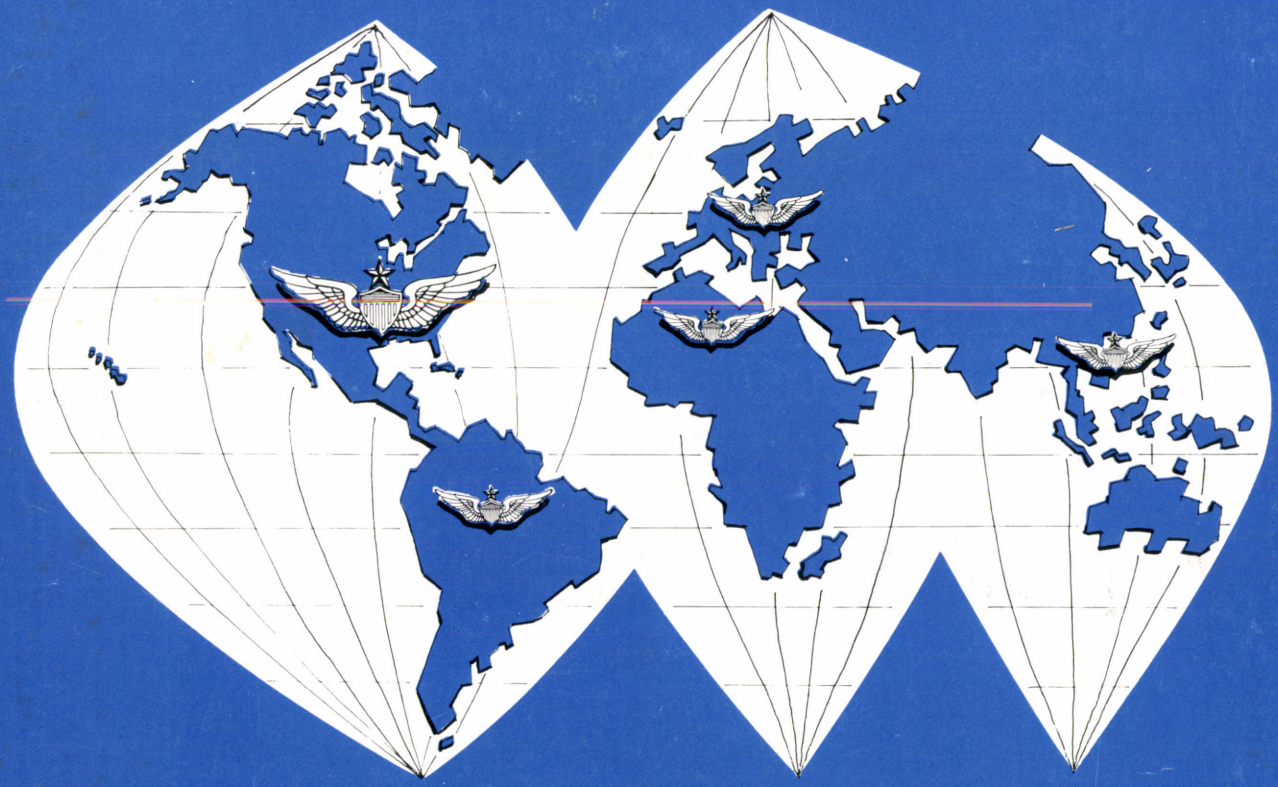
UNITED STATES ARMY JUNE 1966

AVIATION DIGEST



ARMY AVIATION MILESTONES - BACK COVER

UNITED STATES ARMY AVIATION DIGEST

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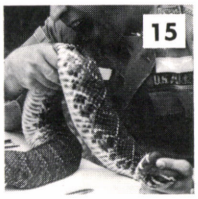

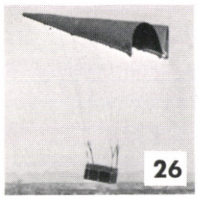

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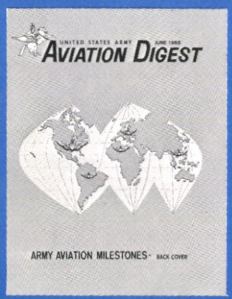

Army Aviation is 24 this Month

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

The DIGEST is an official Department of the Army periodical published monthly under the supervision of the Commandant, U. S. Army Aviation School. Views expressed herein are not necessarily those of Department of the Army or the U. S. Army Aviation School. Photos are U. S. Army unless otherwise specified. Material may be reprinted provided credit is given to the DIGEST and to the author, unless otherwise indicated.

Articles, photos, and items of interest on Army Aviation are invited. *Direct communication is authorized to: Editor-in-Chief, U.S. Army Aviation Digest, Fort Rucker, Alabama.*

Use of funds for printing this publication has been approved by Headquarters, Department of the Army, 29 December 1964.

Active Army units receive distribution under the pinpoint distribution system as outlined in AR 310-1, 20 March 62, and DA Circular 310-57, 14 March 63. Complete DA Form 12-4 and send directly to CO, AG Publications Center, 2800 Eastern Boulevard, Baltimore, Md. 21220. For any change in distribution requirements, merely initiate a revised DA Form 12-4.

National Guard and Army Reserve units submit requirements through their state adjutants general and U. S. Army Corps commanders respectively.

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Instrument Flight Examiner Course

Major Frank H. Bloom

"SO YOU'RE GOING to IFEC, you poor slob."

Similar cracks are almost always received by the qualified and fortunate personnel who have been selected for the Instrument Flight Examiner Course.

Prerequisites are necessarily high for the course, considering less than 10 percent of Army Aviators hold the coveted MOS 1984 and that they are responsible for the instrument flight proficiency for which the Army is known and respected. Before comments like the one used above get them down, they should reexamine their qualifications.

- A current airplane instrument card held for two years or one year providing 10 hours of actual instruments have been flown as instructor pilot or pilot during the past 12 months.
- A minimum of 1000 hours military pilot time with 500 hours as first pilot or IP in fixed wing aircraft.
- At least 100 hours of hood or weather time as first pilot or IP, of which 10 must have been in weather in the last two years. Five of these 10 hours must have been in fixed wing aircraft.
- A certificate of proficiency by an examiner who has been delegated the authority to determine if an aviator is qualified to be awarded or retain an instrument card. (This is sometimes the hardest to obtain since each examiner stakes his reputation on each prospective examiner's success or failure in completion of the course.)

Regardless, preparation must become the order of the day. The future examiner has already been thoroughly checked for ability, knowledge and motivation. Selected students should begin to prepare themselves at the earliest possible time by getting current in the type aircraft used, practicing instrument procedures, and by burning a little midnight oil on some of the regulations and manuals associated with the course.

Many of the major teaching points may be found in the following:

TM 1-225
DOD Flip
Airman's Information Manual (Sec. II, ATC Procedures)
TM 11-2557-27
TM 1-300
AR 95-1, 2, 3, 32, 63
FAR 91, 97

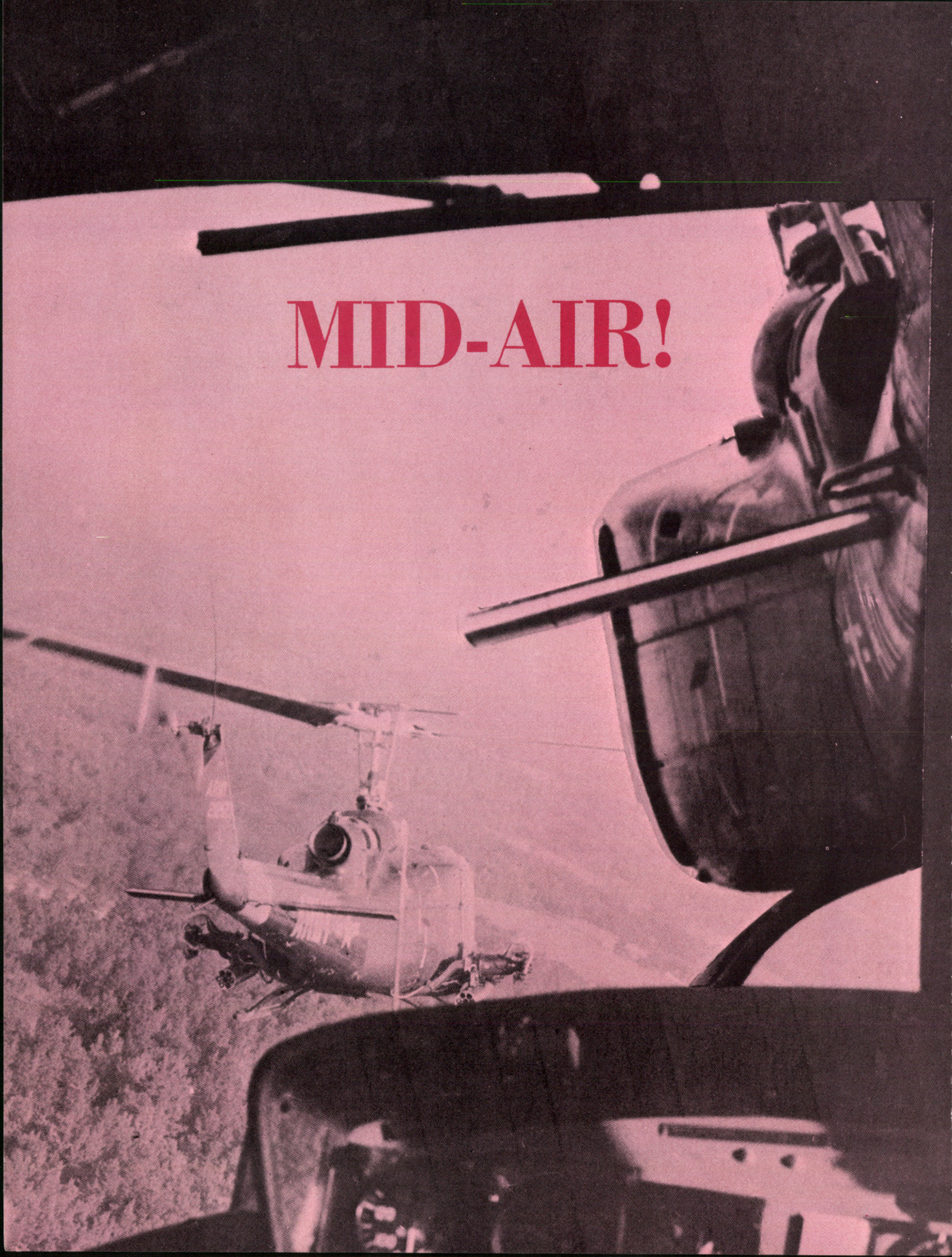
The course is necessarily of the pressure type due to its duration and scope; however, the majority of the pressure felt by students is usually self-induced. Difficulties experienced during training of this nature usually stem from one or more of the "pitfalls" of the course. A close look at these could help prevent the student's falling into his own trap:

- Loss of confidence—He would not have been selected if he did not possess the potential.
- "Canning a problem"—School solutions cannot substitute for good judgment in advanced instrument work, and an examiner must be prepared to make the best of a poor flight condition.
- "Second guessing instructors" —Fly each situation using *your* solution. If it is safe and legal, it is satisfactory.

There is no substitution for preparation for this course; however, a few will always fail to receive their diploma. Considering the type of work for which they were training, no stigma should be attached to failure, nor should it reflect on an instrument pilot's ability as an Army Aviator.

So forget the caustic remarks when orders are received and prepare for one of the most informative courses in your career.

MID-AIR!



MID-AIR!

Captain Robert E. Weathersby, Jr.

IN THE LIGHT OF several recent fatal mid-air collisions in Army Aviation, I feel that the following is a timely article. It is applicable to all Army Aviators participating in formation flight, particularly in tactical rotary wing aviation companies, where unit integrity and surprise in mass airmobile operations are of utmost importance.

As an Army rotary wing aviator while assigned to such a unit, I was involved in a mid-air collision between two loaded UH-1s during a tactical airmobile demonstration. Miraculously, no one was injured out of the 14 personnel directly involved and only slight damage was suffered by the two aircraft. It is not my intent to discredit any commanders, aviators, aviation units, nor unit SOPs.

Almost everyone during his life time has experienced fear or sheer panic at one time or another while performing routine day-to-day activities. For example, if you are driving along an icy highway at a safe, reasonable speed, allowing for road conditions, you could possibly encounter a skid, which everyone will agree is an uncontrollable condition. In this case, fear could be experienced before you hit another vehicle or leave the road. This same sort of fear can be experienced by the high diver who slips off a diving board high above the pool's water level. In times like these, only quick thinking, good planning, and sound judgment can prevent tragedy.

This sort of thing happened to me during the summer of 1962. I was a young lieutenant and unit instructor pilot assigned to an aviation company participating in a demonstration involving both armed and troop carrying helicopters. The troop carriers were in two flights of 15 aircraft each, each flight to be three lines of five aircraft abreast in a sort of box formation. I was number three aircraft in the first line.

This particular demonstration had been rehearsed several times and had been performed with a high degree of precision, exactness, timing and professionalism. Each aviator, flight, and unit involved knew the correct frequencies, formations, and procedures.

Ground control at our field position gave the signal to start engines, and in short order all Hueys in our flight were running up on the ground. The signal to lift off was received and we all took off in a beautiful formation. Unit esprit back at our home station as well as during the preceding weeks of these tests had been based on our can-do attitude, our high level of training, and our skill at precision formation flying.

In fact, the few people who mentioned it led us to believe that our unit integrity and performance was the envy of other aviators involved. We had also been told by other aviators that one day we were going to have a

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Capt Weathersby is an instrument check pilot with the Tactical Instrument Division (Contract), Dept of R/W Training, Ft Rucker, Ala.

***Careful As Ever**—The unit's aviators fly skillfully, but over-confidence brings a near tragedy*

mid-air collision due to flying too close. We couldn't believe this, because we were too good for anything of *that* sort. As we skimmed along the trees in formation, we were as careful as ever and no one realized just how near tragedy was.

I was looking 90° to my right, lining up number two aircraft with the leader, maintaining position in a line, and assuming that numbers four and five were doing the same. At the time, I was just thinking how precise the formation looked, and thinking that we were looking better today for the actual demonstration than we had looked during any of the rehearsals.

Just about this time, I simultaneously heard a terrific crash from behind and felt a sickening lurch in the aircraft. I knew what had happened. In fact, there was no doubt in my mind what had happened. I had been involved in a mid-air collision! I felt that I had experienced a phenomenon from which I, the crewchief in the copilot's seat, and the five infantrymen in the troop seats were certain to be killed or at best suffer serious injuries. This was a long "split second," in which I had plenty of time to think. The very thought of this seemed to be in front of me in big flashing neon letters, "Mid-Air, Mid-Air, Mid-Air!"

Everyone has heard of mid-air collisions in both fixed and rotary wing aircraft. In either case, it is a most serious situation, the thought of which brings shivers to most of us. To me, both then and now, this is to be considered a nonsurvivable situation.

In the split second of the crash, I actually had time to realize all this. I accepted the fact that if there had ever been a time in my life, particularly since I had been in aviation, this was a time for quick thinking, positive thinking, and positive action. Now don't get me wrong at this point. I was really scared—for the first time in my life. I'm not patting myself on the back for my corrective action, but training in the form of quick thinking in times of emergency seemed to pay off. Further, I feel that the following events were by the grace of God, and strictly the instinct of survival on my part. Until this time, I had never experienced an inflight emergency of any sort—not even a precautionary landing in my 800 odd hours of flying, about 500 of which were in UH-1 type aircraft.

At the time of the crash, the aircraft seemed to yaw violently to the left and right. I immediately assumed that I had experienced antitorque failure, thinking I had possibly lost my tail rotor, tail boom and all, since the sound of the crash came from behind. There had been nothing in front of me, and I had been the correct distance from the man on my right. I counteracted the yaw to the right with a decrease of collective pitch. Only then, did I realize that I still had full antitorque control. Luckily, we were just approaching an open area and I was able to descend and decelerate. All this time, I had been experiencing a severe lateral vibration and felt that along with everything else, I'd probably lost about half of both main rotor blades.

Little did I realize it then, but I was probably in danger of being hit again, this time by one of the aircraft from the two lines behind me, since each aviator except the man on the right in each line was looking to his right. However, as I began my descent I made a radio call, "Leader, this is 027—correction 652. I've been hit from behind and I'm going down." I tried so very hard to make that transmission sound calm, cool, and collected, but I guess I was a little

This particular demonstration had been rehearsed several times and performed with a high degree of precision, exactness, timing and professionalism. Each aviator, flight, and unit knew the correct frequencies, formations, and procedures.

too busy in the cockpit and too scared. I had flown 027 for the past several days, and now, of all times, I forgot my call sign.

I have always admired, envied, and tried to be like the individual who, no matter how rough the going gets or how "shook-up" he is, can sound calm and make others around them feel relaxed, even though those around him realize that they are in a bad situation. I had heard a few radio transmissions from inflight emergencies before, and professional pilots always seemed calm in describing their plights. Therefore, to me calmness seemed to be "the thing to do at the time."

My crewchief was one of those people. The troops in the back of the aircraft were quite excited, as could be expected. So the crewchief yelled at them, "Stay seated and shut up; the pilot knows what he is doing." Even this helped to build my confidence.

As I descended below the level of the rest of the flight, I saw the two lines behind me pass overhead. My descent was actually a descending deceleration. I don't know why, but at the time I felt that if I increased any collective pitch, I could lose transmission, main rotor head and all, due to the out-of-balance effect of the main rotor system. (Later, a tech rep told me that if I had been at a much higher altitude, this out-of-balance effect could have weakened part of the aircraft structure and allowed the loss of the entire main rotor system.)

I decelerated in a shallow approach during my descent to the ground, attempting to reach zero groundspeed and the ground at the same time, without "falling through," so I would not have to increase collective pitch at all. This worked fine, but I was landing downslope on a sandy trail. After touchdown, I skidded about one skid length. The toes of the skids dug into the sand, and, ridiculously enough at the time, I was worried about spreading the front crosstubes and breaking a "chin bubble." As it happened, the only damage suffered was that involved in the initial mid-air contact. I had lost about two inches of the leading edge of one main rotor blade at the tip, and the tip weight of that same blade. The other blade wasn't even touched. At any rate, however, we were all glad to be on the ground in one piece and uninjured.

The other aircraft involved had been number four, the aircraft on my immediate left. He had made contact with me somewhere in the left rear quarter of my main rotor disc, with the toe of his *left* skid and the *left* portion of his front crosstube. He continued the flight to a more suitable landing area and landed with no further damage.

Although I don't think that anyone can say exactly what happened, it seems that something caused the number four man to look to his left after a slight turn by the flight in that direction. Number five seemed to be closing on him and number four, being boxed in, had no choice other than to climb. By this time, unknowingly, number four had closed on me. During his climb his skid and crosstube contacted my main rotor system. This was definitely too close for comfort.

I don't think anyone can say who was at fault in this accident. I feel that the actions taken after the collision were correct and proper, particularly since we had only a split second for planning. After thinking about it and discussing it with much more experienced aviators, I find that I would do the same things again and all with whom I have discussed this agree, although no one wants to go out and try it.

From this near tragedy, I learned several things. The most important to me include first, never fly formation any closer than experience, skill, and conditions allow; second, in any flight, never use a formation that will box in any

Sit Down, Shut Up!—*The crewchief's positive response settles the passengers and builds the pilot's confidence*

Let the reader be the judge as to what rules of good formation flying were violated in this mid-air collision

aircraft. Always give every aircraft a clear side, so in case of emergency (including engine failure and servo failure), he will have a clear side to turn to. In event he has to slow down, he won't be hit from behind. Third, for precision, demonstrative type formation flying, maintain a high level of unit training and maintain a professional attitude. Finally, use two personnel for division of attention. This is to say that the individual flying must never take his eyes off the leader. The second individual monitors instruments inside the aircraft. Understand all unit SOPs and instructions concerning all the facets of close formation flying.

Mid-air collisions can happen in the best of units, with the best training possible. However, I will let the reader be the judge as to what rule or rules of good formation flying were violated in this case.

Any mid-air collision is serious —they can also be permanent.

* * *

Here are some final points to keep in mind:

Practice good eye hygiene at all times; avoid infections, injury, and irritations to the eye.

Use authorized sunglasses for proper filtering of light.

Maintain optimum physical health, including adequate nutrition.

Maintain a visual lookout at *all* times when visibility permits.

Do not operate in reduced visibility *except* under positive control.

Know and *use* standard formation procedures and signals.

Keep alert!

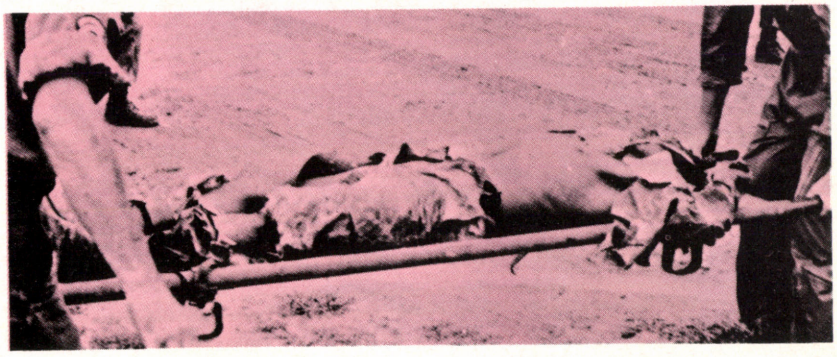
—USAF Flight Safety Officers Kit

***The Alternative**—This could have happened . . .*

or this . . .

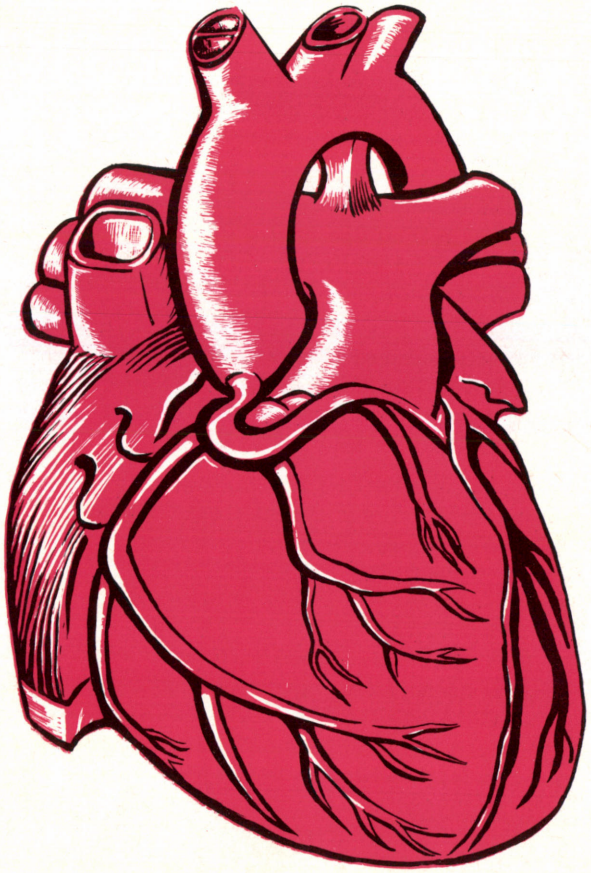
or this . . .

. . . to **YOU**



As far as we have been able to determine, the problem discussed has not occurred in Army Aviation experience. Of course, it could very easily occur at any time, as long as pilots continue to practice self-medication. As soon as the right man takes the wrong pill, we will have a case of our own. —Flight Surgeon

THE CASE OF THE CHARTED HEART



Reprinted from THE MATS FLYER, December 1965

THE SMILING FACE of our friendly flight surgeon welcomed us as we reached the end of the corridor and peered into his office. Since this had not been one of those annual invitations to a highly personal inspection, we had greeted his telephoned "come-on-over" with interest.

As we sank into a comfortable chair, he began a tale of mystery and excitement. It all started, he said, with a pilot undergoing his annual physical. And it turned out that a man's worst enemy

can be a lot closer to home than the Viet Cong.

Pilot Alfa, as we'll call our quasi-hero, rested comfortably on the crinkly paper-covered examining table. Beside him a machine recorded the signals picked up from the many cold electrodes taped to various parts of his anatomy. When the electrocardiogram session was completed, Pilot Alfa was released to await the word of the lab tests.

Eventually the EKG tracings reached the desk of a professional chartreader at the School of Aerospace Medicine, who achieved a degree of excitement. The poor chap must have been having a heart attack while reclining on the table! An unusual circumstance, to say the least.

Pilot Alfa received a quick request to revisit his flydoc, and was given further examinations. No definite heart problem could be identified. But, *something* was wrong, and unless it could be pinpointed, the Air Force might lose the services of one each pilot.

The next step, since the local medicos were unable to come up with a precise answer, was to forward the equally concerned Pilot Alfa to the School of Aerospace Medicine. Down there, the talented specialists began a meticulous evaluation and came up with: no answer. But they kept trying, and during one of the many interviews the following conversation took place.

"By the way, Pilot Alfa, are you taking any medications?"

"Oh, nothing special, Doc. The usual APCs now and then, but that's about all."

"Sure there's nothing else?"

"Well, now that I think of it, I took a couple of pills my wife recommended. But they didn't seem to do anything."

"Do you happen to have any of them with you?"

"I probably do, somewhere in my bag."

In due time the pills were produced and given careful scrutiny. They were sort of ordinary looking tablets, except they were a trifle bigger than the size normally used. And they contained a trifle more of a "secret ingredient" than is normally prescribed. In fact, they held *three times* the amount of what appeared to be a common drug for relieving heart failure.

At last the key had been found, and the problem quickly opened up. Was Mrs. Alfa a cardiac patient? No, the pills had been prescribed by an osteopath to aid Mrs. Alfa in losing weight. It seems that one of the side effects of this drug (besides affecting the impulse signal to the heart muscles, changing the heart rhythm, causing mental depression, and blurring vision) is nausea. Obviously, a continuous sick feeling will put a crimp in the old appetite, and if you don't eat, you're going to lose weight. So went the rationale for the basic prescription. Why the huge dose is anybody's guess.

Thus, the mystery was finally solved and Pilot Alfa's apparently sick ticker received a clean bill of health. All was quiet for a few weeks.

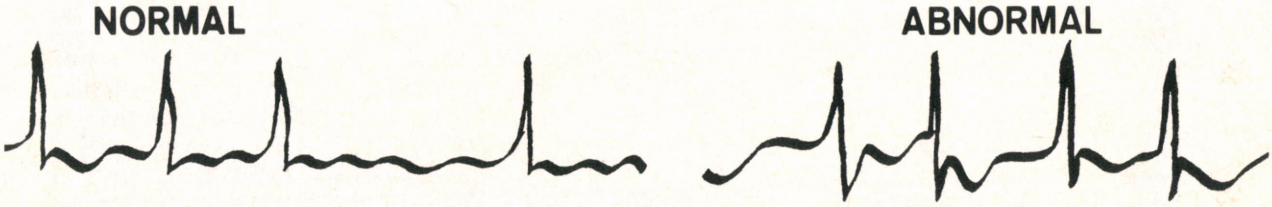
Then Pilot Gamma checked in for a physical and went through the chilly electrode EKG bit without any obvious problem. But when his tracings reached the SAM cardiologist, they too caused some raised eyebrows. A phone call back to the home station brought this to the attention of the local cardiologist, who talked it over with the flight surgeon. Obviously they needed to see Pilot Gamma again.

Recent experience coming to the fore, the doctor asked Pilot Gamma if he had been taking any non-Air Force medications. P. G. replied in the affirmative, and then expressed great surprise at the doctor's statement that he might be enjoying a self-induced heart attack.

Pushing the pills angle a bit further, the doc asked Gamma to bring in the nonprescribed items for a checkout.

When Pilot Gamma walked through the door the next day with a *cardboard box* full of pills, the doc sighed and shook his head. Then he began an inventory, and this is what he found:

- Pill 1—The same *triple-dose heart stimulant* mentioned above. By itself a potential killer.
- Pill 2—A diuretic which causes the body to give off water rapidly. In addition, it causes light sensitivity, lethargy, thirst (obviously),



Find out what the flight surgeon says about do-it-yourself get-well kicks

nausea, headache and weakness. Intensive use causes loss of chlorides and potassium, a condition which is *extremely* hazardous in patients taking a heart stimulant.

- Pills 3 and 4—Readily identified as not being too serious in effect, but *not needed* by this man.
- Pills 5, 6 and 7—Unidentified and unknown to the hospital staff; submitted to the Food and Drug Administration for full chemical analysis.

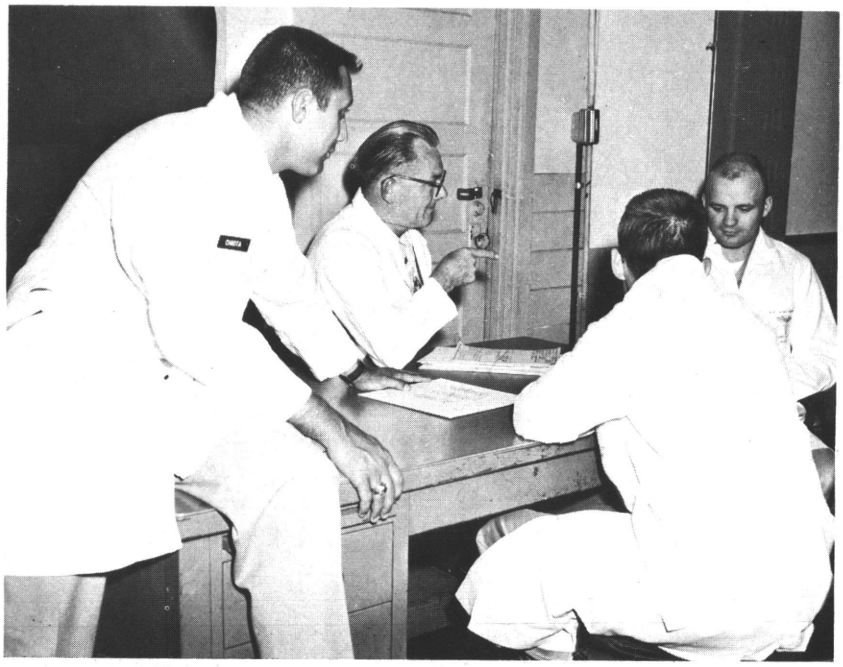
That's right, Pilot Gamma had been taking *seven different non-prescribed* pills.

At this point in his discourse, our flydoc friend showed us a vial containing some of the contents of the box. We saw black pills and green pills, purple pills and olive pills. We saw one huge white tablet similar to those given to ailing cattle by veterinarians.

Some pills were round, some square, some coated, some plain. One was stamped with the shape of the Gateway-to-the-West arch familiar to all who have driven through St. Louis. In all, Pilot Gamma had brought in enough varieties to stock a beginning lab in pharmacy. And not one of them had been a USAF prescription.

And so we move to case three, Pilot Beta. He was stretched out on the familiar table while the machine beside him made its familiar rhythmic squigglings. In due time he was dressed and on his way home. Then the tracings reached the desk of the local heart specialist, who was most surprised. Unless he was mistaken, here was a myocardial infarct recorded for posterity. He immediately passed his findings to the flight surgeon.

This time our medical friend was ready. He promptly called Pilot Beta at home and, after the usual pleasantries, asked him to come for a visit as soon as possible, preferably that afternoon. When the time was agreed upon, the doctor added: "By the way, bring in those reducing pills you've been taking."



***Medical Conference**—Flight surgeons spend endless hours determining the correct medication for a particular illness*

The 30 seconds of silence told the flydoc he'd hit pay dirt. When P.B. regrouped, he said he'd bring them along.

He turned up with three kinds of medicine, one of them the same triple-dose mystery drug. The other two, while not prescribed, and probably of no value to him, at least weren't likely to finish him off overnight. But the triple-dose special was hard enough on his circulatory system without any extra help.

Alfa, Beta and Gamma—three apparent cardiacs. The one common factor in all three cases was the outside source of "dietary" pills. One man needed a diet as badly as Ichabod Crane. The other two perhaps had valid girth-control problems. But all three, in their misguided dedication to keep hacking the program through personal diagnosis, had almost been able to ground themselves permanently. One even came close to under-grounding; another week of taking both pills 1 and 2 would have done it. Only one of the three is back on flying status.

We will not give you a long beating about the ears with our moral. You know what the flight surgeon says about do-it-yourself get-well kicks, and YOU know why he's in business. For a professional crewman, that's enough of a reminder.

A hard look at several types of corrosion and what you can do to halt this invader

CORROSION IS AN UGLY WORD

Huey L. Brannon

CORROSION IS an ugly word. Derived from the Latin *corrosus,* meaning "the act of gnawing," or to be eaten away or consumed by degrees, the word has an unpleasant but important meaning for the Army Aviator.

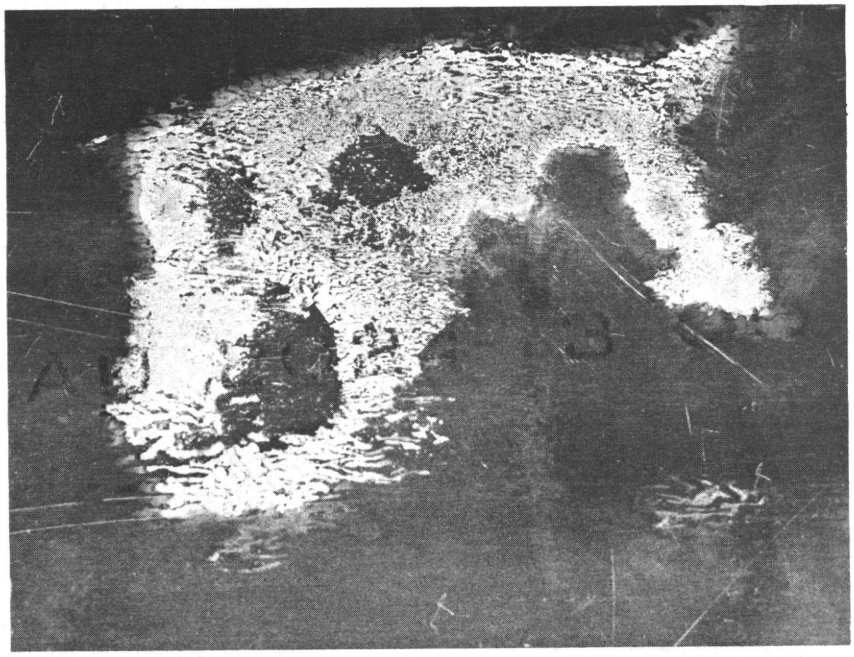
Basically, corrosion is the tendency of a metal on exposure to the atmosphere to return to its natural (or chemical) state. Such a breakdown in chemical structure can weaken an aircraft component to the point of failure. Reduction in structural strength is gradual and is most dangerous in an area where it may remain hidden.

Corrosion deposits usually warn of corrosive attacks, but structural damage may be more difficult to detect. All metals will corrode. The type and condition of this corrosion will depend on the combination of environmental conditions and maintenance practices.

The best method for maintaining the airworthiness (and appearance) of your aircraft is through constant and thorough inspections, followed by necessary preventive maintenance. Some of the methods used to detect structural flaws in aircraft are radiography, fluoroscopy, magnaflux and ultrasonic and penetrant dye.

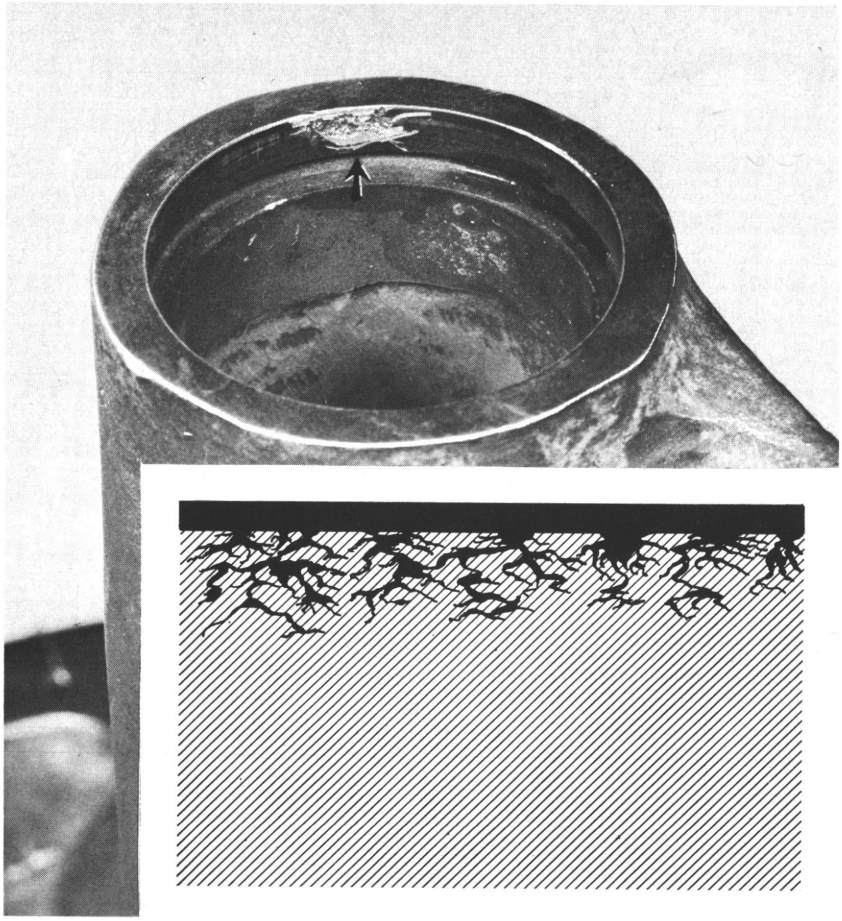
Correct preventive maintenance can result only through an understanding of the types and causes of corrosion. We may consider corrosion as being of two general types: *direct chemical* attack,

***Beware**—Oxidation or atmospheric corrosion*



where positive (anodic) and negative (cathodic) changes occur at the same point, and *electrochemical* attack, where positive and negative changes occur at a distance from each other. An example of the first type is the action of acid on metal; the second, the action that occurs when metals of dissimilar types are wet with salt water.

Both types of corrosion normally depend on moisture to provide a conductive medium so that ions and electrons may flow. A truly dry material will not normally attack metal. Even moisture in the air, however, is often sufficient to start the reaction. If we could keep all metals enclosed in an airtight bag with all moisture removed, we would probably never have a corrosion problem. But when an aircraft, constructed of many metals, is exposed to its normal environment (exhaust gas residues, atmospheric moisture, waste water, salt water, spillage, gun blast deposits, etc.), all factors necessary for chemical or electrochemical action are present and the possibility of corrosive attack exists.



Undermined—*Intergranular corrosion strikes deep*

Since some areas of aircraft are subjected to more corrosive substances than others, necessary control measures vary accordingly. All corrosive attacks start on the surface of the metal. If allowed to progress, the corrosion will work into the core of the material and destroy the mechanical and physical properties of the metal. Since corrosion never originates in the core, surface evidence of an attack is always present.

For practical purposes, corrosive attack on airframe structure may be classified under the following headings.

UNIFORM ETCH CORROSION

Uniform etch is caused by the application of chemicals, such as battery acids or cleaning chemicals, to bare metal surfaces. If these agents are allowed to remain on the metal, they can cause severe forms of corrosion. On a polished surface this type of corrosion is first seen as a general dulling of the surface. Continued reaction will cause the surface to become rough and possibly frosted in appearance. Prompt remedial action is recommended to forestall serious damage. Acid-resistant paint applied to the affected areas and frequent and thorough cleaning procedures and inspections will retard or minimize this corrosive action.

PITTING

The most common effect of corrosion on aluminum and magnesium alloys in aircraft is pitting. It is first noticed as a white or grey powdery deposit, similar to dust, which blotches the surface. When the deposit is cleaned away, tiny pits or holes are observed in the metal. Pitting may occur in any type of metal or alloy.

INTERGRANULAR CORROSION

Intergranular corrosion is an attack on the grain boundaries of a material. It is by far the most dangerous because it may have severely weakened a structural member before any external evidence is visible to the naked eye. This

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The author was a lieutenant assigned to the Dept of Maint, Ft Rucker, Ala., when he wrote this article.

***The Rains Came**—Precipitation compounds hazards of corrosion*

type of corrosion attacks the grain boundaries of a crystalline structure or alloy. Each of the grains has a clearly defined boundary which can, in the presence of moisture, set up galvanic action (a direct current of electricity, such as in a battery) with corrosion as the product.

This "battery," being short-circuited, exhausts itself in useless destructive action. These actions cause metals to become weak and brittle. The only outward evidence of this may be hairline cracks, or in some instances blisters, so fine as to be almost invisible to the naked eye. Whenever they are detected, the material should be immediately scrapped and destroyed.

Poor heat treatment of high strength aluminum alloys makes metal more susceptible to intergranular attack. Too, the coupling of adjacent dissimilar metals appears to aggravate this type of corrosion.

It has been recently established that magnesium-alloy rivets are prone to intergranular corrosion, especially when in the presence of sea water and when subject to tropical or semitropical conditions. The attack usually occurs in the head of the rivet, which is liable to drop off when corrosion is in an advanced state.

Cracking of a metal caused by the simultaneous effects of both stress and corrosion is known as stress corrosion cracking. This is similar to intergranular corrosion in that it generally follows the grain boundary, but it is different in that it is nearly a straight line through the metal structure and manifests itself as a crack in the metal, not necessarily accompanied by obvious corrosion. The stress can be either applied stress or one resulting from cold working of the metal without proper stress relief, such as preloading the part during installation. Stress corrosion cracking occurs on both aluminum and magnesium alloys. It is recognized only after the cracking has occurred, and this is usually too late to do anything except replace the part.

EXFOLIATION

Exfoliation is a form of intergranular corrosion and exhibits itself by "lifting up" of the sur-

face grains of a metal by the force of expanding corrosion products occurring at the grain boundaries just below the surface. It is a visible evidence of intergranular corrosion and is most often seen on extruded sections where the grain thickness is usually less than in rolled forms. In some cases faulty heat treatment can be clearly established as the cause.

LOCAL CELL CORROSION

Local cell corrosion forms on the surface of a piece of metal that is unprotected and exposed to elements. It is the simplest form of corrosion and the easiest to correct or forestall. This type corrosion can be prevented by plating, metal spraying, or painting the surface. If it is impossible to apply the protective coating, preventive maintenance, such as washing with fresh water at regular intervals, will prevent the buildup of corrosion deposits.

Local cell corrosion may be described as galvanic corrosion acting on a microscopic scale. Attack takes place irregularly at separate points on the surface and penetrates into the interior of the metal. It is always provoked by local cell action, which is caused by an uneven oxygen distribution on the surface of the metal.

Deposits of soot and metallic dust will set up local cells that enhance the progress of this form of corrosion. Accumulations of dirt and soot on an aircraft will increase corrosion of clad aluminum alloys in just one month's exposure to atmospheric conditions.

GALVANIC CELL CORROSION

Galvanic corrosion is a faster than normal corrosion that takes place when two metals having different electrochemical potentials are in physical contact and both are exposed to an electrolyte, such as smog, salt atmosphere, and salt water. For example, aluminum and magnesium skin riveted together in an aircraft wing form a galvanic couple. When aluminum pieces are attached with steel bolts or screws, galvanic corrosion can occur in the presence of moisture between the aluminum and steel. Galvanic corrosion can usually be recognized by the presence of a buildup of corrosion products at the joint between two metals. Preventive measures include painting and plating.

CONCENTRATION CELL CORROSION

Concentration cell corrosion is a type of metal destruction associated with crevices, scale deposits, or with any means by which differences in solution concentration or composition are established over a metal surface. This is the type of corrosion that causes difficulty between flaying surfaces of similar metals and explains the necessity of insulating between lap joints, although the metals are of the same alloy.

CREVICE CORROSION

Crevice corrosion, another form of concentration cell corrosion, is found between flaying surfaces of similar metals, at lap and butt joints, and at rivet heads.

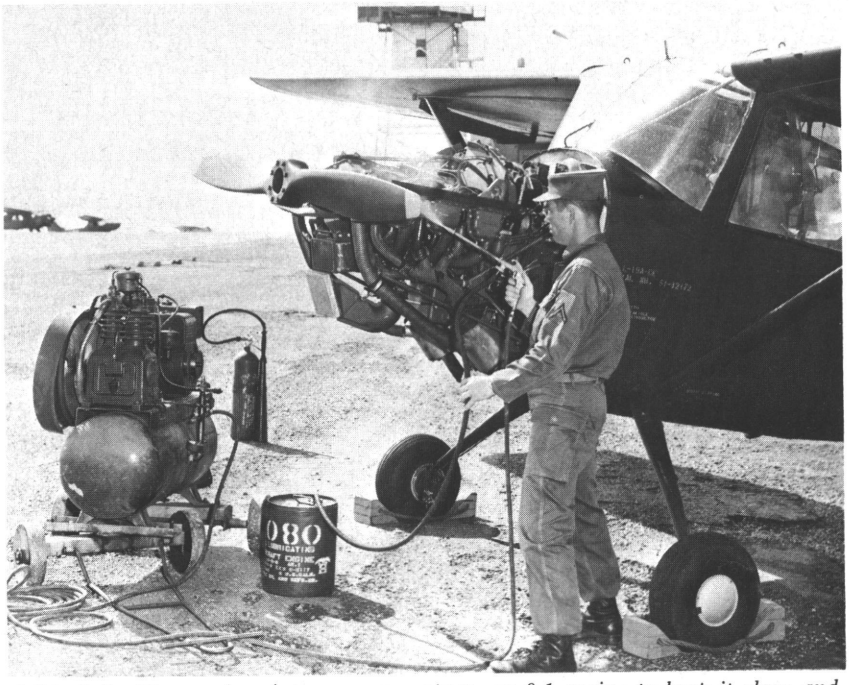
Two devices help in averting crevice corrosion: insulating the metals to prevent electrolytic action and filling with inert materials.

CORROSION CONTROL

The most important maintenance requirement is cleanliness. Aircraft should be kept as clean as operations will permit. The following measures are important to preventive maintenance.

Periodically clean the exterior of the aircraft to remove corrosive agents which are continually being deposited on the metal surfaces, and to remove any corrosion products already formed. Use a detergent or emulsifiable cleaner, or a solvent-type cleaner that does not affect the paint. Use a soft bristle brush to get into tight

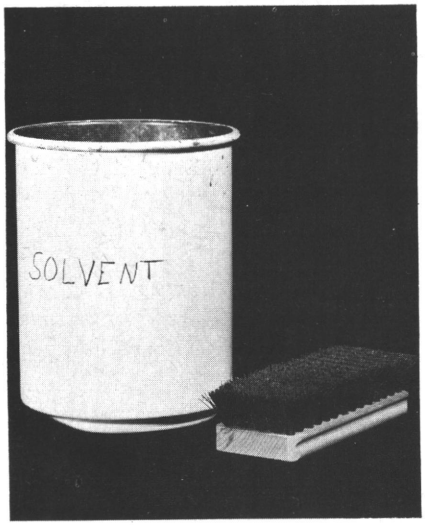
Thorough Check—*In Vietnam, or in a dry area, a sure preventative for corrosion is frequent inspection*



***A Stitch In Time**—A maintenance man sprays an 0-1 engine to keep it clean and prevent corrosion*

places and around laps and fasteners. Do not use metal brushes. The bristles have been known to become lodged in lap joints and crevices, causing galvanic corrosion. When you have completed the cleaning process, rinse the surface thoroughly with clean water.

***Elbow Grease**—A scrub brush may be the answer to a corrosion free aircraft*



When washing the aircraft, maintain a close check on the type and concentration of cleaning compound used, since the use of improper or improperly mixed cleaning compounds causes corrosion.

Wash the aircraft in a shaded area whenever possible during hot weather to reduce staining.

If weather conditions do not permit the use of water due to freezing, you can clean the surface with a dry cleaning solvent. Wipe the surface clean with a rag or mop.

Skins that are enameled or lacquered (except those in areas of high corrosive environment, such as exhaust paths) need not be washed as often, provided the paint finish is intact and in good condition. Remove contaminants from the surface regularly to maintain the protective finish.

Clean painted areas in exhaust gas path frequently with an approved cleaner to minimize damage to the paint finish and prevent corrosion of the structure.

Other measures that maintenance personnel can use to minimize or forestall corrosion are performing thorough inspection and application of corrosion preventive compounds. TM 1-1-1A-20 covers corrosion control and treatment for aircraft.

Corrosion not only affects the surfaces of the aircraft but other working parts as well. During the service life of an engine, deposits formed on the pistons and other internal parts, especially products resulting from the combustion of leaded fuels, can cause severe pitting. External corrosion on the engine casing, cylinder fins and heads, crankcase bolts, nuts, and other such fittings can also be a source of trouble, especially in those parts of the world where there is considerable humidity. The methods of protecting an engine internally and externally depend to a large extent on the engine type.

Fuel and oil systems are also subject to corrosion. Fuels and oils used for aircraft engine operation are in themselves inert and noncorrosive at tank temperature, but water sometimes accumulates in the sumps or at the lowest parts of the tanks. This can be highly corrosive, especially when fuels and oils containing certain additives and, in particular, when leaded fuels are used.

We can compare the activity and effects of corrosion to attempting to infiltrate our lines in a military operation. By the use of proper preventive measures and through constant vigilance we can prevent this infiltration; we can protect our equipment from the effects of corrosion through good inspections and maintenance.

It is much easier to prevent the infiltration of this enemy than it is to correct the damage that may be inflicted if we fail to halt this invasion.

No Catsup?

Sorry about that!

SURVIVAL *once over lightly*

Captain Richard L. Mills

SURVIVAL TRAINING is like insurance; it's never good "until you need it." How convenient it would be if we could just skip our life insurance premiums (and survival training) until, say, the month before we die (or need it). However, neither is this generally the case nor are we given such extraordinary power of foresight.

Besides, comparing survival training with life insurance is misleading. Life insurance doesn't guarantee that we will have a good chance of living longer; survival training does. Survival training is thereby a real form of "life insurance," and the odds are that we will be around to collect on the "policy" providing we engage in survival training.

Army Aviators are given their basic "survival insurance policy" when they attend the United States Army Aviation School at Fort Rucker, Ala., where they spend 26 hours in the field with the Department of Tactics Survival Committee. This policy, as any other policy, will expire with time if steps are not taken to update or renew the premiums.

The Army Aviator must keep abreast of latest survival equipment, principles and techniques through personal study and unit training. Unit training officers should implement Army Subject Schedule 1-13, "Survival Following Bailout or Crash Landing." Their everyday training should project the unit aviator into a realistic survival situation, confronting him with psychological as well as physiological factors.

Survival principles and techniques are nothing more than "facts of life" that have evolved through experience. Constant study of these principles and techniques coupled with common sense and the *will to survive* will generally bring an individual through a survival situation in a physical condition adequate to cope with his environment.

Basic survival can be defined as those actions and subsistence items required to satisfy our basic body needs. Adding an enemy to the environment in a combat situation causes the individual to meet these basic needs while on the move and still avoid detection by that enemy. Hence, we have combat survival.

Capt Mills is with the Survival Committee, Special Subjects Branch, Dept of Tactics, Ft Rucker, Ala.

Some American fighting men become prisoners of war. In this environment an individual will be faced with procuring those items for nourishment and personal hygiene under the gravest of conditions.

In the POW environment, you must rely upon improvised and primitive methods to meet your needs. Medically, some treatments may seem shockingly and degradingly strange to you, but these methods grew out of a desperate need and persistent initiative. They have saved and will save lives. Dysentery, cold injury, pneumonia, malnutrition, hepatitus, heat conditions, faulty vision, fractures and sprains, beriberi, burns, lice, worms, snow blindness, and snake bite are some of the things you are likely to encounter.

These common ailments and their suggested treatment are listed in the box below.

In addition to these common ailments and treatments if you do not know what else to do for an antiseptic, use hot water or a hot brick. They will help clean out a wound and stop infection.

The least understood environment that the soldier may face is a nuclear battlefield. While we have very little to go on in the way of experience, science has furnished us with information on body protection requirements and how we may procure food in radioactive surroundings. To be fully prepared for any emergency, we must research somewhat in the nuclear contingency during our training in survival. Since this subject is covered extensively in Army manuals, it will not be discussed further here.

Evaluation of your situation following an emergency will include consideration of hunger and thirst. Obviously, these two considerations will not be of great concern if rescue is imminent. You must, however, take into account the possibility that early rescue may not occur. If you are to maintain your health and strength to effectively cope with problems of field living or even dealing with an enemy from inside a compound, you must provide yourself with food and water.

Water is more important and is required by the body on a daily basis or dehydration will occur. If the body loses 10 percent of its body fluids, immobility and certain death will ensue. The easiest method the downed aviator can use for determining if dehydration is taking place is to check the color of his urine.

Illness	*Treatment*
Dysentery	Keep patient on his feet and taking water. Boil bark from oak or other trees until strong and black looking. Drink it. Char old bones into "charcoal" and eat them. Grind bones into dust. Powder chalk and eat it. Or eat charcoal from burned wood.
Cold Injury	Prevent it. Keep exposed parts, particularly your feet, clean and dry. Frequently massage feet. Elevate feet if swelling is present. Put feet and hands against other warm parts of body. Change footwear upon entering shelters. If frostbite does occur, *do not massage with snow*. Rapid warming is required. Immerse in 105° - 112° F water for 20 minutes.
Pneumonia	Don't lie down. Keep going. Rub the patient with very warm (heated) hay to "steam" the patient. Repeat four or five times for about 5 minutes each. Wrap patient in several layers of dry blankets or clothing and place him in a warm dry place.
Malnutrition	Eat anything given you. Even cats, rats, snakes, dogs, maggots. Cook everything first, if possible. If not, eat it anyway. Steal food if necessary.
Hepatitus	Force-feed patient. Give him sugar if possible. Keep him from working.
Heart Conditions	Preventative. Do not drink extremely cold water, which may shock circulatory system.
Failing Vision	Supplement your diet with green plants and other vitamin foods.
Fractures and Sprains	Put bone back in alignment, splint it, wrap with soft material (not too tightly). Splint beyond joints above and below the injury. Move people with back injuries "belly down" only. Improvise splints and braces, even for broken backs.
Beriberi	Eat anything green; boiled (grass, leaves, weeds) when necessary.
Burns	Boil tree bark and use as ointment. Cover burned areas. Keep warm, give plenty of fluid by mouth, cover burn with grease or oil if possible.
Lice	Remove clothes. Pick off lice by hand. Boil and wash clothing.
Intestinal Worms	Take a couple of teaspoons of kerosene (preferred) or white gasoline.
Snow Blindness	Prevent. Avoid direct exposure of eyes to sun. Cut slits in a card to see through. When blinded, stop exposure to light. Apply cold compresses to your eyes. Use eye ointment if available. Stay in darkened area and blindness will pass in 48 hours.
Snake Bite	Be relatively inactive after bite. Apply constricting band above the bite. Band must not be tight because it serves only to restrict lymph flow. When swelling begins, make ¼" long cut over each fang mark in direction of muscle fiber (long axis). Cuts should be through the skin only. *DO NOT* mutilate yourself with wild slashes. Suck out venom. Keep the wound clean and free from infection. Apply cold compresses and bandage.
Teeth	Cleanse and exercise by chewing pieces of wood. Pull teeth when necessary with wire or similar material.
Bone Pains	Keep moving, particularly limbs involved.
Amnesia	Seems to disappear with improved diet.
Black and Blue Bruises	Raw potato slices will ease pain from beatings but should not be placed on open wounds.

Hunger can make you irrational. In a survival situation the big question is, where do I find food and how do I make it palatable?

A clear water color, or lack of color in this instance, indicates more water is being taken into the body than is required for its physiological functions. So, if water is not abundant, this is the time to cut down on your intake of liquids. A straw yellow color indicates a normal balance between water intake, body functions, and dehydration. A dark orange color indicates that dehydration is taking place and water intake must be increased. If water is not available at this time, keep body exertion at a minimum. Dehydration in its late or terminal stages is evidenced by extremely dark urine with traces of blood. Immediate medical attention is required at this stage or death is almost certain.

Since medical assistance generally won't be available under the circumstances, we can see the emphatic requirement for prevention rather than cure of dehydration. We must be constantly alert for signs of our body losing its fluids through dehydration not only in hot climates but in cold as well.

Lack of food is not immediately critical in a survival situation if the individual's body is strong at the time of the emergency. Extremely cold environments would be an exception to this because energy is required to maintain body temperature. While our bodies physiologically do not require a daily intake of food, it is important to search for, procure, and prepare any nourishment we can find.

The big question now presents itself. "Where do I find this food to satisfy the hunger pangs, and what do I do with it to make it palatable?"

First, consider all edibles that require a minimum amount of exertion to procure. Plants or fruits of plants, insects, and other lower forms of animal life that are slow moving are all excellent sources of nutrition. Once these "other than normal diet" foods get past the thought processes, they often taste quite good.

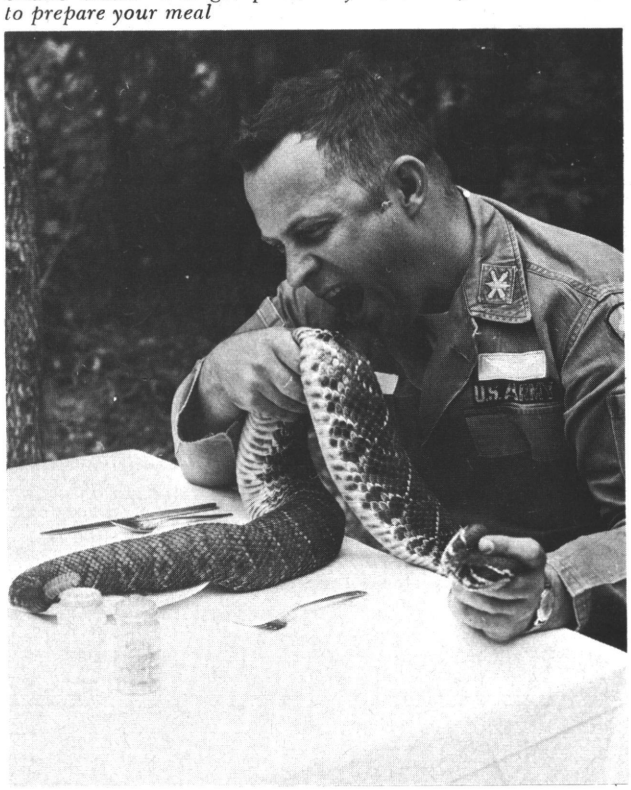
Some precautions are in order, however, to make some of these foods completely safe for human consumption. Hopping insects such as grasshoppers and locusts should have the large bony or spiny hind legs removed. The legs will stick in a man's throat and cause serious disorders that cannot be corrected in a survival situation. While most insects offer a wealth of nutritional value, they must be discounted in a radioactive area as their ectoskeletons will cause radiation sickness if consumed by man.

Wormy or maggot infested meat may be cooked and eaten. The worms and maggots contain the same nutritional value as the meat they are found in. Cooking, needless to say, is definitely in order.

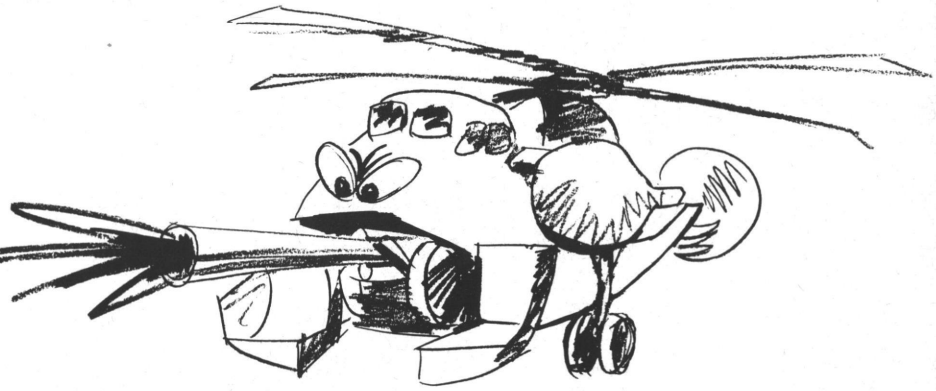
Stewing or boiling of foodstuffs will kill the germs and parasites that are harmful to man. Since man roams all the land masses of this earth, all surface bodies of fresh water must be considered to be contaminated with germs or parasites. Any fish swimming in this water and any animal drinking it must also be considered a potential hazard. As such they must be cooked before consumption. Since man does not inhabit the waters of the ocean to any appreciable degree, most animals, plants and fishes found in salt water may be eaten raw.

Methods of catching larger animals are limited only by the training and ingenuity of the individual. Boy Scout manuals, Army, Navy and Air Force manuals are all sources of woodlore that may come in handy in an emergency.

***Snake Steak**—Hunger pains may be severe, but take time to prepare your meal*



This is one individual's idea of how an aerial artillery unit might be configured and employed. Inasmuch as there is a Department of the Army approved development program for an aerial artillery system, it is pointed out that this article should not create the idea that the presented thoughts represent the goals of the development program.



Concept of Support

Captain Carl E. Dunn

DAWN gently probes at the sky with vermilion fingers as I walk across the runway to the awaiting fire direction ship. Uncertainty plucks at my inner thoughts as the early morning dew soaks my flight suit from the knees down. Tall grass along the edge of the airstrip offers little resistance to my energetic pace. I shiver slightly and wonder if the chill is due to predawn coolness or in anticipation of the impending engagement.

Lieutenant Bealson's greeting comes as a reduced whisper. "Good morning, Captain Baron! Everything is ready to go."

"Morning, Phil! Is the major here yet?"

"Yes sir. He checked all the ships and is over at the command ship now."

"Well you might know it! I've stepped in it again. No matter how I try I can't stay ahead of the major. As his executive officer I should have been here to report to him when he arrived."

"Phil, have each ship commander check his traversing and elevating mechanisms before takeoff and ensure that the Chinooks are loaded with extra ammo. I'm going to the command ship to see the major."

"Yes sir," replies Lieutenant Bealson as he immediately turns and double times toward the dark silhouettes of the waiting UH-1s.

I step up my already accelerated pace toward the command ship. I can't help but feel a minute amount of reluctance at seeing the major now, since I wasn't on time this morning. The major isn't one to tolerate laxity in his subordinates. I learned that lesson well when I first reported to Fort Sill, Okla., six months ago.

Then my orders to the controversial 108th Aerial Artillery Battery were somewhat of a surprise to me. The concept of transporting artillery pieces with the UH-1 was not a new one. In fact, I had on many occasions carried 105s as a sling load. However, this was something else again.

The major had seemed to be a genial sort of guy when I reported to him that first day. A few moments of talking with him clarified the fact that he was dead serious about his role as CO of the 108th. I can remember his words well as I learned the role of this new unit: "Captain, the 108th has the potential of becoming a focal point of revolution in a quagmire of negative thinking."

"The enemy we will be deployed to face is an elusive one. Finding him is a big problem in a land of rice paddies, jungles, and canals. Normal modes of transportation are almost useless. Once he is found, he cannot be held in position long enough for our forces to close with and fight

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Capt Dunn is with the Artillery Committee, Special Subjects Branch, Dept of Tactics, Ft Rucker, Ala.

him. One moment he will be there in as much as regimental strength and then he will vanish, leaving behind only a few snipers to harass and torment his pursuers. Our forces have the means to rapidly converge upon the enemy once he is found. The 108th will provide the firepower needed to fix that enemy and assist in his destruction."

The major turned in his swivel chair and picked up a pointer leaning in a corner. With the pointer he touched an organization chart hanging on the wall. He started to explain the organization of the 108th. A note of pride in his voice was obvious.

"We have seven modified UH-1s and one LOH assigned. Not only are these utility helicopters changed as far as the undercarriage is concerned but their powerplants are much more powerful than the engines employed with the UH-1D. The UH-1s can traverse 360° around their vertical axis while on the ground. This is accomplished by using a base-ring and race system similar to that used on a self-propelled artillery piece or a tank. Each aircraft is provided with hydraulic jack pads so that it can be leveled upon slopes up to 10°."

The major arose and replaced the pointer in its corner. He took a pipe from his pocket and began to chew on the end as he walked back and forth across the room. I could see that he was filled with abundant nervous energy.

"Each UH-1 has been armed with 4.5" rockets. These rockets are extremely accurate when used in a direct or indirect mode. They are stabilized along their trajectory by a gyro that minimizes their dispersion probable error. The projectiles are mounted in a pod that automatically feeds them to an adjacent launching tube. Pod and tube are made of fiberglass and thus very light. A pod and tube is mounted on each side of the aircraft and contains 24 rounds in each pod. We can deliver, if we have to, the equivalent firepower of a 105 mm howitzer battalion! One of the aircraft has a field artillery digital automatic computer on board. That aircraft has been designated the fire direction ship. You will operate from that ship."

I asked him, "Sir, how will the 108th be tactically employed?"

He answered in his brisk, clipped tone. "Our normal support mission is to provide close and continuous fire support for an airmobile assault. The battery is flown to a position 3,000 to 5,000 meters from the objective area. We deliver indirect fires on the objective from that position.

"We are not limited to the support of just airmobile assaults. We can provide artillery support for any type of operation. Our type unit is particularly effective as general support artillery. We can be rapidly moved from position to position so that our fires can be used where they are most needed at any given time.

"Since I have mentioned displacement I would like to expand that point. Until the 108th was organized, airmobile artillery was sling loaded into an area and then left high and dry without their prime movers. We no longer have this problem. The 108th can be out of a position as quickly as we can start the aircraft."

I heard those words six months ago. It seems only yesterday.

Just ahead is the major's command ship.

His tall frame is outlined against the soft, red glow emanating from the cockpit of the LOH. Intently studying an acetate covered battle map, he answers my greeting with nothing more than a guttural grunt and a nod of his head.

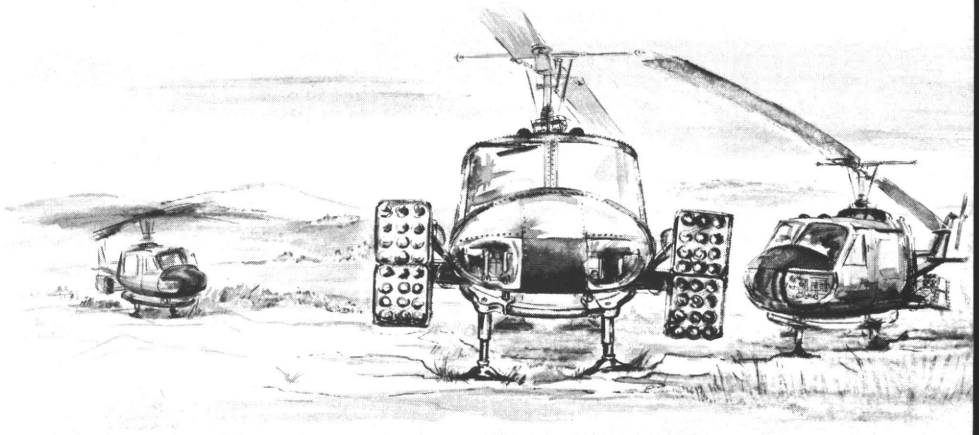
"At ease, Ray! As you know, the battalion will lift off in one-zero minutes. Area alpha has been selected as the primary firing position. If this position proves untenable, I will select one of three alternates as per my instructions. We will rendezvous with the battalion at ACP number 1 and go to area alpha from there. Do you have any questions?"

"No questions, sir!"

"Good! Man your ship and I'll see you at alpha."

As I race toward my ship, I can see the black shapes of the battalion painted against the orange sun rising above the steaming jungle. A quick glance at my watch confirms that they are exactly on time. If everything goes as planned, we should be in position and have prelanding fires on the objective two minutes before the arrival of the battalion. Upon the direction of the airmobile commander these fires will be lifted and placed upon routes of withdrawal and any targets of opportunity that might present themselves.

The battery is already "fired-up" and in position for takeoff. Phil has the fire direction ship's door open for me and is ready to go. As I buckle myself in the thought uppermost in my mind is, Will this concept of support work?



ARCs of Communications

Lieutenant Donald F. Matson, Jr.

ALL OF US have diligently studied our ABCs, but the attention given to our ARCs is generally a different story. Airborne Radio Communications provide the aviator with a lifeline to Mother Earth, and lack of communications provides the aviator with an excellent chance to use his survival, escape and evasion training.

The ARCs of communications mean different things to different people. Take the case of Petey Pilot, who advocated Abuse, Recklessness, and Confusion. Petey just wanted to know how to turn on the "bloomin" radio, and radio procedure was just another rule to be broken. All other information was reserved for the flag wavers.

Petey's first assignment was a visit to Congland, where most of the aircraft in the unit became subject to the first portion of his misconceptions, Abuse. Petey knew that any parts that had fallen off the aircraft should be noted in the -13. However, he overlooked the crushing landings which were hard enough to break the tubes in the radios. This sometimes caused the next pilot a little excitement.

***Number Please?**—A UH-1 pilot makes an approach to a landing zone under the guidance of a communications man*

Petey could never understand that first item in his checklist, all switches off. Little did he realize that the surge of current produced when the aircraft is fired up is enough to make a man's hair stand on end. And it could turn those erect locks gray when you go IFR and your radios have been rendered useless by that first electrical charge.

All in all, Petey's attitude was less than desirable and did little to instill a sense of responsibility in maintenance personnel. Our radios will perform their mission if they are properly maintained and operated in the prescribed manner. Bent radio mounts, weak transmitters which are not written up, improperly maintained sets, and lack of operating knowledge do little to enhance the probability of communicating when the going gets tough.

Lt Matson is with the Communications Branch, Special Subjects Division, Dept of Tactics, Ft Rucker, Ala.

Petey's first chance at Recklessness and Confusion was Combat Mission Number 1. During the mission briefing he was handed a confusing booklet labeled SOI (signal operation instructions). It contained some crazy tables called brevity codes, authentication tables, map coordinate codes, along with more frequencies and call signs than Petey thought was necessary.

During the mission, the unit was to change frequencies at the command "Goldmine" to provide relatively secure communications during the crucial phase. After departing the last ACP (air control point), the word "Goldmine" came blaring into Petey's headset. "Hmm, something I must have missed in the briefing." By the time Petey recovered from his thoughts, there was no one left to talk to.

From the ACP to the RP, our hero tried and tried to raise his comrades on the old frequency while the Cong were obtaining a perfect DF on each of his futile efforts. Enemy intelligence was plotting the results of the DFs and translating the information into the unit's probable destination, which was relayed to the Cong Welcoming Service via tom-toms.* Petey could have just as easily handed them a copy of his flight plan.

To Petey's surprise, everyone seemed to split apart at the RP —something else he must have missed at the briefing. Upon reaching the LZs, the unit encountered a maze of arrows, small-arms fire, and a few effective blasts from a couple of borrowed quad fifties. Suppressive fire and rescue operations proved inadequate, and the few remaining aircraft regrouped at the return IP to begin the laborious journey home.

Back at the airfield the tower operators were counting the returning aircraft as they staggered in (shades of Twelve O'Clock High) when Petey's call sign was heard over the speaker. "Lat towel, this is Lattail 13, estimating youla position at foula-five, authentication of foxtlot-mike is Lomeo, Lomeo." Tower operators laughed at Petey's high humor—imitating the enemy of all things. They were in the habit of accepting self-authentication to save time, and did not bother to mark down the used authentications to prevent reuse by the enemy. This war isn't *that* sophisticated.

When a target appeared on the scope, everyone assumed it was Petey coming home. No consideration was given to the fact that it was moving a little too rapidly. An airplane broke over the field and a neat line of tracers formed a lighted pathway through the rows of parked aircraft, terminating with a resounding boom in the barracks. Thus was the commencement of air warfare by the enemy and the conclusion of Petey's unit, except for—you guessed it!

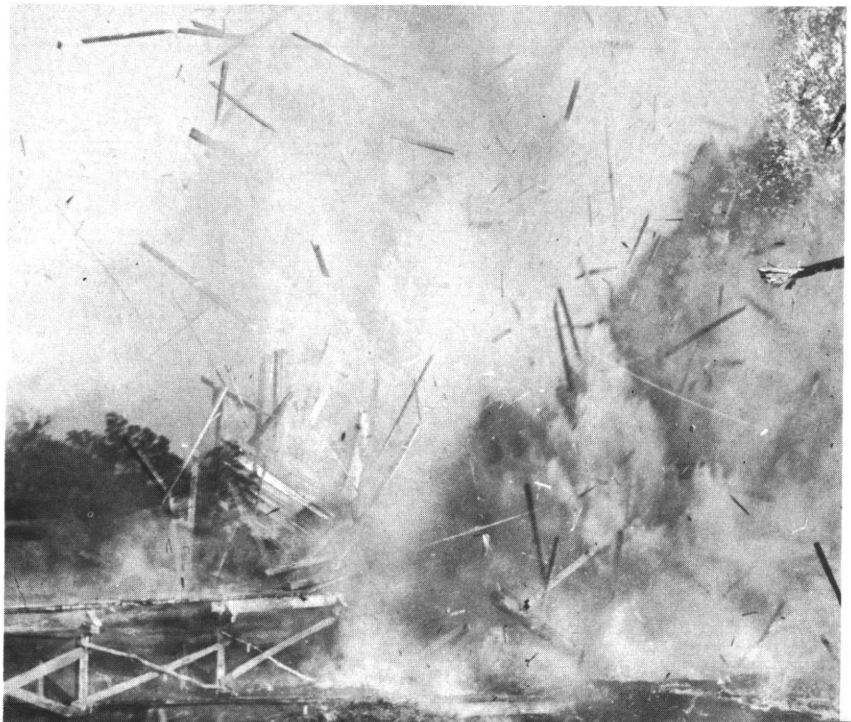
What had happened to our hero? He had not been able to find his way from the RP to the LZ and he was out stumbling around when the airfield was victimized. Navigation was not one of Petey's high points. When he had studied FM homing he thought D meant derelict and U meant uninformed. But all in all Petey had survived when no one else had.

Our hero was looking for a new home, and he had expectations of sloughing off that Mickey Mouse communications garbage in his new unit, too. However, Petey ran into a commander whose ARCs were Aggressiveness, Responsibility, and Confidence.

The commander had established an Aggressive training program and absorbed communications training into every operation. He realized that communications can only provide command control when talk is kept to a minimum and response is instantaneous. (A condition of overtalk is a hindrance to command control, not an asset.)

SOP was developed to cover all

Barooom!—*A resounding boom rocks the barracks as the enemy commences air war, thanks to Petey!*



* Note — The enemy's unsophisticated communications network seems quite effective and requires little maintenance. Possibly discipline and training are their answer.

Aggression, responsibility and confidence -- the answer to Airborne Radio Communications

recurring operations, and a code word was assigned to each operation. Each man was briefed on his responsibilities and was expected to follow them to the letter. When communications were necessary, good communications technique kept the messages clear and concise. Visual signals were used whenever possible and elicited immediate response from the disciplined unit.

The commander ensured that all new men, such as Petey, were properly indoctrinated to the ways of the unit. The communications officer carefully briefed the new men on signal operations and the SOI and SSI (standing signal instructions). Emphasis was placed on the unit's authentication system and map coordinate code. Self-authentication was *not* to be used with voice communications. The new men were communications experts in a short while.

Maintenance and avionics briefings were held to ensure that the aircraft and radios were written up properly, and the men were told to ensure that no discrepancies were overlooked.

Each new aviator was assigned to an old hand who explained all facets of the unit's operation. The unit SOP was covered in detail and the new aviator found out why the commander used visual communications and brevity codes so extensively. The commander wanted the unit to sound as much like a tactical unit as possible, realizing that clear context messages would hand the enemy tactical information and any transmission that marked the unit as Army Aviation would steal the element of surprise.

Aviators in the unit met their Responsibilities head on. Their unit would succeed only if they functioned properly. Each man knew that the success of the mission and the welfare of the personnel rested, in part, on his shoulders and every man met the challenge. The aviators' interest in the condition of their aircraft and radios instilled further responsibility in the crewchiefs and mechanics; they knew that the success of the mission and the lives of the aviators depended on their work.

A genuine team was developed within the unit, a team which had Confidence in the commander, Confidence in the team, and Confidence in the equipment they were using.

Even Petey was swept away with the new methods he was learning. The communications complexity that Petey had anticipated turned into simplicity. He was astounded at the response a single word over a radio could produce. The commander's ARCs became Petey's bywords; he was part of the team.

Petey's story will never happen (we hope!—remember when the Cong captured a radio and directed RVN airstrikes onto a friendly battalion?), but the story of Petey's new unit should be happening in every unit in the Army. Instead of a mental block the size of the Berlin Wall occurring every time the word "communications" is spoken, simplicity and dependability should come to mind.

New and better equipment is being introduced to assist the commander. Training programs to ensure proper operator procedure and communications procedure should be established and communications should become a part of all mission planning. Once the procedures are recognized as beneficial to the entire unit, a sense of pride and responsibility will develop and success will follow.

***Any Questions?**—The commander makes sure newsmen are thoroughly familiar with the authentication system and map coordinate code*

***Let's Go!**—Thorough preparation ensures that no discrepancies are overlooked. The payoff is a smooth operation.*

RIDE A SLICK SHIP...

CWO-3 Sidney C. Cowan

to Hell...

and Back

This article was written the night of 16 November 1965, after the battle of Ia Drang Valley ended. Each incident mentioned in the story actually happened during this famous battle by the 1st Cavalry Division. Some names were changed to prevent identity of wounded aviators.

THE SMELL OF sweat is high in the hot briefing tent. Twenty stern faces watch the briefing officer move his pointer across the route to be flown in today's assault. You can feel the tension mount as flight positions are called off. A sigh of relief is sensed from those who have "lucked out" and missed the first wave.

These 20 faces belong to the aircraft commanders assigned to airlift troops of the 1st Cavalry Division into one of the many "hot" LZs in Vietnam. . . . These are the men who fly the slicks.

What is a slick ship?

To the ground soldier it is a helping hand. It carries him into battle refreshed and ready to fight. It resupplies him with ammunition, water and rations. When he has fallen, then the slick becomes wings of mercy. To unit commanders of the flying horsemen division, it has the most beautiful, ugly sound in the world. Her whining engine and popping blades mean precious cargo. She

has become famous all over the world.

What is the slick to the men who fly her?

In Vietnam the word "slick" means unarmed. She was born in Fort Worth, Texas, as a UH-1B helicopter, lovingly called the "Huey." As the war required that some of the Hueys be armed with rockets and automatic weapons, it also required the unarmed Huey. Her job: to carry a load.

To the pilot she is a graceful, forgiving, overloaded, underpowered, ugly brown lady. She is loved and pampered like a mistress. Like all women, she must be handled by a man. Her pilot and copilot seats have been armor plated to assist in maintaining this control. Her doors, upholstery and headliner have been removed to allow more payload. Now stripped for battle, she demands attention.

Twenty slicks have been assigned as five flights, four each. Aircraft commanders have briefed their crews on the operation.

Today we will be Yellow Four. As Yellow is taking the lead elements into the LZ (landing zone), the gunner automatically begins a double check of his weapon. The pilot sets the mission frequency on the slick's radios as the crewchief, already tired from grooming her most of the night, takes another look at the big T53 turbine engine.

Troop pickup zone, called "Falcon," is located 10 miles south of Plei Me. LZ "X-Ray" is our destination. This area is infested with a hard core Viet Cong regiment. Our cargo of deadly infantry must land exactly 15 seconds after the lifting of friendly artillery. Flight route and timing have been memorized by the flight commanders. All is ready.

The roar and sight of 20 slicks in heavy left echelon is beautiful to witness from the ground. But from the cockpit this sight will make your heart stir. The slicks fly slowly but proudly. She had wonderful control reaction and will "hang in" as smooth as a rose petal. Her blades will "pop" back in anger if you try to overcontrol her. Sensitive but determined, she deserves her place in the sky.

Wings Of Mercy—*Troops carry wounded to a UH-1 for evacuation to a field hospital where highly trained medical personnel take over*

Loading at Falcon is accomplished in a matter of seconds. Each ship load has been given a color and number corresponding with the flight's position. The faces of the infantry reflect, without a doubt, that they know "Charlie" is waiting.

The pilot sits waiting in the dim light of the cockpit, his eyes following the second hand on the instrument panel clock. "Yellow Flight, bring 'em up to operating rpm" the voice from the radio orders. The command is relayed, in order, to the remainder of the flights. Twenty engines spring to life, ready to lift the cargo into the sky.

Suddenly, your mind begins to recall the last assault, and the one before that—when the Old Man's crewchief got it in the neck— the night mission that Captain Burns from Charlie Company had his left arm split open as a round tore the door apart—the sunny morning that aircraft 781 had her whole rear end shot up—blood running freely on the floor of Captain Miller's ship on a day, it seemed, the world was red.

It has been said that an aviator's bad luck is another aviator's meat. What did he do when that moment came? Can we now learn from his mistakes? What will I do when my moment comes? Will I fail my crew? These questions ride day and night with aviators the world over. Now, over here in this hot stinking jungle, something more has been added: If we survive the crash, can we live in the Viet Cong infested terrain?

The slicks move heavily towards the LZ; skids slap at treetops as pilots maneuver to stay close to their wing man. All eyes search the ground for a sign of Charlie. This speed and treetop level flying are our only defense on short flights. The gun ships (armed Hueys) fly overhead, waiting for the first sign of enemy fire. As Charlie has learned to fear

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CWO Cowan is with Co A, 229th Assault Helicopter Battalion, 1st Cavalry Division (Airmobile).

After the artillery lifted, the old man's voice came on the radio: "Pick your spot and good luck."

these awkward looking birds, with their rockets and machineguns hanging out, so have the men who fly the slicks learned to love them.

Artillery has lifted. The old man comes on the radio, "Pick your own spot and good luck."

Yellow One went into a flare as his tail boom cleared the last row of trees around the LZ. In turn, like dominoes, all of the slicks pointed to the sky.

Fifty feet above the ground all hell broke loose. Deafening sounds of an automatic weapon filled the cockpit. Our radio came alive with the voices of pilots reporting fire. Yellow Four shuddered and yawed hard to the right. She had been hit bad. A high pitched voice came through the radio headset—Lieutenant Baker had been hit in the head.

Yellow Two had unloaded her troops and started leaving the ground when she fell hard against a tree, her main rotor blade snapped like a match stick. Three GIs fell on the skids of the Old Man's ship. For them the battle was over. One wounded man was hauled aboard as the major received word that White Flight was on final.

In The Attack—*UH-1s pour into a landing zone with fresh troops in an operation against the Viet Cong*

"Let's get the hell out of here" came an unknown voice over the airways. Crewmembers from Yellow Two were onboard Yellow Three and we were on our way home. Pungent fuel odor filled the aircraft. We reported to the flight leader that Yellow Four had received unknown damage and was losing fuel. The Old Man decided to land at Falcon and make a damage check of all aircraft.

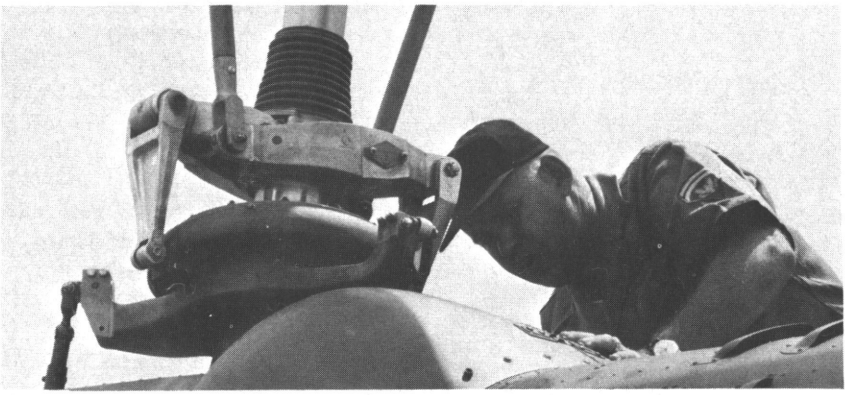
Yellow Four had made her last landing for quite awhile. Her stabilizer control rod had been badly damaged and the fuel cell was punctured. She had taken seven rounds and remained in the air.

The large multiengine Chinook hovered over Yellow Four as she was prepared for the trip home. I will never forget how proud she looked, hanging beneath the flat belly of big brother Chinook, as if she knew she had given her best.

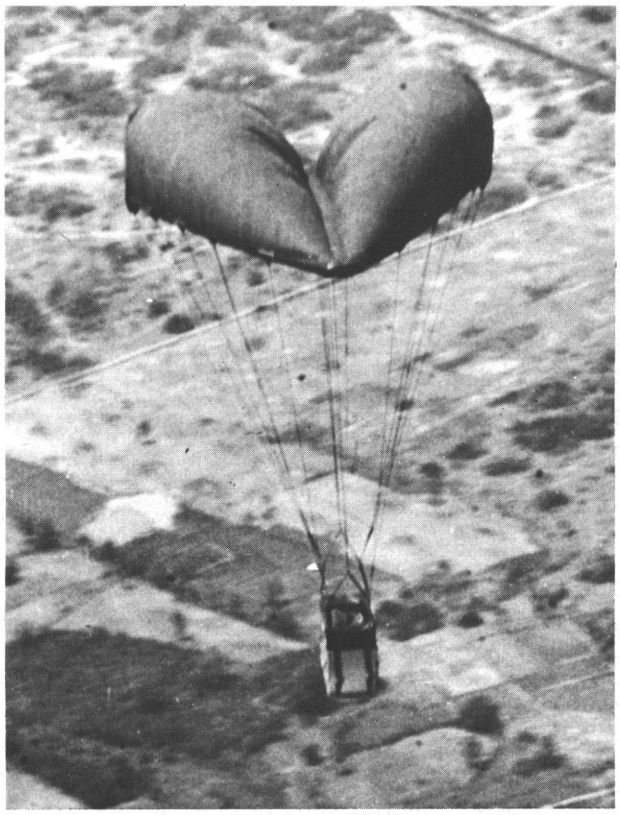
The major smiled as he reported that the LZ was secure. Our mission had been successful. Now more troops and supplies could be delivered with little danger.

Now that the sun had disappeared behind the tangled trees the operations tent had cooled down some. Flight crews now shed their flak jackets and flight gear, sat around retelling stories of today's mission to the eager ears of those who had missed this one. Yet all eyes stole secret glances at the hand of the operations officer as his grease pencil filled in names for tomorrow's mission.

Another Day—*The mission no sooner ends than a maintenance specialist begins preparing the Huey for the next day's action*



GLIDER DELIVERY OF SUPPLIES



William H. Smith

IMAGINE A situation where a combat unit, deep in enemy territory, needs supplies badly and every method of delivery available to the Army is impossible to use. You can't make delivery by land because the terrain is bad or enemy troops are too strong. You can't come in by air because it's a dark night or there's heavy cloud cover. You can't even drop the supplies by parachute because you don't know the exact location of the friendly troops, or the enemy would shoot you down as you passed overhead.

How would you make delivery?

If you say that delivering the supplies is impossible, you are probably right—for the moment at least. But soon you may have a simple device for use in such difficult delivery cases.

It's called a Precision Drop Glider (PDG), developed by the Ryan Aeronautical Company. Ryan has been working on this concept for a long time and now feels ready to go into production. They have been given a contract for six PDGs expected to be delivered in June or July of this year.

These first six gliders will be used for testing. If they do what the Army wants, Ryan will make 25 more. These will be used for military potential testing and some may be turned over to combat units for troop tests.

Precision Drop Gliders have flexible delta wings. These wings are made of plastic coated material attached to a keel and leading edge member to form an arrow or V-shaped kite-like surface.

Wings fold into a compact package similar to a parachute pack and are attached to a cargo container. After being launched from an aircraft the glider wing automatically unfolds itself, homes in on a ground transmitter and guides itself in.

Gliders being built under this contract will be able to carry a cargo of from 300 to 500 pounds. They can be dropped from a helicopter or airplane at speeds up to 150 knots (IAS) at altitudes from 500 feet to 30,000 feet.

Command control and guidance system for the PDG is the radio receiver 242R 1001 and transmitter PN 542T 1001. That part of the guidance system housed in the glider has enough battery power to operate for 45 minutes.

Gliders will be self-controlled until within 200 feet of the ground station. At this point an operator takes over and guides it in the rest of the way. For this purpose, the operator uses a control that attaches to a standard PRC. When the control unit is not attached the PRC can be used in its normal manner.

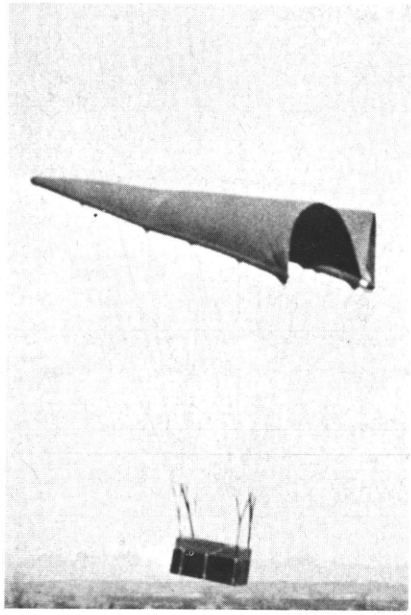
Precision Drop Gliders need to be very simple, inexpensive, and rugged. According to the contract

a reliability factor of 80-90 percent will be accepted but 100 percent is desired.

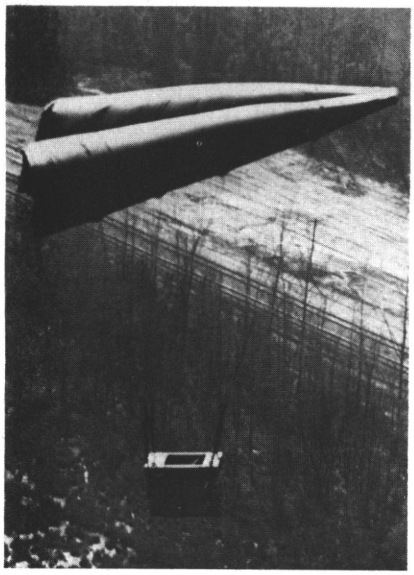
Simple construction precludes long or complicated procedures for getting the equipment ready to operate. Parts will be interchangeable. Those costing less than $25 will be simply thrown away when they break instead of trying to repair them. All components will be removable with tools in the organizational mechanic's toolbox.

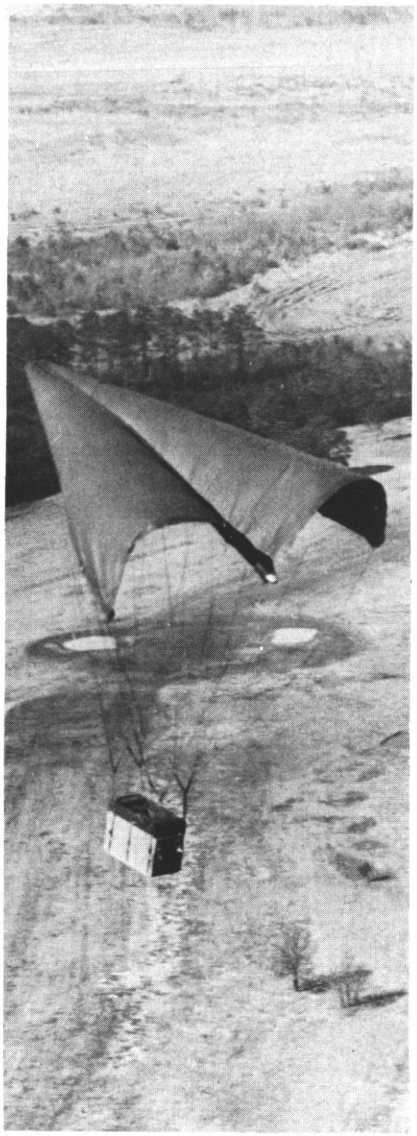
TOE maintenance personnel will handle repairs on PDGs. Maintenance personnel will require skill levels similar to that of parachute riggers and electronic repairmen.

Equipment must be able to operate in climates anywhere in the world. For this reason the manufacturer tested its prototypes in foreign countries. They were damp heat tested in Thailand and dry heat tested in Iran. On one occasion in Thailand they were used to deliver rice to an isolated village.

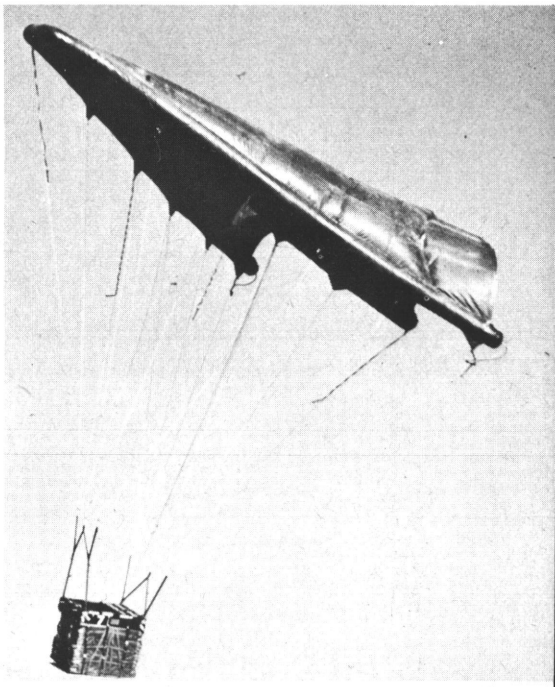


Gliders can be dropped from helicopters or airplanes at speeds up to 150 knots



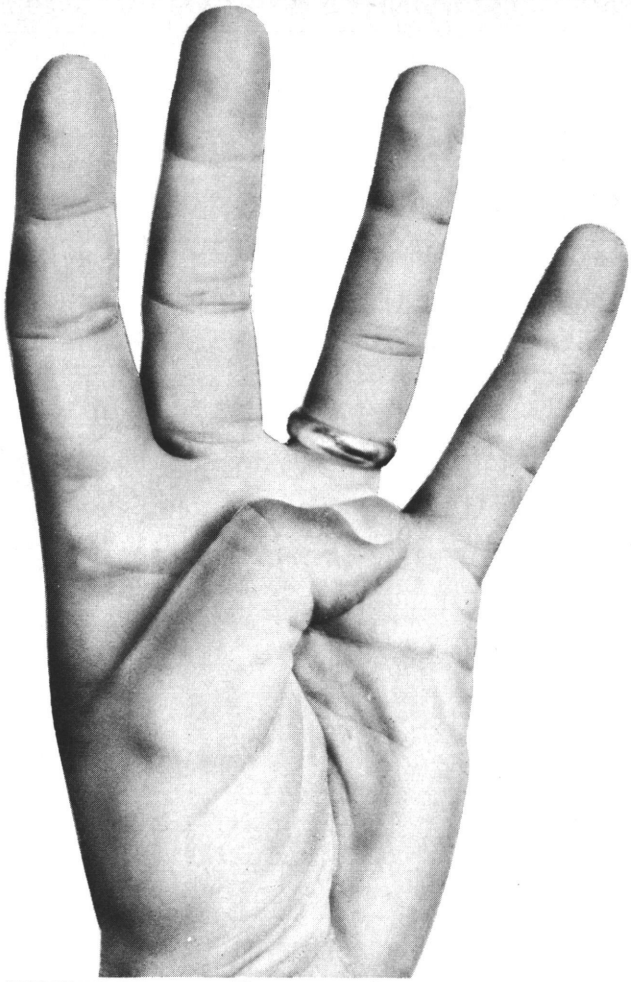


After being dropped from an aircraft, the glider's wings unfold



Gliders of this type can carry up to 500 pounds of cargo

A series of events that happened in Vietnam have made a difference in the home life of this aviator—TODAY HE IS AN "OUTCAST."



WOULD YOU BELIEVE 4 FINGERS?

Captain Donald J. Mascia

BEFORE MY departure to Vietnam my life was happy and complete. Solidarity was the keyword in my family.

Now, after my return from the "mildew country," I live a very desolate existence. My wife—by laws alone—won't speak to me; she serves all my meals in the spare bedroom on the desk. My two daughters ignore me like I have the plague; close relatives don't telephone or write anymore; and my neighbors have built high fences around their yards.

Allow me to give you the complete details, and then you judge if my actions are justifiable.

For 10 months in Vietnam I flew the Otter—low, slow and reliable. An IP for 7 months with a flawless record, I was the hallmark of the company. A normal checkout day consisted of innumerable landings and takeoffs with aviators with varying degrees of proficiency. My precision instruction, even with the weakest student, was like, or compared to I've heard, a space age solid state tuner.

Whenever I departed from the routine of checkouts I flew with Orville—we made an impeccable team. Rumors about our adroitness and expediency spread like wildfire.

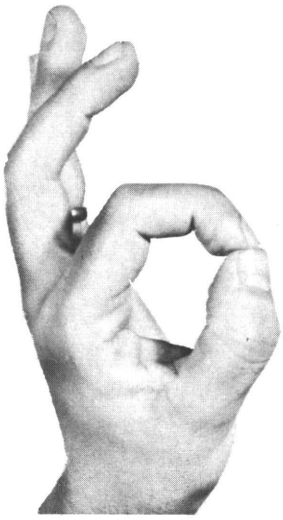
Otter operations was constantly answering queries about our flights and manifests. The troops loved to fly with us and normally thronged about the aircraft prior to our departure, hoping there was an extra seat.

We were performers in the sky. Although not a word was spoken each move was a smooth, coordinated, preplanned action. Passengers, awed by the virtuosos in action, strained in their seats trying to view the gesticulations taking place in the cockpit.

The infamous day happened like this: our mission was to return to Nha Trang after RON

Capt Mascia is with the Command and Logistics Branch, Dept of Tactics, Ft Rucker, Ala.

Although a word wasn't spoken, each move was a smooth, coordinated, preplanned action. Then it happened...



in cultural Saigon. Departing operations we observed a large crowd gathering around our aircraft. Upon reaching the aircraft we modestly waved and smiled to the cheering fans.

Sparko—the crewchief—loaded the passengers as we made our ingress into 707. Sparko's signal of thumbs-up indicated he had completed the perfunctory preflight and our fuel load was full, full, full.

I adjusted the right seat. Orville snickered and, making a quick mental computation, gave me the signal, i.e., 4 fingers—400 pounds over gross weight. No sweat! We enjoyed conveying additional personnel, and increasing our cargo made the charts look better.

Orville chuckled and gave the Pratt & Whitney a few quick primes, hit the switch, and instantly she coughed into action. I put my visor down—the signal

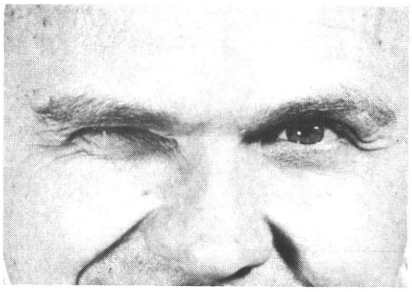
to Orville that we were cleared to taxi, runway 24. Orville's quick mag check at the yellow line told me the runup was complete. I pumped down climb flaps. Orville knew we were cleared for takeoff. Takeoff was rather lengthy that day, about 2,800 feet, but finally Old Reliable reluctantly became airborne. I adjusted the prop; Orville winced and reduced power; I retracted flaps. Orville was cleared for a right break.

The awed passengers realized that with any other crew they would still be on the ramp. Even though Orville had not donned his crash helmet, everything was perfect—without a word—without the slightest murmur.

I adjusted the flap selector. Orville grinned and leveled at 3,000 feet. A smile from Orville, and I had the controls with prop reduced to 1800 rpm. Orville reduced power to 28 inches.

Approaching Nha Trang I put my foot on the ignition analyzer and Orville graciously accepted control of the aircraft. Breaking the silence for the first time since takeoff, I called for an ADF approach. I reached for the Jepp, held up 4 fingers, and Orville understood we were cleared for an instrument ADF approach—estimated ceiling 400 feet.

We hit the beacon, I coughed; Orville turned to a heading of 070°, reduced power and smiled; I had the controls and adjusted prop to 2000 rpm. I raised my visor and Orville had the controls, turning to a heading of 250°. Orville smiled, I had control of the aircraft. The ADF needle swung —the signal—Orville again had the aircraft. Reporting beacon inbound, a revised weather report indicated ceiling was now 100 feet below minimums. No problem. In the event we didn't break out at 300 feet (minimums were 400 feet) we would proceed east for 12 minutes and let down over the South China Sea.



I adjusted the carb heat and Orville applied 30 inches—missed approach. Orville smiled and again I had the aircraft with power reduced. The field was in sight.

Orville winked; I turned base, reduced power, set climb flaps, and moved the flap selector to the

Checklists now adorn objects which require more than one step . . . but they just don't understand

up position for expeditious retraction of flaps upon touchdown.

Orville donned his crash helmet—the last signal—and made his first oral sound of the flight. My duties were finished and I removed my headgear.

I turned and waved to the passengers. They loved it—another flawless performance.

The entire flight was without a word to the pilot—without a checklist—without wasted effort. All Orville had to do was plop the beast down on the overrun and make the first taxiway.

Suddenly, without a signal, Orville pumped the flap handle. We started to fall like 8,220 pounds. Orville applied power. The powerful Pratt & Whitney Wasp coughed and was silent. The right gear hit a small mound and the empennage swung violently to the left. Taking two barbed wire fences, posts and all, was no obstacle to the Otter. We finally ground to a halt after flipping over.

Instantly, the crowd was there. They couldn't believe their eyes: the two perfectionists were in the cockpit. Within minutes the company commander was hanging on the curled prop, crying like a baby. The executive officer stood like a piece of marble, looking incredulously at the twisted airframe.

The accident board's voluminous report concluded that Orville, in an attempt to land short, started to put down land flaps but with the flap selector in the up position, the aircraft flaps retracted and the aircraft went into a stall configuration. The Wasp coughed and remained silent because the rear tank was empty. The fuel pressure warning light was inoperative and not found in the preflight. No checklist—no preflight—over max gross. I was sure my flying days were over.

Since that irreparable time I have made the metamorphosis from a second rate aviator to a first class checklist-using aviator. Some even say I have a tendency to be "loquacious" in the cockpit.

At home I have acted accordingly: I have attached checklists to the stove, bicycle, tricycle, car and other sundry objects which require more than one step. Daily my family is chastised for not using the required checklists. They just don't understand!

But I still continue to rant, rave, yell and holler, "Use your checklists!" I've warned them all: if they don't use their checklists, I'll spank them from the beginning of their exterior check to the end of their after-operation check.

So am I wrong when I holler, scream and yell, "Use your checklist"?

. . . 9, 10, You're Out—*Barbed wire fences, posts, and the like proved no match for the rampaging Otter, but finally the Ole Gal lurched up and over onto her back. It was all over for her, but not for me*

"...THERE WAS NO POST-CRASH FIRE"

there are a number of ways of preventing postcrash fires, but the most promising and the most practical has been that of fuel containment . . .

Major Robert W. Newton

NOW THAT OH-13G, H, and S helicopters have been modified with the new crash resistant fuel cells, it will be of interest, especially to you who fly OH-13s, to see if these tanks are doing any good. Have they eliminated or reduced postcrash fires? Can similar techniques be applied to other aircraft?

USABAAR studies on accidents involving postcrash fires in helicopters identified the OH-13G and H as having a higher rate of postcrash fires than other helicopters. A typical example of the type of accident that occurred is an OH-13H accident that happened 3 years ago. A pilot hovered his OH-13H across an open field to pick up an observer. He set the helicopter down on a narrow dirt road, with the left skid positioned on a slight rise or bank and the right skid on the road. The bank was 18 inches higher than the road. Mast bumping occurred just before the right skid touched the ground. As the pilot attempted to level the helicopter and come to a hover, it moved backward, the right skid dug into the ground, and the helicopter rolled over on its right side. It immediately burst into flames.

The observer escaped, but could not get close enough to assist the pilot. In a few seconds the pilot exited through the bubble which was enveloped in flames. He sustained second and third degree burns on his face, hands, arms, and back.

Numerous other similar accidents occurred in the past. USABAAR conducted a series of three crash tests on OH-13s at Fort Rucker in January 1964. One of the helicopters was equipped with standard saddle tanks, one with wrapped tanks, and one with a completely new tank made of a material similar to that used to wrap the tanks. These tests simulated as close as possible the accident described above—a rollover type of accident in which neither vertical nor horizontal forces were present. The results of these tests and the recommended action to be taken appeared in an article in the April 1964 issue of the DIGEST.

These tests showed that the fires were caused by the swash plate making contact with the fuel tanks while the helicopter was turning over and the rotors were striking the ground. As the tanks were ripped open, the fuel was atomized by the strong air currents, and an ignition source was contacted by the

NO POSTCRASH FIRE

. . . tests showed that the fires were caused by the swash plate making contact with the fuel tanks . . .

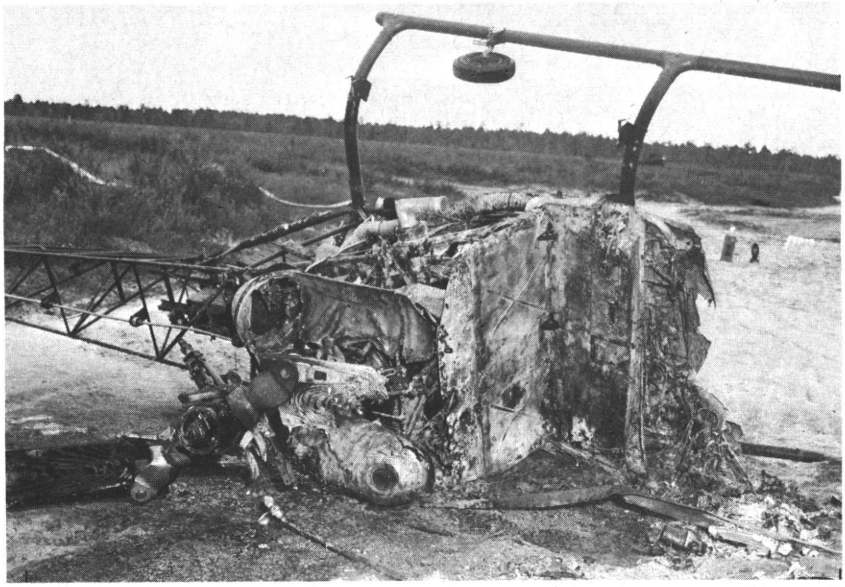


Photo shows the helicopter after it burned

atomized fuel. In the case of the test with standard saddle tanks, this was an exhaust stack. A very large instantaneous fire resulted. USABAAR recommended that all OH-13 aircraft equipped with saddle tanks be modified with either the wrapped tank or what we called the nonmetallic tank. In the USABAAR tests, only the helicopter with the standard tanks had a fire.

There are a number of ways of preventing postcrash fires—fuel jelling, breakaway tanks, fuel emulsion. But the most promising and the most practical method has been fuel containment—find a good place to put the fuel cells and then make sure no fuel spillage occurs during an impact survivable accident. In the case of the OH-13, location of the fuel cells was poor, but couldn't be changed. The solution was to find an economical way to contain the fuel without adding a lot of weight.

Two Bell Helicopter engineers, George Rodriguez and Les Spencer, hit upon the idea of wrapping a standard tank with four layers of continuous weave nylon cloth that has been impregnated with a polysulfide rubber binder. It was found that with such a wrapping, the tanks were extremely difficult to puncture. Try it on a salvaged tank someday.

Another concept was to make a completely new tank from the nylon material. This tank had a bladder installed and was called the nonmetallic tank. These tanks had the disadvantage of requiring extensive and time consuming tests in order to certify them against existing FAA and Mil Spec requirements.

In May 1964, AVCOM decided to modify all OH-13S helicopters with a larger fuel cell and to include wrapping the tanks as recommended by USABAAR. These modification kits were obtained on an expedited basis for the S models because the tests were run by what was then the 11th Air Assault Division. The new tanks were installed during September and October 1964. On 25 October an OH-13S equipped with the new tanks crashed. The wrapped tanks prevented a postcrash fire.

The OH-13S was part of a recon team preparing to depart on a mission and the pilot was at a 3-foot hover, waiting for his team leader to depart. After the team leader departed, the pilot made a right pedal turn. The right skid hit a terrace and the helicopter started to roll over to the right. The pilot applied left cyclic and, as he states, "The next thing I knew, the aircraft had settled to the ground, the main rotor had stopped, and the top of the bubble was in my observer's hands." The pilot turned off the engine, which was still running, and exited the aircraft with the observer.

By early 1965 all OH-13S models had been retrofitted with the crash resistant tanks, or had the tanks incorporated in production. Incidentally, all of the TH-13Ts were produced with the wrapped tanks. Bell Helicopter also decided to start wrapping all production commercial models of the OH-13. The S model has not experienced a single postcrash fire in an impact survivable accident since being modified with the wrapped tank. During this same time period, the G and H models experienced

Photo shows the aircraft after the accident. Note that both drag struts to the main blades are broken, indicating that the main blades struck the ground very hard

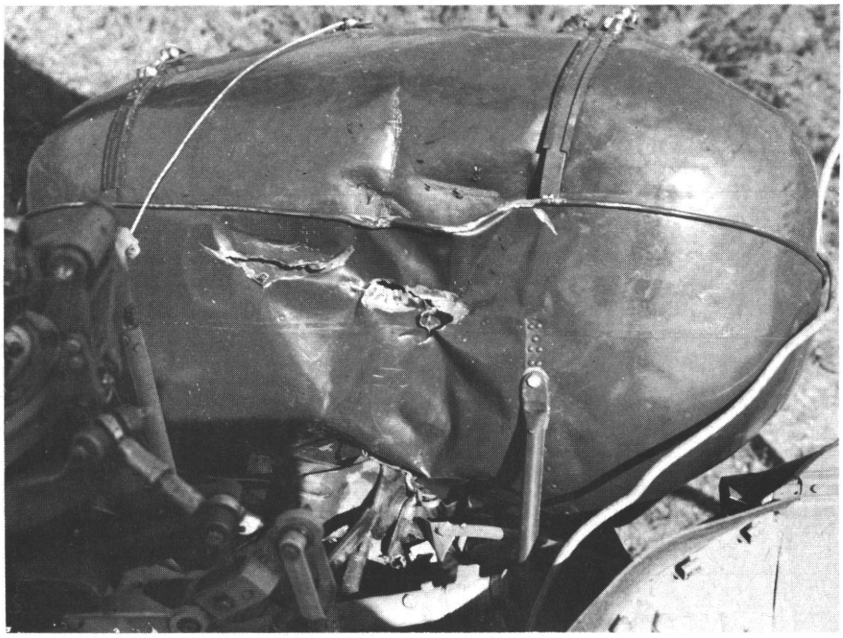


Photo of left fuel cell shows damage to cell caused by swash plate as it rotated into fuel cell when the main rotors struck the ground. Note that the fire shield has two large rips. If the fuel cell had not been wrapped, similar rips would have been made in the fuel cell. As it was, the cell only received a large number of dents, most of which can be seen in the fire shield

a number of postcrash fires that could have been prevented had they been modified.

The modification program for the G and H models should be completed by the fall of 1966. The problems involved in modifying these models were more complex than the S model. Since larger tanks had to be included in the S kits, new tanks were bought. These were wrapped by the manufacturer. For G and H models, the modification included only the wrapping of existing tanks. The problem was how to wrap tanks that were installed on operational aircraft without disrupting their flying program. A joint effort between USABAAR, AVCOM, AADMAC, and those units with the aircraft resulted in a very quick and novel modification program. Arrangements were made to fly kits to each unit with OH-13 helicopters on a prearranged schedule. The wrapped tanks were left with the unit and the old tanks picked up and flown back to AADMAC for wrapping. The Army had about 100 sets of tanks in the supply system which were used as working spares. The program started in December 1965 and by March 1966 all aircraft in CONUS had been modified, as well as 60 in Europe.

It would have been impossible to accomplish the modification of the OH-13G and H helicopters by normal means, unless a new set of tanks had been

bought for each aircraft. By using a "team" concept, the program, once decided upon, was accomplished in a short length of time at a big saving in money to the government.

Research programs for development of crash resistant fuel cells have been conducted for a number of years. USABAAR conducted the tests on the OH-13 because the general research programs had nothing in sight to solve the problem for the OH-13. A recent series of tests conducted under direction of the United States Army Aviation Materiel Laboratories (Av Labs) disclosed a type of tank having *outstanding* crashworthiness features. This fuel cell is very similar to the OH-13 nonmetallic tanks in that they are constructed from nylon but have a slightly different bladder. Here is a description of one of the tests conducted by AvSER at Phoenix, Arizona.

A C-45 had two of the "tough wall" tanks installed in the right wing. The aircraft was run down the track at 100 knots. There were two poles 18 inches in diameter lined up with the two fuel cells. As the poles were contacted, the outboard tank was torn completely out of the wing as the pole cut the wing in two at this point. The inboard pole cut through the wing until it drove the main spar into the fuel cell. At this point, the wing tore loose from the fuselage at the wing root. *There was no leakage from either tank.*

These tough wall tanks are light and somewhat flexible. They recently underwent a one-year program to qualify for use as fuel cells. Those tests included self-sealing requirements, FAA requirements, and crashworthiness requirements. Complete test results are not available at this time, but the tanks should have excellent application in such aircraft as the CH-47, CV-7, and the AAFSS.

Before bringing the story of the postcrash fires in the OH-13 to a close, here are the circumstances of the latest "save" that occurred in Vietnam a few months ago.

An OH-13S had been on a night recon. It was refueled and was then to hover to the parking area. The pilot was not using his landing lights and was being guided by a man using wands. The pilot glanced at the instrument panel to check the rpm, while hovering slowly forward. He did not immediately see the wands when he looked up. When he did see them, they appeared to be moving to the left. Actually, the aircraft was hovering sideward to the right at this time. The right skid hit the ground and the aircraft rolled over, coming to rest in an inverted position. No fuel spillage occurred and there was no fire. To quote a statement made by the reviewing official, "Photographs 1 through 4 re-emphasize the importance of crash resistance fuel cells on this aircraft. These cells did not rupture and there was no postcrash fire."

Helicopter rolled over and came to rest inverted. Note the large dents in the fire shield.

THE NUMBERS RACKET

Can we really prevent accidents and do our jobs the way they should be done with numbers and rates?

Pierce Wiggin

"OUR ACCIDENT RATE is the lowest in the command!"

"Yes, but we have projected a 20 percent rate reduction for next year. This will put our unit ahead!"

Sound familiar? All too often, these and similar comments dominate the talk at aviation safety meetings. We speak in numbers and rates, showing mountains of statistics in charts, graphs, and slides. We compare our numbers and rates with those of other units and commands, projecting lower numbers and rates for the months ahead. For what? Can we *really* prevent accidents and do our jobs the way they should be done with numbers and rates? Commanders and safety officers who rely on numbers of accidents and rates to plan aviation safety programs are armed with the answers to only two questions: *what* and *how many*.

Unit A had a safety program built around numbers and rates. When he took command, its CO ordered an immediate all out effort to reduce the accident rate. Looking at the statistics compiled by his aviation safety officer, he found that three

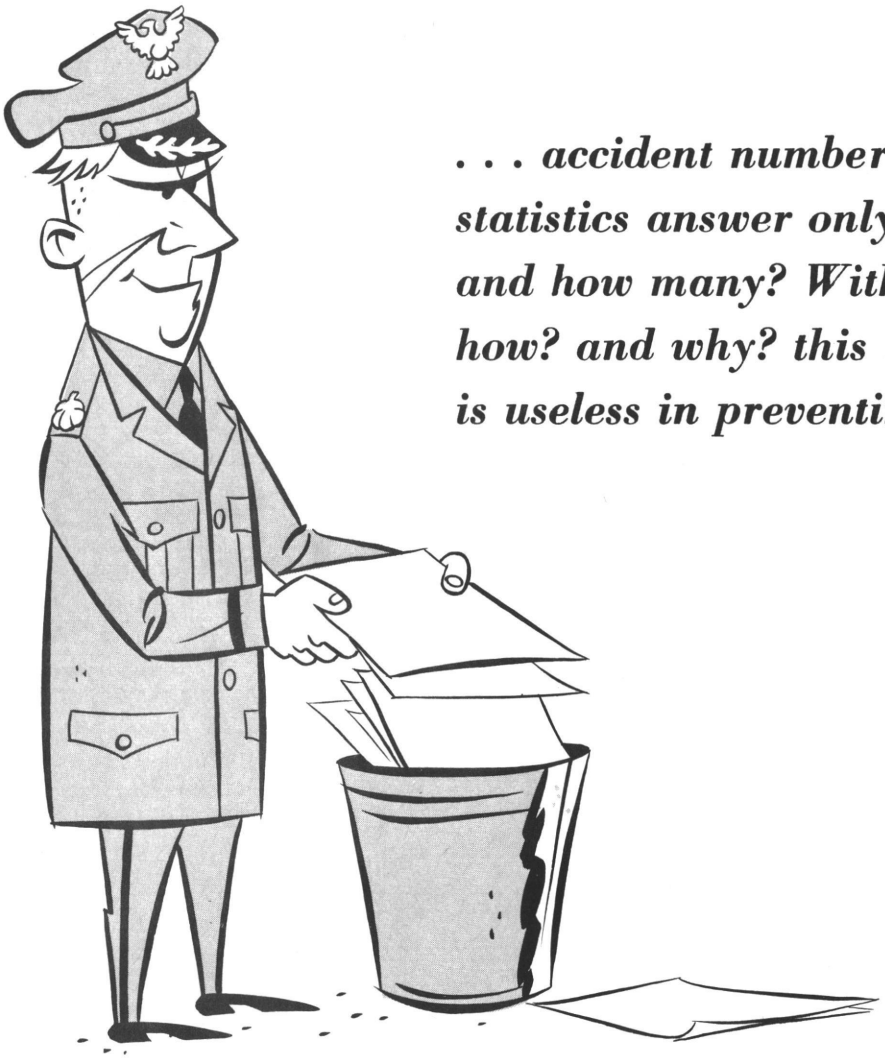
THE NUMBERS RACKET

fixed wing landing accidents happened during short field practice at unprepared strips. One rotary wing accident happened during a practice autorotation touchdown with a qualified IP aboard. Another chopper hit a tree during a confined area approach, and a third fell through on short final of a mountaintop approach.

Unit A's CO took immediate action. He closed all unprepared strips, banned practice touchdown autorotations and confined area practice, and limited mountain flying to required missions flown only by his most experienced instructor pilots. These actions brought an abrupt halt to unit accidents and this was proudly reflected by the graphs and charts posted on the walls of the safety office. It was also loudly proclaimed at the monthly unit aviation safety meetings where the zero rate was compared to the higher rates of other units in the command.

Of course, there were a few mishaps, even with the restrictions applied. An O-1 pilot landed long on the main airfield, ran off the end of the 3,000 foot runway, and nosed over. An OH-23 pilot landed on the skid heels and rocked forward hard enough to flex a main rotor blade into the tail boom, and a U-6 pilot taxied into a parked UH-1. In each case, the unit was able to shave the repair manhours low enough to avoid accident classification. The mishaps were recorded as incidents and forgotten.

When the command held its annual aviation safety meeting in the fall, Unit A was awarded a handsome safety plaque. Its record of no accidents was pointed out as a shining example for all units to follow. At the rear of the cheering audience, the CO of Unit B quietly gathered and stacked the graphs and charts showing accident numbers and rates that were passed to him during the meeting. He placed them in a folder, walked out of the room and dropped the folder into a trash can.



. . . accident numbers, rates and statistics answer only the what? and how many? Without the how? and why? this information is useless in preventing accidents

Unit B's CO took command at the same time and in the same geographical location as the CO of Unit A. Unit B had an accident history that was identical to that of Unit A. There the similarity ended.

After ripping all aircraft accident statistical charts from his office walls, the CO of Unit B reviewed the accident reports for his unit's six accidents. He found that the aircraft accident investigation boards had done an excellent job in describing the circumstances and pinpointing accurate cause factors for each accident. The reports were well documented with evidence to support their findings and recommendations.

He found that one aviator had ground-looped an O-1 on an unprepared strip while trying to salvage a landing from a bad approach. A check of the aviator's flight records showed he had flown only helicopters for the previous 6 months. The flight which resulted in the accident was his first in an O-1 and his first fixed wing short field approach in nearly a year.

Another aviator had stalled a U-1A on short final and landed hard, driving the left main gear into the fuselage. The same aviator had a similar mishap the previous month which resulted in only incident damage. He had been given no dual instruction or practice approaches in the month that separated his incident from his accident.

A third aviator had taxied into a hole on his way to take off from an unprepared strip. No ground reconnaissance had been made.

An OH-13 pilot had flared too high and pulled pitch too soon during a practice touchdown autorotation. The helicopter landed hard and rolled on its side. The IP who was aboard at the time of the accident had been appointed IP only because he had the highest number of helicopter flying hours. He had no other qualifications to indicate he would make a suitable instructor.

A CH-34 engine failed over heavily wooded terrain. Although the pilot did an outstanding job in getting down without injury to himself or his passengers, the helicopter was so badly damaged it had to be salvaged. The MWO for installing an engine chip detector and cockpit warning light had been carried forward in the records for more than a year without compliance.

The unit's sixth accident happened during a maintenance test flight when a UH-1 engine failed shortly after takeoff. Engine failure was caused by an unsecured fuel line quick disconnect coupling which opened and caused fuel starvation. The unsecured coupling was overlooked by the mechanic who installed the fuel filter, by a maintenance inspector, and by the pilot. The pilot failed to recognize engine failure, let his rotor rpm decay, and dropped in hard, spreading the skids. One main rotor blade sliced through the tail boom. Like the OH-13 IP, this aviator was appointed a test pilot with little regard for qualifications other than flying time.

After reviewing the accident reports, Unit B's CO called in his aviation safety officer, relieved him of all other duties, and assigned him the task of conducting an immediate aircraft accident prevention survey, with emphasis on the cause factors of the six accidents. While the survey was in progress, he flew with the operations officer and all the designated IPs. He toured the maintenance area with the maintenance officer and queried him about the mechanics' qualifications and on-the-job training. He visited the flight surgeon, the control tower, and the POL area.

Armed with accurate cause factors and complete information about the unit's past accidents, the discrepancies brought to light by the aviation safety officer's survey, and the notes he made during his visits to all unit activities, he planned and launched a training program designed to improve every unit function. He established a standardization board with himself as chairman and began a program to standardize all unit IPs and aviators. In place of restrictions, he ordered more training.

He organized an enlisted safety council and paired his most experienced men with the inexperienced for continuous on-the-job training. He insisted that every unit member learn to do every task better. During his first 6 months, Unit B had two more accidents. Both could have been classified as incidents by fudging a little on manhour requirements, but he insisted they be fully investigated and classified as accidents.

Shortly after he returned from the command aviation safety meeting where Unit A was lauded for its accident record, both units were ordered into the field for a training exercise. The two units were given identical missions in support of ground forces.

Unit A was totally unprepared for flying from unprepared strips under field conditions. Three aircraft were lost to accidents in the first day of operations. A fourth was lost on the morning of the second day. Three other aircraft were grounded for maintenance and the unit commander had to refuse several requests for aviation support. When word of this reached command headquarters, the unit was ordered out of the field.

Unit B excelled in every function. Its aircraft and pilots were ready to go on a moment's notice. It flew every mission requested and completed the exercise without an accident.

THE NUMBERS RACKET

". . . some of us shop for safety the way women shop for shoes. We find something that looks good, then buy it, with little thought for whether it fits or pinches our aviation operation."

Writing in the March 1964 issue of the ARMY AVIATION DIGEST, Colonel Robert M. Hamilton, former director of the U. S. Army Board for Aviation Accident Research, said: "Some of us shop for safety the way women shop for shoes. We keep trying on safety programs until we find something that looks good. Then we buy it, with little thought for whether it fits or pinches our aviation operations.

"Like the ladies, we wear our safety with great pride while anyone is watching. But let us get in the privacy of our own bailiwicks, and off come the shoes and safety. We wiggle our toes and heave great sighs of relief. Now we can operate!

"Why does a safety program pinch? It pinches because we substitute *don't!* when we can't answer *how*. It pinches any time there are unnecessary restrictions.

"It pinches because we find ourselves in the same rut that automotive safety has been in since we started paving roads. Let a holiday weekend come along and the news services are filled with predictions of doom. They tell us how many will be killed and maimed. They do their best to scare us into staying home and if that fails, they tell us to 'Drive Safe!' Not *how* to drive safe, but 'Drive Safe!' In the meantime, we go on building 100 mile-an-hour cars for 60 mile-an-hour roads and 40 mile-an-hour drivers.

"Negative safety has never worked for cars and it damned sure won't hack it for aircraft. I defy anyone to show me how wearing a set of *dont's* can prevent accidents *and still let military aviation do its job.*

"We can't afford to let ourselves be scared by negative safety into staying on the ground. We can't afford to restrict our operations in any way. We need a positive safety program that fits—a program that will extend our operational capabilities."

RATES

Accident rates, past, present, and projected, are used to represent the number of accidents per exposure unit. What is an exposure unit? Step up and take your choice!

Some measure accident rates by passenger miles. If someone has a lower rate, you can buy a new airplane that will carry more passengers or change to seat miles and lower your rate. Some measure by hours flown. If you find this method gives you a high rate per exposure unit, you need only adjust the number of hours per unit and you automatically lower your rate. Some use a specified number of flights as an exposure unit, while others use a given number of landings.

On the front side of the rate equation is the word "accident." Again, you have a wide choice of definitions. Will you call an unplanned event involving damage to your aircraft an accident only if the cost of repair exceeds a certain dollar value? Will you call it an accident only if a major component has to be replaced? If so, how will you define major components? Will you call it an accident only if the manhours required to remove, repair, and replace damaged components and parts exceed a specified number? All of these, singly and in combination, are in current use for private, commercial, and military aviation.

With the choice of definitions and exposure units wide open, any comparison of rates between aviation activities using different definitions and exposure units becomes ridiculous. To illustrate in an aviation publication, the accident rate for general aviation was recently compared to that of a military service. The rate for general aviation was considerably higher, based on the same exposure unit (100,000 flying hours). But the definition of what constitutes an aircraft accident varied widely.

In the same publication, another article gave the definition of a general aviation accident: "Small aircraft accidents involving substantial damage (damage exceeding $300)." The definition of an accident for the military service involves a manhour criteria for "removal, repair, and replacement" of damaged parts. If the manhours do not exceed this criteria, the mishap is classified as an "incident," regardless of cost, and does not appear in the accident rate. The average cost of military aircraft incidents far exceeds the dollar damage accident classification for general aviation aircraft accidents. It's small wonder the general aviation accident rate was higher.

What happens when you compare the accident rates of activities using the same definition and exposure unit? Is this a valid comparison? *Only if the aircraft, operational environment, and mission are identical in every detail.* Flying observation helicopters in mountainous terrain, for example, is far more demanding than operating utility fixed wing aircraft over flat terrain between permanent air bases with paved runways. Can you reasonably expect both to maintain the same accident rate? Would you expect the same accident rate for heavily loaded cargo aircraft operating in the dust of unimproved pads and strips that you expect from the same aircraft operating from paved surfaces?

With Army aircraft operating in all possible environments of terrain and climate while performing a wide variety of missions in many types and models of aircraft, any comparison of accident rates is like comparing the birth rates of rabbits and elephants. Yet, many persist in comparing accident rates between commands and units, accepting the rates as accurate measures of performance or failure.

HOW? WHY?

Certain numbers, rates, and statistics play a vital role in aviation. They are used to design, maintain, measure, and control aircraft performance. They are used in logistics, flight planning, weather measurements, and in hundreds of other ways. They are used successfully in these ways because they provide the answers to *how* and *why*.

But accident numbers, rates, and statistics answer only *what* and *how many*. Without the *how* and *why*, this information is useless in preventing accidents through past accident experience, except for applying restrictions. Answers to *how* and *why* can be found only through a complete study of accident descriptions and cause factors. The knowledge that your unit had three pilot error, two maintenance, one materiel failure, and two supervisory caused accidents for an accident rate of 21.8 per 100,000 flying hours will not help you prevent similar accidents. You must know the complete details of *how* and *why* each accident happened. Armed with this information, you can apply corrective action that will assure performance without unnecessary restrictions, and with fewer accidents.

Positive safety is not measured in numbers, rates, graphs, and charts. It is measured by the job we do today and the job we're ready to take on tomorrow. In his article, Colonel Hamilton explained what we need for positive safety:

"We need to examine our equipment. Does it operate like it's supposed to? Is it reliable? Does it place the least possible demand on our crews? If we get a 'no' answer, we need to show *how* and *why* and get the equipment changed.

"We need to examine our training. Are we training our crews to do every part of every job the way it should be done? Are we standardized? If we're not, let's find out *why* and make changes.

"We need to examine our operations. Are we doing everything the way we should? Here again, are we standardized? If not, let's do something about it.

"We need to examine our facilities—our control towers, weather services, approaches, runways, taxiways, and the hundreds of other items that play a part in *positive* aviation safety.

"We need continuing surveys of our equipment, our people, and our facilities. When we get these, and when we get immediate corrective action, we'll have *positive* safety."

Failure to use correct emergency procedures resulted in a $94,000 accident which could have been prevented

"What do I do?"

A U-8D WITH A PILOT, copilot, and three passengers aboard, took off for a 2 hour cross-country flight.

Pilot: "Takeoff and initial climbout were normal. At approximately 8,000 feet, no. 2 propeller surged to 3450 rpm and remained there. I retarded the propeller control with no change in the rpm on no. 2.

"I then reduced throttle and this resulted in no change to the rpm reading. I attempted to feather the engine. It would not feather, but with the throttle closed, the rpm dropped to between 2700 and 2900. We altered our flight route and chose an airfield with a long runway for our destination.

"With the prop windmilling, we were unable to maintain altitude or safe single engine airspeed. A descent was started to maintain 90-100 knots. With 45 inches and 3200 rpm, I then brought the prop control for no. 2 out of feather into the detent position. With the throttle closed, the rpm went immediately to 3200-3300 rpm. I again attempted to feather the propeller, but was unsuccessful. The oil pressure and temperature on no. 2 were well within normal operating limits.

"The descent was stopped at various times in an attempt to maintain altitude. However, it was impossible. The oil temperature and cylinder head temperature began rising on no. 1 because of the increased load.

"No. 2 was brought out of the feather position with the same results, and another attempt to feather no. 2 was unsuccessful.

"With 48 inches on no. 1, the aircraft was descending at approximately 400 fpm. By this time it was apparent that we would not reach our destination and we selected a field for landing. The passengers were advised to brace themselves and I elected to land gear up because of the uneven terrain.

"I maintained a nose high attitude with power until ground contact. The airspeed was approximately 75 knots the last time I looked at it. The aircraft skidded to a stop approximately 90° from our landing direction. We turned the switches off and evacuated."

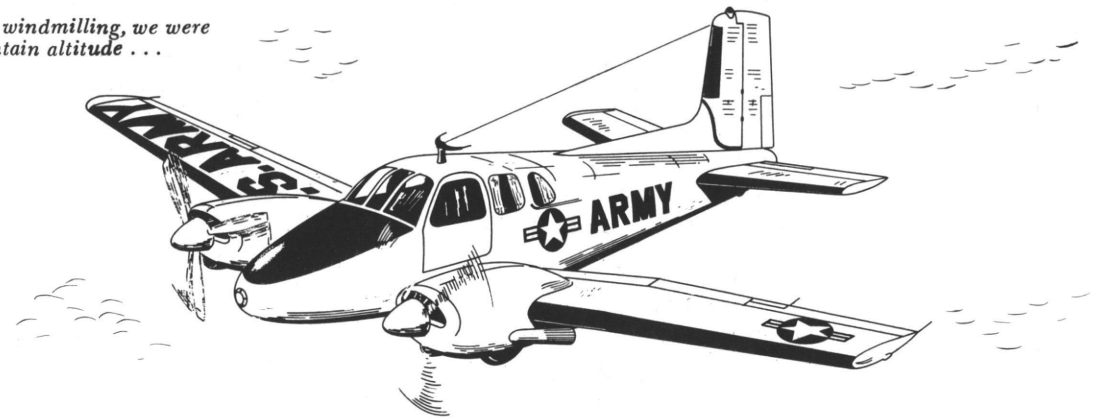
Question: "How much fuel was put into the aircraft at your point of departure?"

Answer: "I don't know."

crash sense

PREPARED BY THE U. S. ARMY BOARD FOR AVIATION ACCIDENT RESEARCH

With the prop windmilling, we were unable to maintain altitude . . .



Question: "Who checked the fuel?"

Answer: "I did not. Before we took off, I thought the copilot did and he thought I did."

Question: "Were you taught any emergency procedure for propeller failure?"

Answer: "There was none discussed, but I was given a standardization handbook which I had with me at the time of the accident. I gave the handbook to the copilot after I began experiencing propeller trouble and asked, 'What do I do?' "

Question: "Did you think that you were over maximum allowable gross weight prior to takeoff?"

Answer: "No."

Question: "Were you aware that shoulder harnesses were available to all occupants?"

Answer: "No."

Question: "What was the emergency procedure taught you for propeller failure?"

Copilot: "Treat it as a single engine procedure."

Question: "Were you aware that shoulder harnesses were available for your passengers?"

Copilot: "No."

Question: "Was there a -10 aboard the aircraft?"

Copilot: "I don't know."

Question: "What is your estimate of the weight of each of the occupants that was aboard the aircraft?"

Copilot: "The pilot, about 190 pounds; I weigh about 210 pounds; one passenger about 220 pounds, another passenger about 170 pounds, and a third passenger about 155 pounds."

Question: "Were you concerned with being overweight?"

Copilot: "I thought about it. I thought we must be close to maximum allowable gross weight."

Question: "When the pilot handed you the emergency procedure handbook, what did you do?"

Copilot: "I only looked at the single engine emergency procedure."

Question: "Did you look at the propeller failure emergency section of the handbook?"

Copilot: "No, just the single engine procedure."

Question: "Did you receive a briefing on emergency exits prior to this flight?"

Passenger: "No."

Question: "Did you receive any briefing at all?"

Passenger: "No."

Maintenance supervisor: "Upon removing the propeller governor cover from no. 2 engine, I found the propeller governor control cable was separated from the rod end bearing. The rod end bearing was still on the governor control arm, but the nut from the control rod was off the rod. The propeller governor is spring loaded to low pitch, high rpm. It will automatically return to this position if separated from the control rod. It is my belief that this is what happened."

Aircraft accident investigation board analysis: "The aircraft took off at an estimated total weight of 7,460 pounds, 160 pounds over maximum allowable gross takeoff weight. After attempts by the pilot to feather the no. 2 propeller were unsuccessful, the no. 2 engine was shut down, with the propeller in unfeathered position. Due to the windmilling of no. 2 propeller and the drag it created, maximum power was added to no. 1 engine.

"Continued attempts by the pilot to feather no. 2 propeller were unsuccessful. The aircraft continued to lose altitude and airspeed due to the drag created by the windmilling of no. 2 propeller. Approximately 15-18 minutes after the first indication of trouble, when the aircraft was at an altitude of approximately 100 feet, the pilot elected to make a gear up landing in an open field to his front. The passengers were told of the pending gear up landing and advised to brace themselves.

"The aircraft impacted the ground in a nose high, wing level attitude, at an estimated airspeed of 70-75 knots. It bounced and impacted three more times, and on the fourth impact, the left engine hit a slight rise, causing the aircraft to turn to the left 88°. It then slid sideways for 105 feet before com-

Failure to use correct emergency procedures for propeller failure resulted in a $94,000 accident which could have been prevented with a knowledge and application of correct emergency procedures

ing to a stop. Damages to the aircraft totaled $94,-473.

"Shoulder harness was available but not used by either the crew or passengers."

Cause factors: "Pilot used improper emergency procedures for propeller failure.

"Aircraft was 160 pounds over maximum allowable gross weight at takeoff.

"Jam nut on propeller governor linkage control disconnected, resulting in an uncontrollable propeller.

"Pilot and copilot were not proficient in emergency procedures for propeller failure.

"Emergency procedures for propeller failure were not adequately covered during initial checkout of pilot and copilot for this type aircraft."

The board stated its opinion that the propeller control linkage became disconnected from the propeller governor because it was not properly installed or inspected after adjustment. Apparently, the governor control cable was not attached to the rod and bearing by more than one turn.

One passenger sustained a broken collar bone as he was caught between the other passengers and the right wall of the cockpit when the aircraft skidded sideways. The flight surgeon stated that the use of shoulder harness would probably have prevented this injury.

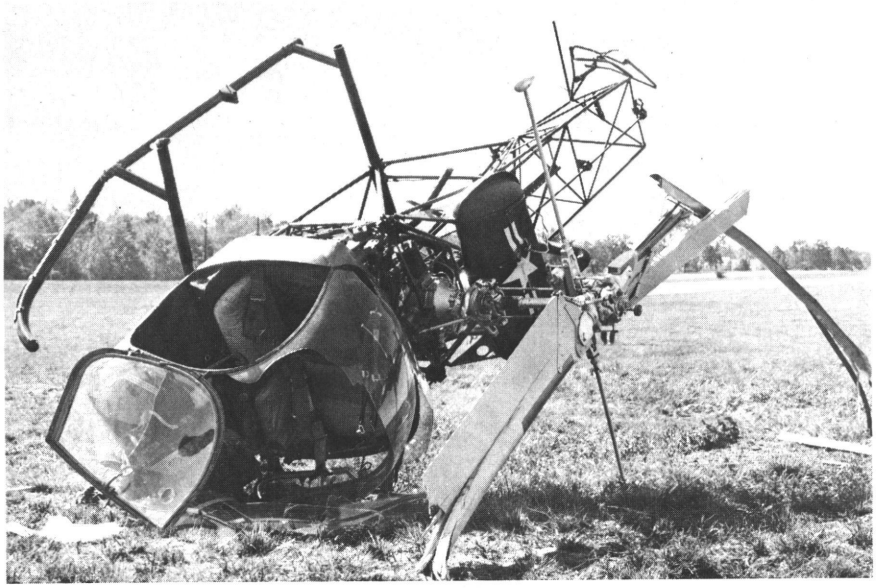
Correct emergency procedures for propeller failure are listed in chapter 2, section III, TM 55-1510-201-10. During the past nine years, more than 55 percent of all U-8 accidents, incidents, forced landings, and precautionary landings were caused by powerplant failure or malfunction. During the same period, the second highest cause factor was failure or malfunction of the landing gear. These cause factors point to an important aviator requirement: *Know the emergency procedures contained in TM 55-1510-201-10. With a complete working knowledge of emergency procedures, you will be able to successfully cope with emergency conditions.*

MWO Compliance . . . c. g. Limitations

An OH-13E instructor pilot was demonstrating cyclic control to his student at a hover.

Instructor pilot: " . . . I placed the cyclic control forward of the center position approximately one inch to show the effect that movement of the cyclic, rather than pressure, would have on the aircraft.

"The aircraft nosed over entirely too far for normal and I started my recovery of this nose down attitude. I had full aft cyclic in before the aircraft recovered. The nose of the aircraft came up too high and I released the aft cyclic. The aircraft nosed over again and full aft cyclic would not stop



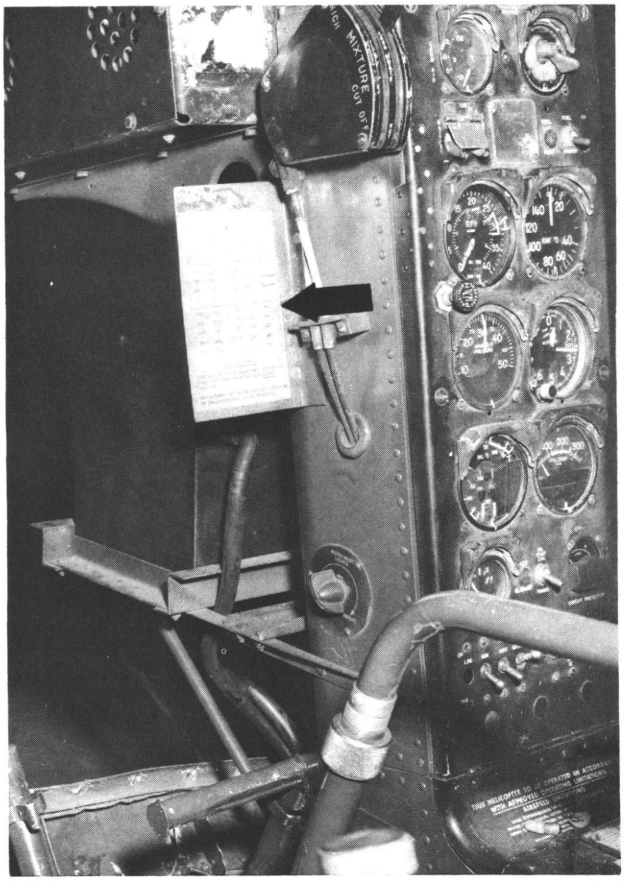
OH-13E became uncontrollable and rolled on left side during demonstration of cyclic movement at hover. Forward c.g. limitations were exceeded.

the downward movement of the nose. I realized that the aircraft would probably roll over on its back, so I lowered the collective and the skid dug into the ground and the aircraft rolled over on its side.

"The flight controls and engine appeared to be operating normally prior to the accident."

Aircraft accident investigation board: " . . . The board examined the damaged helicopter and found that it had not received the latest modification (MWO 55-1520-204-34/18). This modification provides for a movable ballast weight, which does away with the requirement for movement of the battery. On those aircraft not modified, the requirement still exists for movement of the battery, dependent upon cockpit loading. The battery in this helicopter was installed in the forward position. It was secured and safetied in such a manner that it was evident there was no intention of having the battery moved. In addition, the required electrical connections (waterproof relay) on the rear sliding rack had been removed from the helicopter. The helicopter was placarded in the cockpit in accordance with TM 55-1520-204-10, dated September 1960.

"The instructor pilot and pilot were weighed with the clothing and equipment they were wearing at the time of the accident. Their combined weight was 370 pounds. The remaining fuel was measured and found to be 12 gallons. This information was used to compute the landing center of gravity of the helicopter. The weight and balance form showed a forward c.g. limit of 83.0 inches. The c.g. of the helicopter at the time of the accident was computed to be 82.93 inches.



Cockpit placard lists loading limitations which were exceeded by combined weight of instructor pilot and pilot with battery in forward position

". . . the cause of this accident was an uncontrollable flight condition due to center of gravity limits of the helicopter being exceeded."

"To the extent possible, the flight controls and servos were checked and found to function properly.

"Based on the physical evidence and statements of individuals involved, the board concludes:

"a. The helicopter exceeded the forward center of gravity limits.

"b. Flight personnel were not moving the aircraft battery in accordance with the provisions of TM 55-1520-204-10, dated September 1960, on those aircraft not modified with a movable ballast weight.

"c. Provisions for movement of the battery to the rear position (waterproof relay) had been removed from this helicopter.

"d. There is a general misconception on the part of both maintenance and flight personnel that the requirement for moving the battery no longer exists.

"e. The amount of forward cyclic applied by the instructor pilot was not excessive. However, with the aircraft out of forward c.g. limits, there was insufficient aft cyclic with which to recover.

"The board concludes that the primary cause of this accident was an uncontrollable flight condition due to center of gravity limits of the helicopters being exceeded."

The board recommended that a survey of all OH-13E series aircraft be conducted to ensure that the proper configuration as prescribed in the appropriate TMs and MWOs is being complied with, and that all necessary equipment is available to maintain the aircraft within the desired center of gravity limitations. It also recommended that c.g. and loading limitations of OH-13E helicopters as prescribed in the -10 be re-emphasized to all flight and maintenance personnel.

The reviewing official concurred with the findings and recommendations of the board and added another recommendation that USABAAR publicize the cause factors of the accident to ensure compliance with MWO 55-1520-204-34/18 at other stations, to emphasize the importance of compliance with TMs and MWOs and to re-emphasize the importance of adherence to prescribed center of gravity and loading limitations.

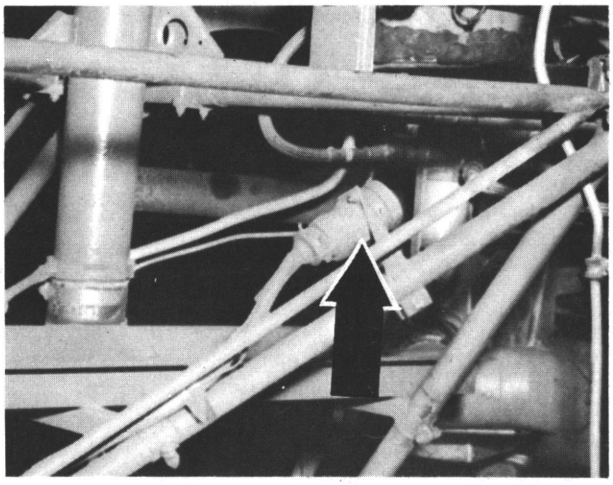
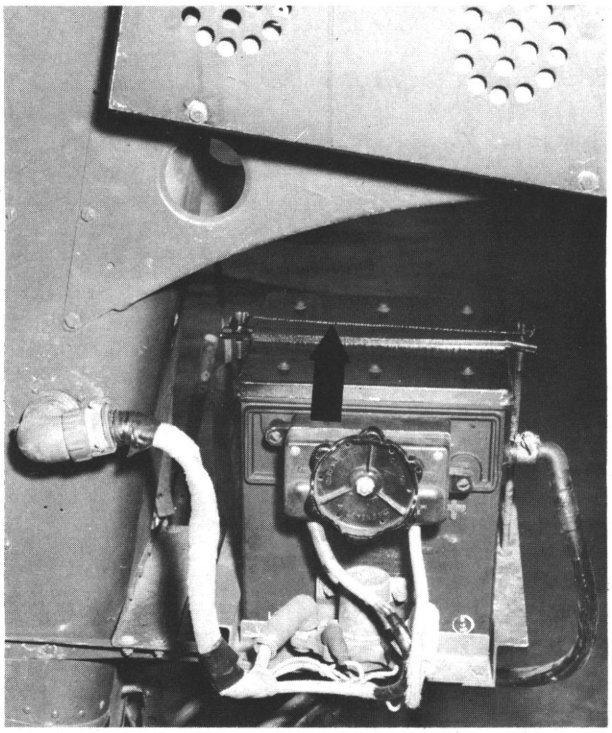


Photo shows sliding rack aft battery mounting location. Waterproof relay had been removed.



Battery mounted in forward position and secured with safety wire

THEN AND NOW

Accidents from the past are quoted from a letter by the Acting Chief Signal Officer to the Chief of Staff, dated 28 February 1914. Current accidents are from USABAAR files.

MATERIEL FAILURE

17 September 1908: "Mr. Orville Wright was flying the original Wright type of machine for acceptance test at Fort Myer, Va., with Lt T. F. Selfridge as passenger, when one of the propellers broke, the machine being at that time about 75 feet from the ground. The machine side-slipped and nose-dived, striking the ground with such force as to fatally injure Lt Selfridge and break Mr. Wright's leg.

"Cause of accident: Breaking of propeller and consequent loss of lift in the machine. Lt Selfridge's death can in no way be connected with any question of type of machine or skill of pilot."

1965: A UH-1B pilot was making a gentle climb (200-300 feet per minute). At 900 feet, he felt a severe vibration from the tail section, and heard a loud bang. He lost directional control and the aircraft turned to the right. It descended, making one or two complete clockwise revolutions and struck the ground on the tail boom and right skid. It bounced forward approximately 40 feet and came to rest on its right side with the fuselage tilted to the right. The tail boom separated from the fuselage at initial impact. The pilot and crewchief, the only occupants, sustained minor injuries. The aircraft was damaged beyond economical repair at a cost of $193,648.

Cause: Fatigue failure of machine bolt (P/N AN174H21) that connects the pitch change link assembly to the white tail rotor grip. This failure caused loss of antitorque control and allowed the tail rotor blade to strike the pylon section of the tail boom.

PILOT FACTOR

10 May 1911: "From the evidence given the board finds that Lt Kelly had made a flight of approximately five minutes duration, in a Curtiss bi-plane, at about 7 a.m., under good atmospheric conditions. As a result of this flight he met his death.

"He had made not a normally hard landing. Upon landing, at least one and possibly both sides of seat fork were broken at a point between pilot seat and foot rest. At the same time it appears that one diagonal bamboo brace from front wheel to front elevator was broken, and its mate was bent.

"After striking the ground the first time, the machine bounded to a height approximating 10 feet, and gradually rising to about 30 feet until, within about 75 yards of the camp of the Eleventh Infantry, it made a sharp turn to the left, banked up with the turning wing, and made an abrupt dive to the ground. Lt Kelly was thrown clear of the machine to a distance of about 20 feet.

"As a result of the first impact with the earth, it is apparent that the pilot lost control of the front elevator and therefore had only partial control of the machine.

"It is the unanimous opinion of the board that the front wheel must have struck an abrupt depression in the ground or some obstacle causing the strain which resulted in the break.

"From all of the preceding facts the board is of the unanimous opinion that the accident was due to the efforts of Lt Kelly to avoid endangering the occupants of the Eleventh Infantry camp in which endeavor it became necessary for him to make a sharp left turn, which, in the crippled condition of the machine, put more strain on the controls than would have been required in a straight away landing. Such straight away landing was impracticable owing to the proximity of the tents.

"Probable cause of accident: Error in judgment on part of pilot in selecting an unsuitable place."

1964: A UH-1B was leveled at 30 feet during approach to avoid children moving onto intended landing site. It fell through and landed hard, sustaining major damage.

crash sense

Cause: High rate of descent, low airspeed, and delayed power application.

WEATHER

8 April 1913: "Lt Brereton left the hangars about 10:30 a.m., piloting the flying boat, No. 15, with Lt Chandler as passenger who accompanied him to learn the controls of this machine.

"At time of departure, the wind was blowing fairly strongly and somewhat unsteadily, and so-called 'puffs' were particularly bad in the vicinity of Point Loma. The bay near the place of the accident is subject at times to treacherous gusts from the ravines on Point Loma which apparently converge there, making even sailing as well as flying difficult in that particular part.

"Flying into the wind Lt Brereton attempted a right turn to start returning. When the turn was partially completed, a sudden gust of wind struck the machine, augmenting the amount of its bank to such a degree that despite every effort on part of the pilot to regain control, that it slid inward and downward falling about 100 feet into 30 feet of water. Apparently the nose and right wing struck simultaneously. The forward portion of the boat was splintered and separated from the rear but the planes held up the wreckage. Lt Brereton was thrown out and escaped with little injury but Lt Chandler, sitting on the right, was pinned beneath the wreckage and drowned before help arrived. Each man wore helmets and 'non-sinkable' coats, and Lt Brereton probably owes his escape from serious injury in part at least to his helmet as both received serious blows on the head.

"The machine was almost completely wrecked. The engine was not damaged to any extent, and other saved parts were: one aileron, the stabilizer, and the rear section of the boat.

"The board is of the opinion that the accident was due to bad atmospheric conditions, aggravated by the natural sluggishness of the flying boat in answering its controls."

1966: A U-6A was on the latter portion of its landing roll when a gust of wind lifted the right wing and the aircraft pivoted over the left wing and gear, coming to rest inverted. The accident resulted in major damage to the propeller, wings, and rudder. Surface wind, gusting 10-18 knots, was considered a factor.

PROFICIENCY

4 September 1913: "Lt Love left the field at 7:23 a.m. in Wright machine No. 18. He climbed to approximately 2,000 feet and flew at that altitude until 8:01 a.m., when he started a volplane. After completing a right turn at an altitude of approximately 1,000 feet, he continued on a straight-away glide very little, if any, steeper than the normal gliding angle of this machine. At an altitude of about 300 feet he was observed to put on power. He continued gliding at approximately the same angle as before for quite a perceptible interval of time. Then the angle of glide gradually became steeper and steeper, the machine becoming vertical. There is a difference of opinion as to whether the machine went beyond the vertical or not, but the majority of witnesses are of the opinion that it did, striking the ground on the top plane first. The position of the machine seemed to bear this out. Witnesses are uncertain as to whether power was kept on until he struck the ground. The machine was a total wreck, but an examination showed all wires intact. Up to the time of the final dive Lt Love seemed to be flying well, with the machine under thorough control, and as far as anyone could tell there was no collapse of any part of the machine in the air. The machine was thoroughly examined before Lt Love went up and had already been flown several times that morning.

"The board is therefore of the opinion that the accident was due in no way to any defect in the aeroplane itself. The air at the time was slightly puffy, but not dangerously so. The machine at all times up to the final dive seemed to be under thorough control, therefore the only reasons that can be given for the accident are either that Lt Love became unconscious in the air or that the dive was caused by bad air. Immediately after the accident full details were telegraphed to Mr. Orville Wright, who telegraphed in reply that he was convinced the accident 'was due to a light gust when descending at too great speed and too small an angle of incidence.'

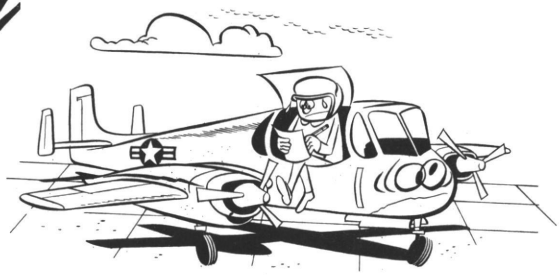
"Probable cause of accident: Stalling."

NOTE: Lt Love had a grand total of 12 hours and 25 minutes flying time.

1965: A UH-1 aircraft crashed during a night ferry mission when its pilot lost visual reference to the ground. There were two minor injuries and the aircraft was destroyed at a cost of $193,648.

Cause: It was apparent that the preparation for this flight, the preflight planning, and the preflight briefing were totally inadequate. This pilot was not instrument qualified and had not received any instrument flying training for two years prior to the accident. The weather forecast called for low clouds, ground fog, and rain over the intended flight route. The pilot was obviously unqualified for night flying in such weather.

Reader Survey



We of the DIGEST would like to know how you, the reader, would classify our publication. Below are some questions which will help us to give you a better magazine. We ask that you fill in the blanks, expressing your frank opinion. Then tear this page out, fold and staple where indicated on page 48, and mail it to us at no postage cost to you.

1. What is your rank? _____
   Your principal duty assignment? _____
   What is your unit or civilian employment?
   _____
2. Are you a rated aviator? _____ How long? _____ Aviation qualifications: F/W _____ R/W _____ Dual _____
3. Do you possess related aviation skills or qualifications? _____ What? _____
4. Circle your highest grade of education
   7 8 9 10 11 12 13 14 15 16 17+
5. Which of the following publications do you read?

	(check)
APPROACH MAGAZINE	_____
ARMY INFORMATION DIGEST	_____
ARMY TIMES	_____
MILITARY REVIEW	_____
ARMED FORCES JOURNAL	_____
P.S. MAGAZINE	_____
AVIATION WEEK	_____
U.S. ARMY AVIATION DIGEST	_____
OTHER	_____

6. Which of these publications do you consider best? _____ Why? _____
   _____
7. How often do you read the U.S. ARMY AVIATION DIGEST? Monthly _____ Every 2 or 3 months _____ Two or three times yearly _____ Other than listed _____
8. Does the DIGEST help you in your work? _____
9. Do you have any difficulty in obtaining the magazine? _____ If so, what do you suggest to help get the magazine to you? _____
   _____
10. Do you recall any article which appeared in the DIGEST during the past year which you found particularly interesting or helpful? _____
    What was it? _____
    _____
    Why did you like it? _____
    _____
11. Which of the following types of articles do you find most interesting and helpful? (Number by preference, 1st, 2nd, 3rd, etc.)

Roles and Missions	_____
Maintenance	_____
Research and Development	_____
Training and Proficiency	_____
Operations and Tactics	_____
Other (Specify)	_____

12. What type of material would you like most to see covered in the DIGEST? _____
    _____
13. What do you think about the style of writing in the DIGEST?

	(Check)
Too technical	_____
Not technical enough	_____
Difficult to understand	_____
Easy to understand	_____
Interesting and clear	_____
Dull and dry	_____
Opinionated	_____
Other	_____

14. Would you consider writing an article for the DIGEST? _____ What would prompt you to do so? _____
    _____
15. What do you consider to be the DIGEST's strong points? _____
    _____
    Weak points? _____
    _____
    Do you have any recommendations for improvement? _____
    _____
    _____
16. What is your frank opinion of the DIGEST?
    _____
    _____
    _____

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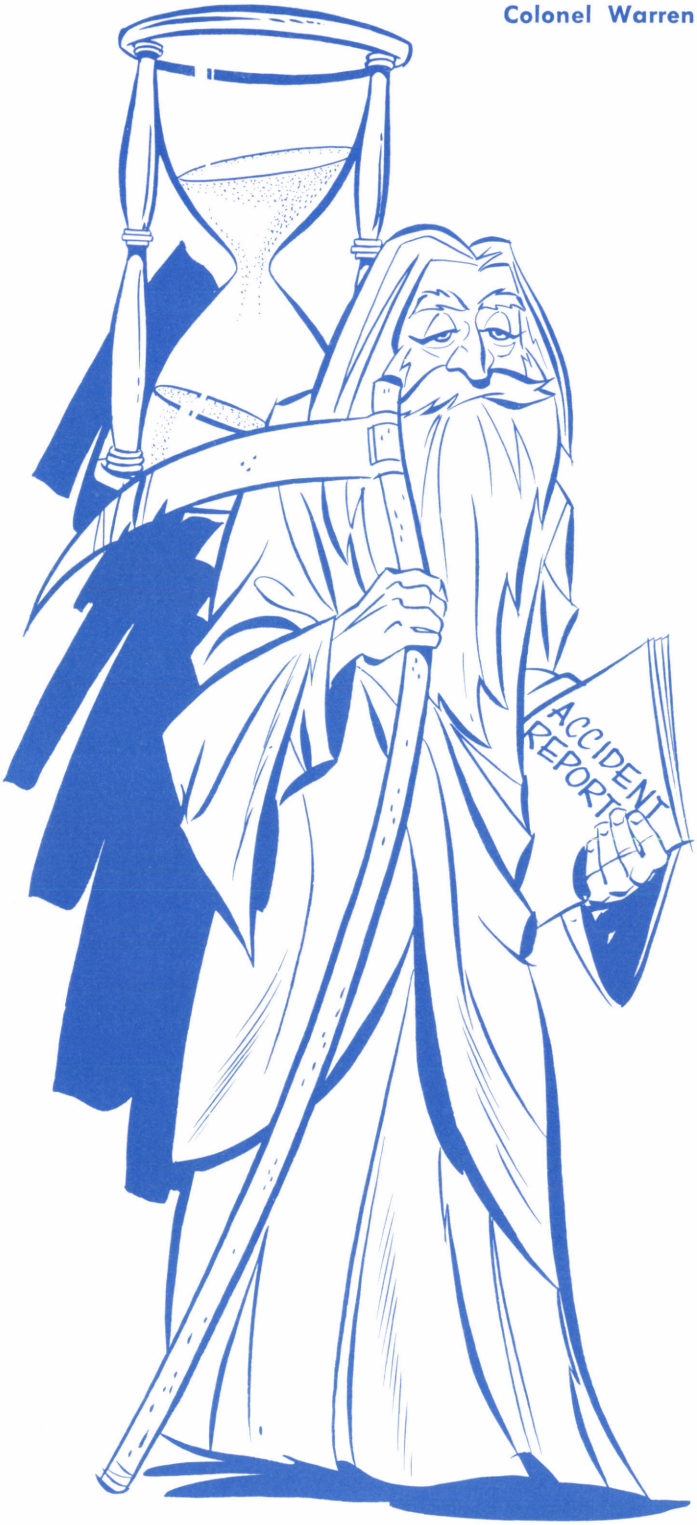
PREVENTION IN TIME

Colonel Warren R. Williams, Jr.



AR 385-40

"2. *Policy*. An essential element of an accident prevention program is the *immediate investigation, reporting, and analysis* of all accidents . . . "

"24. Technical Report of U. S. Army Aircraft Accident (DA Forms 2397 through 2397-10) . . .

"b. Reports of major and minor aircraft accidents occurring within the continental United States will be dispatched by the activity conducting the investigation *within 35 working days* and those occurring outside the continental United States will be dispatched *within 45 working days* after the accident."

"25. *Aircraft accident investigation boards and preaccident plans.*

" . . . Activities of Army aircraft accident investigation boards will be given sufficiently high priority to assure expeditious completion and transmission of reports. Responsibilities imposed on these members by this assignment will take precedence over other duties . . . "

The sole purpose of conducting aircraft accident investigations is to prevent future accidents by assembling sufficient data and evidence to indicate the conditions which, if they had been corrected or changed, would have prevented the accident or minimized the extent of damage or degree of injury.

Any delay in submitting aircraft accident reports invites accidents from similar cause factors throughout the Army. The information in aircraft accident reports is *timely* and *vital* to the Army aviation safety program.

Many aircraft accident reports are delayed because investigation boards do not have laboratory reports, etc., or because someone in the chain of command nonconcurs in the findings or recommendations. This delay is not necessary nor desirable. Information that is not available at the time of the investigation should be submitted as supplemental data when it becomes available. *It should not delay submission of the report.* Nonconcurrence with the report, its findings, or recommendations should be stated, with reasons, in forwarding letters or indorsements. *They should not delay submission of the report.*

The accident report you submit may well prevent a similar accident in a unit halfway around the world *if it is submitted in time.*

ARMY AVIATION MILESTONES

Fort Sill, Okla.

6 Jun 1942. Army Aviation is born with the establishment of organic air observation units for field artillery units.

1 Jan 1943. The U.S. Army Aviation School is established. (The School's official birthday is later changed to 6 June to coincide with the birthday of Army Aviation.)

Aug 1942. The first Army Aviation mechanic's class graduates.

Sep 1942. The first Army Aviation flight class graduates.

North Africa

9 Nov 1942. Army Aviation makes its initial entry into combat. Four Army Aviators fly to shore from the aircraft carrier **USS Ranger** in three L-4s to participate in the invasion of North Africa during World War II.

Korea

Jun 1950. While World War II proved the validity of the concept of Army Aviation, the Korean war brings out its unlimited potential, especially in the field of medical evacuation. Army Aviators evacuate over 21,000 casualties and contribute immeasurably toward achievement of the lowest mortality rate of wounded reaching medical channels of any previous major war.

Fort Rucker, Ala.

1 Nov 1954. The U.S. Army Aviation School is established in its own home at Camp Rucker, Ala.

13 Oct 1955. Camp Rucker is redesignated Fort Rucker and made a permanent Department of the Army installation.

24 Mar 1958. The 7292nd Aerial Combat Reconnaissance Company (Experimental) is organized as a result of Sky Cavalry experiments and studies which originated in 1956. ACR opened the way to further develop tactical doctrine and organization involving armed helicopters and airmobile concepts.

Washington, D. C.

7 Jan 1955. The position of Director of Army Aviation is approved by the Chief of Staff. The Director is to be a general officer responsible for coordinating Army Aviation matters in the General Staff and for centralizing control of aviation personnel.

Fort Wolters, Texas

26 Sep 1956. The U.S. Army Primary Helicopter School is established at Camp Wolters.

27 Apr 1957. The first rotary wing class trained at Wolters is graduated.

1 Jun 1963. Camp Wolters is redesignated Fort Wolters and made a permanent Department of the Army installation.

Fort Monroe, Va.

22 Oct 1956. An Army Aviation Section is established in Headquarters, U.S. Continental Army Command.

Fort Hood, Texas

3 Feb 1962. The Army's first TOE ROAD aviation battalion—the 501st—is activated in the 1st Armored Division. The Army reorganized all divisions to include up to 103 aircraft, depending on the type division.

Republic of Vietnam

9 Dec 1961. The 57th Transportation Company (Lt Hel) and the 8th Transportation Company (Lt Hel) are the first Army Aviation units to arrive in the Republic of Vietnam.

23 Dec 1961. These units participate in the first combat support mission ever flown by U.S. Army helicopters. Since, the 57th and 8th have been joined by many other units which have consistently proved the validity of the Army's airmobile concepts.

Fort Benning, Ga.

15 Feb 1963. The 11th Air Assault Division (T)—calling for 459 aircraft is organized to test concepts recommended by the Army Tactical Mobility Requirements Board (Howze Board) which was convened in 1962.

1 Jul 1965. The 1st Cavalry Division (Airmobile) with 434 aircraft is activated in the wake of successful 11th Air Assault Division tests. The 1st Cav begins deploying to Vietnam in August 1965.