovered that the eye has two systems: one for daytime viewing (cones) and one for nighttime viewing (rods). A German by the name of Wilhelm Kuhne isolated the photopigment rhodopsin in rods which causes them to absorb light, thereby initiating the visual process. Some time later it was found that rhodopsin does not absorb red light very well. Therefore, if red light cannot stimulate the rods it cannot cause them to lose their dark adaptation.

If there is a physiological basis for the use of red lighting, why has its use been the source of so much heated debate in recent years? For one thing, red lighting is not as compatible with night vision goggles as are some other colors. (See "ANVIS," on page 12.) Long-wavelength (red) lighting overactivates the goggles and thereby reduces the pilot's ability to see outside the cockpit. The question, then, is: If red lighting is better for preserving dark adaptation of the unaided eye, and blue-green lighting is required for the night vision goggles, must we install two different color lighting systems in all cockpits?

The U.S. Army Aeromedical Research Laboratory at Ft. Rucker, AL, and the U.S. Army Human Engineering Laboratory, Aberdeen Proving Ground, MD, addressed

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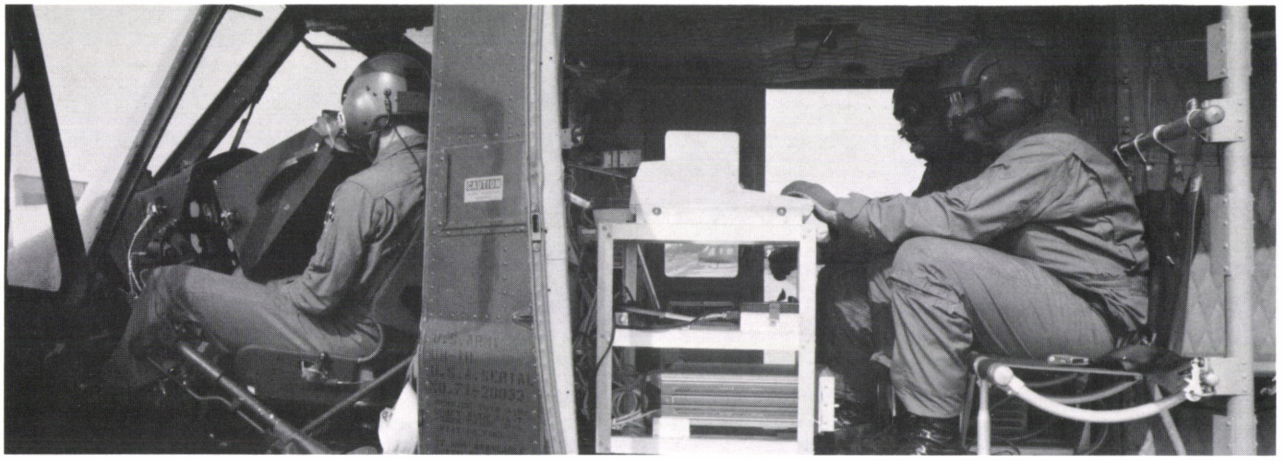

FIGURE 1 (above): The experimental apparatus inside a UH-1 aircraft. The copilot is holding an early version of the adaptometer. The computer and technicians are in the rear of the aircraft.

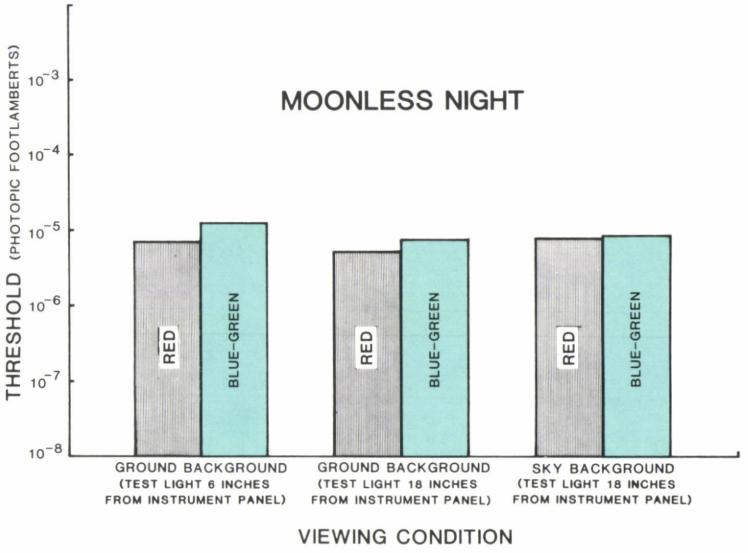

FIGURE 2 (right): The results of the study showing the dark adaptation thresholds for the red and blue-green cockpit lighting for three different viewing conditions. The lower the bars, the better the dark adaptation. It can be seen that the dark adaptation was slightly better with the red lighting under all viewing conditions.

this issue to determine if under realistic conditions the advantage provided to the unaided eye by red lighting was sufficiently great to justify its continued use. A special computer-controlled adaptometer (a device which determines one's dark adaptation) was constructed for this study. Figure 1 shows the copilot holding an early version of this device.

Crewmembers flew a UH-1 helicopter at about 1,000 feet above ground level at night along a course south of Ft. Rucker. First, the copilot used the adaptometer to determine his dark adaptation while the pilot flew the aircraft. Later, the pilot determined his dark adaptation while the copilot flew the aircraft. This was done repeatedly over several nights, using both blue-green and red cockpit lighting. The blue-green lighting was achieved by using the secondary floodlights which were filtered with BG-7 glass.

The adaptometer consisted of a light-emitting diode fixation light and a green LED test light which was located 13 degrees away from the fixation light in order to test peripheral dark adaptation. The adaptometer was located so that the test light was positioned either 6 or 18 inches away from the edge of the instrument panel. The intensity of the test LED kept increasing until the pilot or copilot indicated, by pressing a button on the side of the adaptometer, that he saw it.

The end of the adaptometer was open so that adaptation could be tested against realistic (ground or sky) backgrounds. Since the background against which one attempts to detect a dim light is extremely critical, backgrounds were carefully controlled. (This is known intuitively by anyone who has tried to shield a dim light from a bright background with his hand or some other object in order to see it better.)

The results of this study are shown in figure 2, with the red bars representing the adaptation level with the red cockpit lighting and the blue-green bars representing the adaptation level with the blue-green cockpit lighting. Since the lower the bar, the better the adaptation, the dark adaptation was somewhat better with the red lighting than with the blue-green lighting in all cases.

However, these differences were small and not judged to be operationally significant.

To further understand the results of this study, it is important to understand the distinction between the effect of the cockpit lighting (either red or blue-green) on one hand, and the effect of the background illumination (all other lighting in the environment such as skylight, starlight and ground illumination), on the other. This distinction is important because an increase in intensity of either of these two types of illumination will have opposite effects upon the resulting differences between the red and blue bars of any given pair. That is, an increase in the intensity of the cockpit lighting will increase the difference between the red and blue-green bars of each pair. An increase in the intensity of the background illumination will decrease the difference between the red and blue-green bars of each pair.

Intuitively, this makes sense because if there is a difference between the effects produced by red and blue-green cockpit lighting, one would expect that increasing the intensity of these lights or pointing one's gaze closer to them would increase this effect. On the other hand, an increase in the intensity of the background illumination will tend to wash out this difference. To cite an extreme example, if while flying on a bright sunny day you turned on the cockpit lights, you could not expect them to produce any difference in your state of adaptation because they would be so dim compared to the background illumination.

Bearing in mind these two types of illumination, the pattern of differences between the various pairs of bars is exactly what one would expect if there is a true difference between the effects of red and of blue-green cockpit lighting. That is, the biggest difference between the red and the blue-green bars occurs when the amount of cockpit lighting impinging upon the eye is greatest, i.e., when the test light is only 6 inches from the instrument panel, and the background used is darkest (ground).

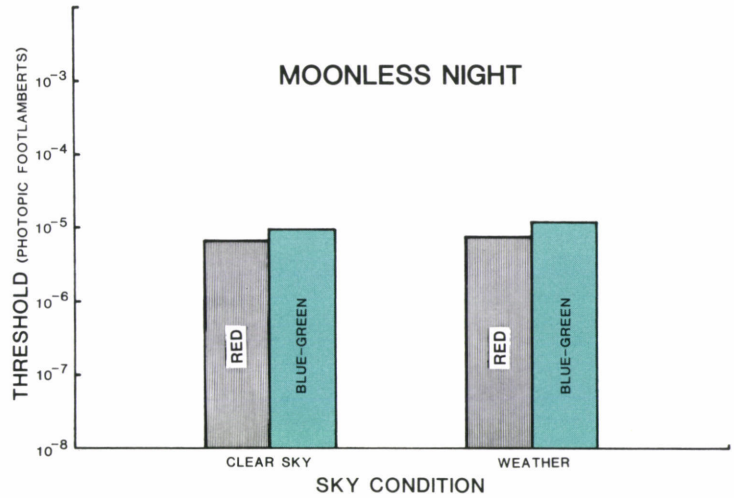

FIGURE 3: The data from figure 2 averaged across the three viewing conditions (clear sky). Also shown is the data from a weather night averaged in the same way.

The next biggest difference occurs when the amount of cockpit lighting impinging upon the eye is reduced by moving the adaptometer to 18 inches away from the instrument panel, but still keeping the ground background. Finally, the smallest difference occurs when the adaptometer is still pointed at the farther (18 inch) location and the brighter (sky) background is used.

One night we were flying next to a zero visibility, zero ceiling weather front and with heavy ground fog. The data collected on this weather night was averaged over the three conditions and compared to the average of the clear night data shown in figure 2. This comparison is shown in figure 3. The difference between the red and the blue-green cockpit lighting on the weather night was greater than on the clear nights.

The greater difference on the weather night was probably due both to the fact that the weather reduced the background illumination level and the fact that aviators tend to set their instrument lighting somewhat brighter in weather conditions. Again, however, even on the weather night, the difference between the red and the blue-green lighting was small and was not judged to be operationally significant.

It has thus been demonstrated that red versus blue-green cockpit lighting produces little difference in a person's dark adaptation state when performing as an aviator in a rotary wing flying environment. Therefore, it is likely that future Army helicopter cockpits will have only a single blue-green lighting system. However, in other military environments having different intensity requirements and/or different ambient conditions, the use of red lighting will probably continue to be necessary.

ABOUT THE AUTHORS

Mr. Poston is a human factors engineer in the Aviation and Air Defense Directorate of the U.S. Army Human Engineering Laboratory, Aberdeen Proving Ground, MD.

MAJ Holly's biography appears on page 11.

Appreciation is expressed to the technicians who helped to collect the data of this experiment: Mr. Simon Grase, SP5 David Schmidt, SP5 Robert Portera.

U.S. Army Communications Command
ATC ACTION LINE

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U.S. Army Air Traffic Control Activity
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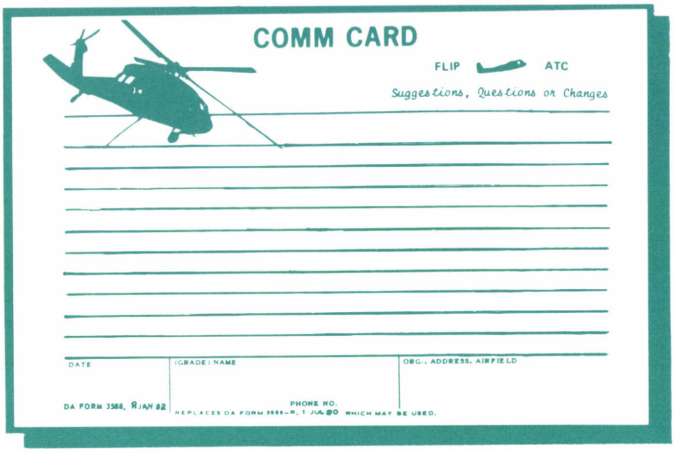

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Implementing the AVIATION BRANCH

Last month the Secretary of the Army approved the formation of an Aviation Branch as a combat arm of the Army. This major milestone in Army Aviation's long history was the culmination of a number of major study efforts. Specifically, the Army Aviation Mission Area Analysis, Army Aviation Systems Program Review and the Training and Doctrine Command Review of Army Aviation laid much of the groundwork for the Secretary's decision. Now the Army is moving forward to promulgate the implementation plan. Since previous editions of the *Aviation Digest* have chronicled the AAMAA and AASPR, the following will briefly discuss the TROAA study and actions being taken by the Aviation Center to implement the transition plan.

The AAMAA and AASPR placed squarely before the senior Army leadership significant issues in Army Aviation which needed policy reivew and high level decisions on guidance to ensure appropriate actions. The preponderence of these issues fell under the TRADOC charter. In that context, the commander, TRADOC formed the TROAA review group to assess the current state of Army Aviation and provide him recommendations which would enhance the use and management of Army Aviation in the future under envisioned concepts of how the Army will fight.

The TROAA review group was chartered to assess Army Aviation as an evolving combat arm and to document information in a number of related areas. First, the employment of Army Aviation today and for AirLand Battle 2000 was to be documented to reflect an ability to gain a synergistic advantage for maximizing the combat effectiveness of Army Aviation forces. Second, the role of Army Aviation elements in fighting and supporting forces were to be described. Third, what leaders and commanders of fighting and supporting forces must know and do for the best use of aviation assets was to be documented. Fourth, what aviators must know and do as crewmembers of an air vehicle, as a leader and commander of an aviation element and as a commander of a combined arms force were to be determined. Fifth, how Army Aviation and Army aviators are to be managed in the future was to be developed. The TROAA review group in essence was chartered to study the full spectrum of Army Aviation concepts, doctrine, tactics, organizations, force design, training, materiel, personnel management, proponency and branch issues, with a view toward formulation of recommendations for better management of Army Aviation in toto.

For more than 3 months, the TROAA review group studied the issues. They made a search of 21 key studies related to Army Aviation; visited several TRADOC schools/centers, corps, divisions and support commands, two DARCOM commands, and HQ TRADOC and DA. The group interviewed more than 600 Army personnel including 39 generals, other officers, enlisted and civilians and fielded a 135-question survey. From all the data gathered, recommendations were formulated.

Twenty-two recommendations were provided in the TROAA report. These recommendations pertained to three major management areas: training and the doctrine and materiel development process; development and management of aviation personnel; and, actions to improve aviation training, development, management and employment on the battlefield. Probably the most pivotal recommendations were to: centralize overall proponency for aviation concepts, doctrine, tactics, training, logistics, force design, materiel and systems, except those peculiar to aeromedical, avionics and intelligence functions, under the commander, Aviation Center; and, establish Army Aviation as a combat arms branch of the Army. These and other TROAA recommendations have been formulated into an Army Aviation Implementation Plan, soon to be released by the Chief of Staff, Army.

In preparation for release of the plan, the Aviation Center is forming a transition cell which will manage those activities required to promulgate the implementation plan. The cell will be headed by a colonel and composed of five to six commissioned and warrant officer aviators. At this juncture, it appears that a major portion of the implementation can be achieved by the end of FY 1985. The transfer points for handoff of carrier branch proponent responsibilities for doctrinal and training literature, ARTEPs, soldier's manuals, and other training products and activities have been identified and can now be finalized. Programs of instruction for captains' and lieutenants' training have been developed and can be implemented in January 1985 and October 1986, respectively. The personnel management plan has been developed but requires further refinement before implementation.

In summary, the Aviation Branch decision has been made and the Army is moving forward to finalize and implement its transition plan. However, much work must still be done to ensure a successful transition is achieved. The yardstick by which this success will be measured is Army Aviation's actions to maximize its capabilities as a combat arms branch and as a full-fledged member of the combined arms team.