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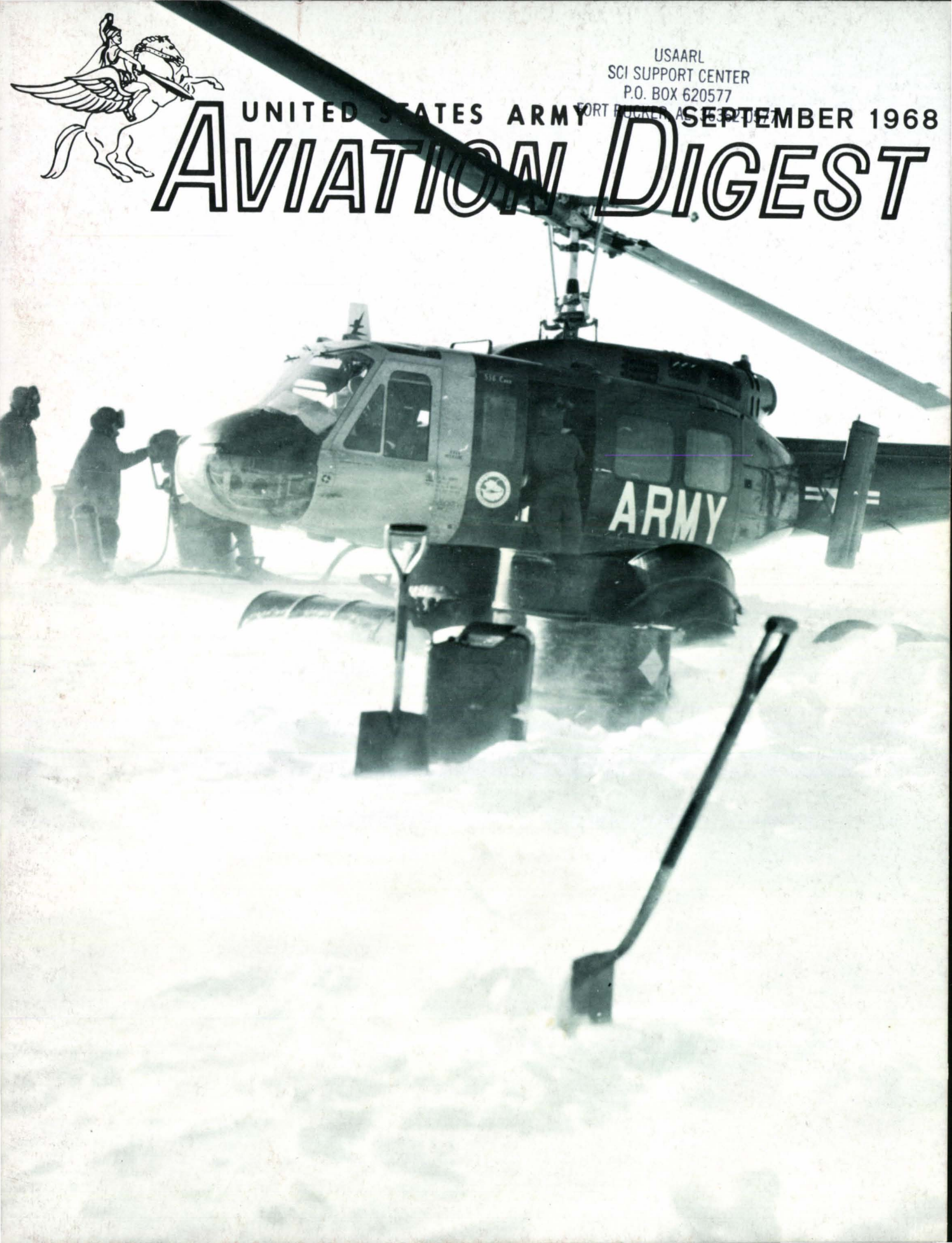
AVIATION DIGEST



UNITED STATES ARMY AVIATION DIGEST

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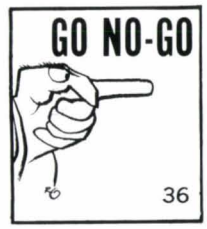

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The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other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

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EDITOR'S NOTE: In this issue the DIGEST features the U. S. Army Aviation Detachment which is supporting personnel engaged in antarctic studies. To free the article of possible distractions, some interesting points about Antarctica itself were omitted. However it is felt the reader will appreciate the achievements of the aviation section and the people with whom it works much more if they have an idea of the unique barriers imposed by the antarctic environment.

The average man knows little about Antarctica, other than that it is cold and is at the bottom of the earth. He wants to know more, and that is one of the reasons the Army has a detachment operating there.

How cold Antarctica is depends on the location, since the continent is as large as Mexico and the United States combined. The official low has been recorded as 126.9° below zero Fahrenheit at the Soviet Union's Vostok Station. Yet temperatures as high as 42° above zero have been recorded at McMurdo Sound.

Scientists estimate that 95 percent of the world's permanent ice is located within the antarctic convergence, a hypothetical line surrounding the continent where the cold sea meets the warmer water from the tropics. Seafarers who cross this imaginary line report a rapid drop in temperature of some 10°F, the only indication of entering the convergence.

All together there are about seven million cubic miles of snow and ice piled on the continent. Scientists theorize that should it melt, the earth's seas would rise by nearly 200 feet. This would cover the entire state of Florida and much of the rest of our country. Also, they estimate the weight of the ice to be so tremendous that if it were removed the continent itself would rise unevenly by as much as 2,500 feet.

Aside from the cold Antarctica offers the worst weather in the world. Along the George V Coast, winds of 100 miles per hour are frequent and have been reported as high as 200 miles an hour. Changes in weather are frequent and zero-zero conditions are common.

Geographically Antarctica differs from the arctic in that it is a continent surrounded by seas. The arctic, on the other hand, is an ocean surrounded by land.

Another difference is that there are no polar bears in Antarctica, and all existing life is either sea life or inhabits the warmer coastal regions. Animal life consists of several varieties of seals; seven species of penguins; Skuas and Snow Petrels, flying birds that look like gulls; and whales, including the vicious killer whales and enormous blue whales. There is an abundance of sea life, which is being considered as a possible source of food to alleviate some of the world's shortages.

Inland is the largest area void of life on earth. Unless it can be seen personally, it is impossible to conceive travelling as far as from Maine to Acapulco, Mexico, without a single sign of life — plant or animal.

Being south of the equator, the seasons are reversed. Like the arctic region, summer is one long day and winter is one long night. There is only one sunrise and one sunset per year at the pole itself.

Evidence, including fossils, petrified tree trunks and geological findings, indicate Antarctica was at one time covered with lush rain forests and enjoyed a warm climate. Why it has changed to a frozen land is one of the answers scientists are seeking. Abundant mineral deposits also are being explored.

Man is curious by nature, and as long as he is curious there will be those who brave the elements of this last frontier in an attempt to unlock the secrets it holds.

ROKA Helicopter School

Major William H. Gardner

NEARLY 50,000 Korean troops, most from the First Republic of Korea Army, are now deployed to the Republic of Vietnam and are fighting, as the largest force by far from any of our allies, alongside our own soldiers. The record of these fine soldiers has been outstanding.

Nevertheless, the tactics and the terrain of the war in Vietnam, as well as increasing requirements for more mobility in the defense of South Korea itself, have precipitated the need for organic helicopters within the Republic of Korea (ROK) army. Korean army pilots, many trained at the U. S. Army Aviation School at Fort Rucker, Ala., have made maximum use of their fixed wing assets (predominantly O-1 and U-6 aircraft) since the end of the Korean War some 14 years ago. Their excellent ground forces now need the mobility and flexibility of rotary wing aircraft.

During 1967 the ROK army received the first three of a significant quantity of observation type, OH-23G Raven helicopters through the Military Assistance Program (MAP). Also, in 1967 the ROK army began training rotary wing pilots in the United States for both service in Vietnam and to meet in-country requirements. Until that time, there was only one rotary wing qualified pilot in the entire Korean army.

Initially 15 of the ROK army's most qualified pilots, both in flight experience and in knowledge of English, were sent to the United States for helicopter qualification and UH-1 transition for eventual deployment to Vietnam. Upon their arrival in Vietnam UH-1D helicopters were made available to them so they could fly in support of the Korean forces there.

The Aviation School at Fort Rucker also established a special UH-1 maintenance course to train the initial 15 UH-1 crewchiefs. In March and April 1967, an additional six pilots were sent to CONUS to receive the full rotary wing qualification course including phases I, II, and III. They completed their training in January and February 1968.

More Korean pilots will receive training in the United States on a scheduled basis during FY 68. This training will produce pilots for both Vietnam and to support in-country requirements, as several pilots will receive training to be instructor pilots in the OH-23G. Enlisted maintenance personnel for both UH-1 and OH-23G aircraft are also programmed for training during FY 68.

However, it was recognized that the undeterminable length of the war in Vietnam, the extent of the ROK commitment, and the need for organic helicopters in the ROK army in the face of increased North Korean infiltration would create requirements for Korean army helicopter pilots that would quickly exceed the numbers that could be produced through schooling in the United States.

The only solution lay in the establishment of a Korean army helicopter school where Korean instructors, both flight line and platform, could teach their countrymen to fly and maintain helicopters. As a result, aviators of Eighth U. S. Army and the U. S. Army Advisory Group, Korea (KMAG) found themselves advising the third largest army in the free world in the establishment of a helicopter school and a helicopter program. In short, several United States officers found themselves in the perhaps unprecedented position of assisting in the creation of a helicopter training base for an important Asian power.

One of the first considerations had to be the training of necessary enlisted personnel to maintain those first three OH-23Gs and subsequent aircraft to be delivered through the Military Assistance Program. It was decided that three experienced fixed wing mechanics, all senior noncommissioned officers, would attend a school held at Detachment L, KMAG, in February 1967, which would cover the organizational maintenance of the OH-23G. Eight other mechanics were sent to the Eighth Army field maintenance support units at Camp Humphreys for similar instruction on the higher echelons of aircraft maintenance.

Of necessity, the instruction was primarily OJT but it was extremely successful, as both units had not only capable and interested U. S. maintenance personnel but also several well qualified Korean civilians employed as mechanics. This latter group helped offset any language problem and was the key to the success of the schooling.

As evidence of the effectiveness of the program, at Detachment L for the last 3 weeks of the 8-week course all organizational maintenance on the four OH-23Gs assigned was performed by the three

The need for Korean army helicopter pilots exceeds the number being trained in the U. S. This has resulted in the establishment of a Korean army helicopter school

Korean NCOs with a minimum of supervision.

The "graduation" of these first OH-23G crewchiefs in the ROK army could only be a stopgap measure. Concurrent with the flight training of ROK army aviators at the proposed school, the establishment of a helicopter maintenance course for Korean aviation personnel and selected enlisted men was deemed absolutely necessary.

Again, using the facilities at Detachment L and its associated airfield, R-401, two officers and one senior NCO were given the necessary guidance and OJT for preparing the POI (programs of instruction) and lesson plans for the maintenance classes to be taught at the new school. The two officers, fluent in English, had just returned from the U. S. Army Aviation School at Fort Rucker where they had acted as interpreters for the ROK army mechanics attending the special course on UH-1 maintenance.

With aircraft and qualified mechanics (both U. S. military personnel and Korean civilians) available at R-401, the major problem was the establishment of a workable and realistic POI for the proposed courses. Two courses were initially envisioned. The first would train enlisted men in the organizational maintenance of the OH-23G. The second would be concurrent with the flight line training of the student helicopter pilots and would not be nearly as extensive.

A letter was sent from the commanding general of Detachment L, BG Samuel McC. Goodwin, to MG Delk M. Oden, commandant of the U. S. Army Aviation School, requesting copies of the POI and lesson plans for all maintenance courses taught in connection with the OH-23 helicopter. Within two weeks the requested material arrived. The three instructors spent the next few weeks working with both their superiors and KMAG personnel in analyzing the POIs and lesson plans received.

By late August, POI for the initial maintenance courses at the new school had been determined. The two officers and the NCO had screened all training films available in-country believed pertinent to their program and had found several that would be of great value. However, with the establishment of their POI they found a complete lack of any other training aids in Korea to support their POI except the aircraft themselves. The lesson plans that had been selected for the POI were carefully reviewed and a list of the required several hundred slides, transparencies, and opaque projections was prepared.

Again, the call went out to the Aviation School at Fort Rucker, requesting as many of the aids as were readily available. In a very short time, a package arrived containing every training aid requested in 35 mm slide form, less two that were no longer pertinent. This quick response by USAAVNS was instrumental in establishing what proved to be a professional and comprehensive maintenance program of instruction in time for the opening of the school.

With the output of qualified maintenance personnel now assured, the next obstacle to be hurdled was the securing and stocking of necessary spare parts. Here again, Eighth Army and KMAG personnel working with the Korean army, established a working relationship that would initially permit the use of U. S. channels but Korea MAP funding. Several personnel from the ROK army received training in aviation tech supply and particularly in setting up the PLL (prescribed load list) for the OH-23G. Field maintenance support is provided by the ROK army itself, with assistance from United States personnel and facilities only when required.

ROKA Helicopter School

With the maintenance problems associated with the birth of a Korean army helicopter program either resolved or solutions in sight, the primary area for concern now was where to find the necessary instructor pilots to teach their countrymen. Major General James H. Skeldon, chief, KMAG, advanced the idea that three of the 15 ROK pilots presently in the United States receive OH-23 instructor pilot qualification at the U. S. Army Primary Helicopter School, Fort Wolters, Texas, and then return to Korea rather than go on to Vietnam.

With the aid of both the Aviation School at Fort Rucker and the Primary Helicopter School at Fort Wolters, the necessary adjustments to the scheduled instruction for the 15 pilots were accomplished. The one rotary wing qualified pilot then in country was transitioned into the OH-23G and was given the responsibility to oversee the establishment of the school. The three USAPHS trained instructor pilots arrived in Korea in August and began working with Eighth Army standardization pilots in formulating the flight POI for the new school.

On 18 September 1967 using their three OH-23G helicopters, the three instructor pilots trained at USAPHS and the six OJT mechanics (four enlisted and two officers) who worked with Detachment L, KMAG, the ROK army commenced rotary wing training in Korea for the "first" time. The first class of four students, after completing the course which consisted of 60 flight hours and after passing final checkrides conducted by U. S. standardization pilots from Eighth Army, was graduated on 18 November 1967. The fourth class is now underway. In the three previous classes 12 pilots have been qualified.

[With the knowledge gained from these classes and an increasing requirement for qualified helicopter mechanics within the ROK army, a course of instruction in organization maintenance training with 33 students was scheduled to begin in July. A course in field maintenance is also being planned.]

There were other considerations. In providing organic helicopters to a country whose army has never had them before, the problem of the education of aviation personnel as well as commanders, especially senior commanders, to the capabilities and limitations of rotary wing flight could not be ignored. Such areas as fuel range, special fuel considerations (ROK fixed wing aircraft use 115/145 without TCP, which is required for the OH-23G), increased maintenance time for both daily and scheduled maintenance, cold weather operations, flying in marginal weather, and turbulence, especially in the mountains, must be thoroughly understood by all who would fly and who employ helicopters for the first time in Korea or anywhere.

Another problem and one of the most common areas where personnel not familiar with helicopters are initially confused, is why helicopter pilots seldom fly direct but rather tend to follow valleys and river bottoms. It wasn't until the helicopter took on such great significance in Vietnam that many senior U. S. officers fully understood the forced landing capabilities and characteristics of the helicopter.

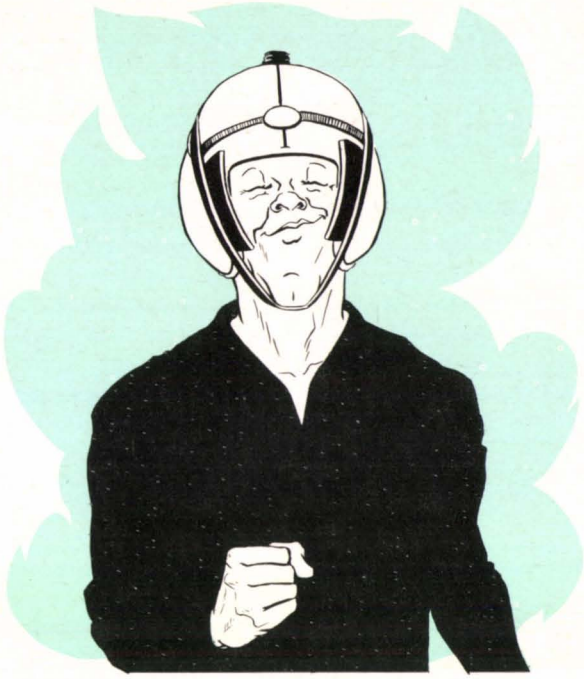
Fortunately Eighth U. S. Army has had helicopters in Korea since shortly after the beginning of the of the war in 1950. Senior Korean officers have often used these aircraft when necessary for the accomplishment of the Eighth Army mission. This fact, coupled with the need for close helicopter support during the antiguerrilla operations of the summer of 1967 and an increased emphasis on helicopter use by the advisors of KMAG, has provided the means to acquaint Korean army officers and men with the OH-23G in particular and helicopters in general.

Pilots from all units within Eighth Army would and do attempt to discuss and explain to their Korean passengers the "whys" and "whats" of helicopter flying. For example, they point out the need for smoke both to identify isolated helipads and to indicate wind direction and velocity. They attempt to explain turbulence and its effects on helicopters. In short, they have accepted the additional mission of assisting the leaders of the Korean army to prepare for the presence of organic helicopters.

Other areas of concern are inflight and ground safety peculiar to helicopters. Here KMAG advisors, in particular, are trying to acquaint Korean officers at all levels with the increased hazards involved.

The interest of all pilots within Eighth Army; the assistance of KMAG and, in particular, the aviation advisor to the ROK army; the support of Eighth U. S. Army, the aviation staff and its standardization pilots; and the invaluable aid of the schools at Fort Wolters and Fort Rucker have been instrumental in helping the professional and dedicated aviators of the ROK army in the successful beginning of the ROK army helicopter program. It has a long way to go, but it is, nonetheless, an auspicious beginning. The program and school will grow and it will not be long before the ROK army helicopter school can take its place alongside its very effective fixed wing school.

Color Rod Green



Rod had become so involved in what was now routine procedure that he was like a horse with blinders — looking for an accident

Major Richard A. Baynard

ROD GREEN ARRIVED in Vietnam in January, ready to win the war all by himself. After all he had been flying Hueys for the last four years. He'd have this war over in no time. He was surprised, to say the least, when he started flying at operating gross weights perilously close to maximum for conditions, with density altitudes that soared with the rising sun. With the passage of time, however, he became accustomed to this new experience.

Next, Rod was introduced to the intricacies of the M-16 system (fourteen 2.75″ rockets and four 7.62 machineguns) which he gleefully took to his bosom. At last, he was to ply his trade. During his orientation, such requirements as maintenance of the system (especially cleanliness) and handling of the rockets (watch out for stray voltage) were stressed. At the end of his initial phase, Rod was stamped and certified as qualified to join the grizzled veterans as they sallied forth to do battle with Charlie Cong.

As a 1000 hour man in choppers, Rod was permanently current according to the regulations, and for the first few months he performed like a champ. He was always in the thick of battle, blasting away accurately. He was really putting his past experience to work. His company commander had to slow him down.

Then, a series of incidents began to happen. Why? Because Rod had become so involved in what was now routine procedure that he was like a horse with blinders.

Returning from an uneventful mission, Rod heard a loud, wailing sound like a million banshees had descended upon his aircraft. He immediately closed the throttle and lowered the collective pitch because the sound was obviously the audio warning for low rpm. He checked his engine tachometer and, noting that it was on zero, diagnosed his trouble as engine failure. With deft precision, he maneuvered into a small clearing while calmly broadcasting his plight to the other ship that had accompanied him. Rod performed a story book autorotation. His ship without weighty ammunition, handled like a charm. His skid marks were just a wee bit longer than his Huey.

"That's what experience will do for you," he cracked to the crewchief, his chest bursting with pride. "Let's secure this broken bird until maintenance gets here to haul it back to base camp."

"The engine is still running, sir," replied the crewchief.

Startled, Rod was speechless!

"Something is wrong! That engine can't be running! The tachometer is on zero and the exhaust gas temperature is—the exhaust gas temperature! Why didn't I check it before? I remember now, the audio sounds when the engine tachometer drops below operating rpm. All I have is engine tachometer failure."

"Change one. Mount up and fasten your seat belts. We're pulling pitch."

Green guided the helicopter back to base camp and proceeded to search for a new bird. Old "99" had just come back from a series of tests at direct support maintenance and was without an operator. Intrepid Rod strolled over to the crewchief and queried him as to the capabilities of his bird.

"We've had a bit of trouble with this one, sir," replied the crewchief. "As you can see on the dash 13, it has a weak engine. All of the tests at DS maintenance haven't turned up a thing. It seems to function normally, but every aviator who takes it up says the engine is weak."

"Aw shucks," grinned Rod. "The problem is probably poor pilot technique. I had the same trouble myself when I first started making these max gross flights. Give 'er to the old sage and I'll wring her out for you."

A breathless radio operator dashed out at that precise moment and handed Rod a piece of paper.

"Hold on young man. What's the problem?"

"One hundred VC in the open, sir, and those are the coordinates. The CO says to get all available ships on target ASAP."

"On the way! There's nothing like a combat situation to really test the mettle of man and bird. Let's hop to it."

The Huey was really loaded for bear. On the takeoff, the crewchief closely monitored the rpm — 6600 — 6400 — 6200 — 6250. Ah! We're going to make it.

On the field of battle, old 99 left 'em weeping and moaning. "Killer" Green was credited with 50 percent of the casualties (according to his story).

Later, at the refueling and rearming point, Rod remarked with gusto to the crewchief, "Son, that's the way to handle a bird. I would just disregard that weak engine bit. It was obviously poor pilot technique. Load 'er up for our next joust with our unfortunate adversaries. You can bet old 99 won't leave 'em laughing."

On the approach back into his tactical position, the rpm dropped slightly at the termination of the approach but it was disregarded.

In another 30 minutes the drama was repeated and all events were similar *except* the takeoff. Again the crewchief was monitoring the rpm — 6600 — 6000 — 5800! He braced himself for the crash.

The warbling sound of the audio warning screamed in Green's helmet. The warning light on the panel lit up the cockit. Violent shudders shook the helicopter as the rotor blades steadily reduced in speed. Witnesses were later to remark that they could count the revolutions.

"If I ever needed speed, believe me, I need it now," mumbled the perspiring Green. "Translational lift, where are you?"

Almost as if by divine decree, a small valley appeared to the right front of the helicopter. Rod nosed the ship over slightly and depressed the right pedal gently. As the aircraft neared the ground the airspeed began to build and the rpm began to rise. The popping sounds of the blades passing through translational lift were music to the crew's ears. The heavily ladened bird began to rise into the heavens and joined the other Hueys for a brief, violent encounter with Charlie Cong.

After the action was over, Rod had the ship serviced with fuel and returned to the tactical area.

"Chief, this just can't be. I know I exercised my usual deft control touch in nursing old 99 off the ground on that last flight. Yet the beast seemed bent on self-destruction! Sure, we lost a bit of rpm on the initial takeoff, but it was nothing like that last one!"

"Sir, I'd like to have maintenance take another peek at her. Would you hover it down to the maintenance area?"

"Well, seeing as how I'm temporarily on the ground again I think I'll lend my vast knowledge to those maintenance men. Imagine, giving me a broken down bird like that. How can I expect to win the war if I don't — I've got it! Translational lift! That's why we lost so much rpm the second time. Remember? We took off from the maintenance area the first time and had a ground cushion for a longer period of time while we were building up speed. The second time, I parked closer to those trees. Why didn't I think of that before? I remember us discussing that, 'way back at Wolters! That still doesn't mean she isn't a little sick though. Maintenance, here we come."

Early the next morning, the combat operation was terminated and the order given to return to the base camp area. A new tachometer had been installed in Rod's original ship and was he glad.

"Chief, get your gear together and let's drive home for a well deserved rest. I'm sure Charlie won't be effective in this area for quite some time. We'll just leave most of the ammo here for Joe's company. It'll keep them from having to requisition more."

A few minutes later, the company was winging south for their permanent base camp. After a flight of 45 minutes, Rod contacted the tower, "Wing Ding Tower, this is Killer 77, 15 miles north for landing. Over."

"Killer 77, this is Wing Ding Tower. Landing is to the south, wind is 180° at 10 knots."

"This is Killer 77, 'Roger.' "

The approach and landing were normal. After the aircraft was unloaded, Green flew the ship to the refueling and rearming point and returned with a full load of fuel and ammunition. As he started to hover to his parking spot, the audio warning sounded again.

"Well of all the —! What's the trouble now? I realize I'm close to max N_1, but the old girl has always been able to carry this load and even take off with it at this density altitude. Let's see now, what are we doing that's different. For one thing, we're landing to the south and we've always landed to the north before. Surely that can't affect the hovering, except I'm hovering downwind. We've hovered downwind in 10 knot winds before, too. Say, that parking area seems higher than the touchdown point when landing to the south. When we landed north I just made my approach directly to the parking area. I'm hovering uphill and of course it takes more power! It'sa good thing these rear echelon types had those large rocks dragged away. I could have broken a skid or even worse."

Of course, there never was a Rod Green. However, the incidents did happen, but perhaps not in such a dramatic fashion. In each case, the basic knowledge for the lessening of apprehension in the cockpit was available in the mind of the individual. Why, then, didn't he use it? The simple reason is that Rod Green's operations had become so routine that he had ceased to be alert for the unexpected.

No one remembers everything. Whether you have been flying for just a few months or since the birth of aviation, you owe it to yourself to periodically read the operator's manual for the aircraft you fly. Additionally, sharing flying experiences helps others — and I don't mean for you to tell only the stories in which you are the hero. However, reading that -10 and talking it over with your buddies will reduce the panic factor when your next close call occurs — or would you like to try for an accident?

Fatigue and Night Flying

How could you have been so far off course? You were tired, but can you blame it on fatigue?

Major Ira L. Hartwell

IT WAS ONE of those typical nights you expect on a field problem in Germany. Solid overcast and black as the inside of a pocket. You sit in the operations tent while your trusty steed, "Old Sioux," stands ready outside. It is now 2008 and as you are waiting for the colonel's word to go you recap the day's events — it's been a long day.

Actually it began last night with the ever-present aggressor — the friendly enemy who sleeps while you work and then harasses you all night so you can't sleep. Last night he was at his best, launching three separate attacks which limited you to about 3 hours of sleep. Ah, but with the aid of a good cold water shave (ugh) you managed to pry the eyelids open and awaken for your first mission at 0730.

After that it was a series of short flights, and you managed to accumulate 03+50 hours of flying and returned to the command post at 1530. The return was just before departure of a convoy headed for a new field location. You barely had time to check with your section sergeant to ensure that all the equipment was going forward and remind him that one of the fuel trucks should remain behind and then move the rear detachment.

The convoy moved at 1600. Shortly after, the other OH-13H left for convoy control. Your only O-1A left for the new site at 1730. The colonel remained waiting for corps headquarters to move into position and become operational so the remainder of headquarters could move. The Old Man wanted to visit corps and two of the battalions before going on to the new CP. You studied your map and were ready and anxious to go, since it appeared to get blacker every minute. You also knew it would be at least 3 hours flying to the new CP.

The silence of the night was suddenly shattered with the ringing of the phone. The call was for the colonel and you hoped it was time. Glancing at your watch you noticed it was 2015. The colonel gave you "thumbs-up" and you grabbed your gear and headed for Old Sioux.

At exactly 2025 you pulled pitch and headed for corps. It was still quite black but you noticed some improvement in the visibility and a slight breeze.

The trip to corps was uneventful and after 30 minutes there, the Old Man decided to visit all five battalions. Another long night with very little sleep; oh well, all in a night's work. The battalions were spread out, with the three actually participating in the field exercise in field locations and the other two set up at permanent installations.

You proceeded to the first field battalion as another routine flight. While there you called on the aviation section to discuss any problems they might be having. All seemed to be going well and once again about 30 minutes elapsed before the colonel was ready to go. The flights to the next two battalions were accomplished in a like manner.

The time was 2345 and you still had two battalions to visit. Both were at field sites and you proceeded to the closer one. About five minutes out you called the operations section to tell them you were inbound with Beaver 6. They "Rogered" this and their battalion commo officer came on the air to say he had two urgent messages to send on the radio and needed a relay station. Their own helicopter was down for maintenance and they wanted you to relay for them. The colonel nodded his approval and you replied in the affirmative. After landing to drop the colonel, you took off to perform the task of radio relay. The messages were sent, answers received, questions arose, another message and more answers. All in all the operation required 45 minutes of flying.

The colonel was finished by the time you landed, and you proceeded to the final battalion. All went well and by 0150 you were finally ready for the flight to the new CP and the long awaited bed!

You planned this leg of the flight while the colonel was visiting and figured it to be about 45 minutes of flying. You had about 01+30 fuel, so planned to refuel at an airfield about 27 miles north of the new CP. This was just a precautionary measure since you had never been to the new field site, and with minimum lighting it could be difficult to find. That extra fuel might be very nice to have.

Your flight to the airfield was again uneventful and you landed

and refueled. While refueling you checked the maps and confirmed the heading to the CP. After take-off you climbed to 1,500 feet, took up the heading and called operations, informing them you were inbound and would arrive in about 20 minutes. You made sure the heliport was lighted and they had a vehicle standing by for the colonel.

About 2 minutes elapsed and the commo officer asked you to relay a radio message. You consented and grabbed a pad and pencil, placed your knee against the collective and told him to go ahead. You glanced out of the corner of your eye, hoping the colonel would copy the message. He made no move. The message proved to be very lengthy and you became quite involved in copying it.

Occasionally you glanced at the gauges and tried to stay on course but it was difficult. After what seemed an eternity you finally finished. Checking your watch, you noticed it had taken about 7 minutes to relay the messages. You wondered how far you might have drifted off course.

You continued for about 5 minutes, looking for the CP. You circled the general area. The circle became wider and wider, but still no CP. You called operations and asked them to step outside and listen for the sound of your helicopter and let you know if they can hear it. A short time later came the reply, "Negative!"

A glance at your watch showed 0245 and you realized just how tired you were, but the only solution was to find your bed and that appeared to be a problem. The FM homer was inoperative, so you continued to circle and rack the old brain for a solution. The presence of a fuming colonel in the next seat didn't help any!

If only the homer worked, you could lock right in on the station and head for home. Both helicopters were in the same fix; they required an MWO and the parts for this work were not available. The Bird Dog was the only aircraft you had with an operational homer and it sure couldn't help you now.

WAIT A MINUTE! Why couldn't the homer on the O-1 be used? You could have one of the pilots start the aircraft up and turn on the radio; you could key your microphone and he could taxi the aircraft around until he got the signal off the nose and then give you a reciprocal heading. It just might work — and at this point you didn't have much to lose. You called operations and put your plan into action.

It took a few minutes but finally you got a call from the pilot that he was on the runway and ready. Okay; the test began and you keyed your mike for 30 seconds. The pilot called you and said he needed another key and this time could you hold it for a full minute. You "Rogered" and went through the drill again. This time the pilot called back and told you to take up a heading of 225°. You swung the aircraft around to that heading and headed for home — you hoped.

A few minutes passed and you ran through the keying procedures again. The pilot gave you the necessary correction, assuring you the signal was stronger and you were heading in the right direction. A few minutes more passed and you had the area in sight.

A great feeling of relief swept over you and you set up the approach and landed at the CP. Home at last!

After the colonel left and the aircraft was refueled and bedded down for the night, you sat in operations with your coffee and your maps trying to figure out what happened. Why were you so far away from the CP? You have always been rather proud of your navigational ability, but this time you weren't even close.

You flew a heading of 182° for about 15 minutes which should have put you close to the CP, but when you were picked up with the homer you were northeast, since it was necessary to fly 225° for about 10 minutes before reaching home. It wasn't the compass, because it worked fine when you finally found the road home.

You pondered a few minutes more and decided to go to bed. Maybe in the morning you would be able to come up with the answer.

On the way to your tent you noticed that it was really quite breezy — then the light dawned. A quick telephone call to weather revealed that at 2,000 feet the wind was 220° at 32 knots. That explained why you were so far northeast, but why didn't you notice it before? While thinking about this you remembered how tired you were and wondered if that was the answer? You had been up for 21 hours and the previous night you slept for about 3 hours. You had 3 hours sleep in 46 hours. You flew more than 12 hours and half of it had been at night.

When you think about what might have happened during that night flight, you shudder slightly. Perhaps it's a lesson learned the easy way, or even several lessons.

First you learned that at night you should not attempt to copy a long message, especially when you have a passenger who is free to copy it for you. Second, in the event the homer on your aircraft is inoperative and you have an aircraft on the ground at your intended destination you can use that aircraft and homer to direct you. Last, but by no means least, you realized what fatigue can do to you and your passengers. Many things that would normally be noticed might be overlooked when you are tired.

Army Aviation In The Antarctic

The aviators fly scientists from base camps as high as 8,000 feet to volcanic craters as high as 15,000 feet . . . these men frequently are the first to ever set foot on much of the continent

John Penman Jones

THIS MONTH a group of 13 Army aviation personnel at Fort Eustis, Va., is preparing for an annual war that is never the subject of major news headlines, nor do these people arouse much curiosity among their contemporaries at Eustis. No Purple Hearts will be awarded, and chances are they'll return with little more fanfare than quiet family reunions and a few cordial handshakes with close friends.

This baker's dozen of hand-picked volunteers constitutes the U. S. Army Aviation Detachment, Antarctic Support, that wages a war with some of the most adverse weather this earth has to offer. They and their three JUH-1Ds (J indicates special project, temporary) have been charged with the mission of providing helicopter transportation and limited logistical support to geophysical scientists and topographic personnel of the National Science Foundation engaged in antarctic studies.

The unit, as such, began its unique mission four years ago and has an agreement with the U. S. Navy (which has logistic support for antarctic exploration) to continue until 1970. The Army sent its first UH-1s to Antarctica in 1962, but there was no specific unit for antarctic support until 1965.

The aircraft are standard D models as they come off the line at Bell with no appreciable modifications. They had radar altimeters for the first time in 1967-68, which now are considered a must due to severe whiteouts, blowing snow — and the loss of an aircraft for the lack of one during a whiteout in 1966.

Additional equipment includes long-range fuel bladders, giving a 6 hour range, and muff-type heaters with an output of 400,000 btu's. The aircraft are equipped with advanced avionics equipment including HF, UHF, VHF, FM, and an ARA-25 UHF ADF homer. They also have an HF monopole electronically-tuned antenna and an FM repeater and transmitter-receiver that operates on a commercial frequency.

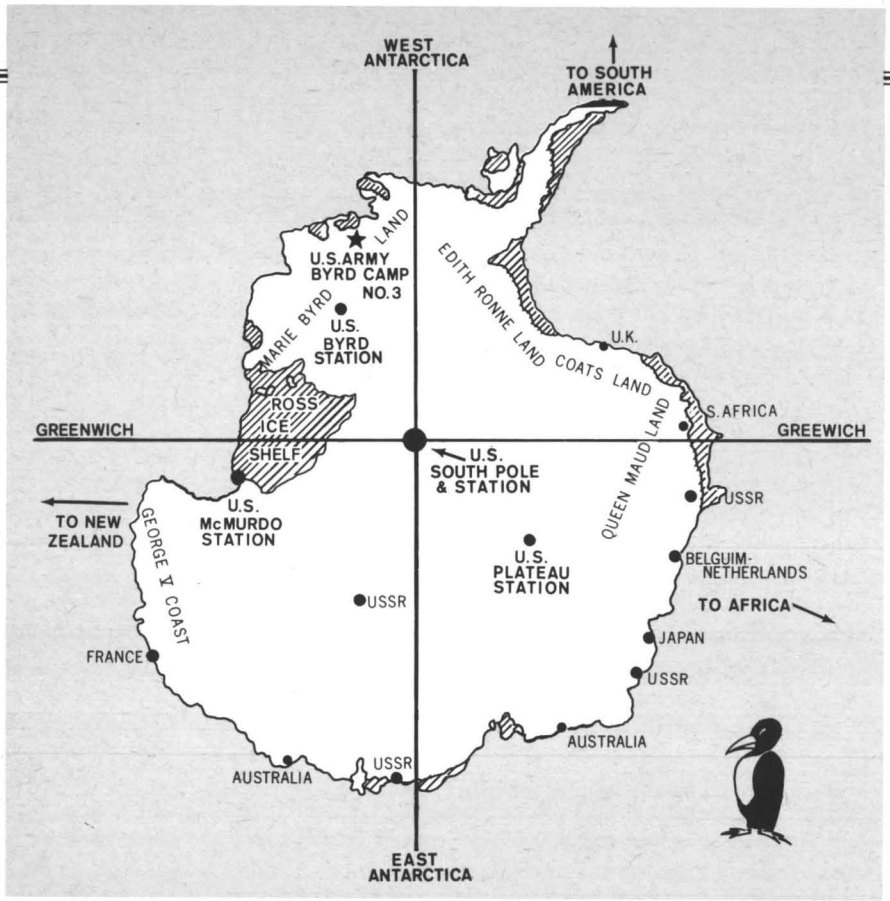
While this wide range of sophisticated avionics may make some less fortunate aviator who still uses a replica of Marconi's wireless as his only means of communication drool with envy, there are very definite reasons for having them. The absence of electronic navigational aids and the existing hazards of terrain and extreme climatic conditions dictate that reliable communications with far ranging flights be maintained. Navigation is accomplished through pilotage and dead reckoning. Problems have been encountered in this area resulting from magnetic variations as great as 120° due to the proximity to the magnetic South Pole.

It must be remembered that the continent is not naturally inhabited and there are no ground navigation stations. In fact, in the whole area — which is as large as the United States and Mexico combined — there are only seven weather observation stations.

For this reason, weather cannot be accurately predicted and, in most cases, can only be reported as it happens. There are two weather satellites which relay a fairly accurate indication of cloud cover and pressure systems to ground stations. However, even here comes deviation from normal weather rules. A low pressure system, for instance, may bring almost any kind of weather and is anything but predictable.

Many of the trying weather conditions experienced there are similar to those in the arctic, but they occur with greater frequency, usually are more severe and, as previously mentioned, the lack of predictability multiplies the hazard.

Whiteouts that limit vision to something akin to looking through a glass of milk are common. A lack of surface definition and a lack of horizon make landings nerve-trying ordeals. There is a much greater lack of depth perception than that commonly experienced while flying over water.



These factors alone would make flying more a task than a pleasure, but there's more.

While the unit is in the antarctic temperatures may drop as low as -40°F. The weather can be beautiful and 15 minutes later be so closed in that it is difficult to determine which way is up. The only dependable navigational aids available are mountain peaks, and if sight of them is lost the winds are certain to blow the aircraft off course.

Winds in Antarctica are more prevalent and severe than in any other place in the world. Along the George V Coast, on the east side of the continent, winds of 100 mph are not uncommon and have been reported as high as 200 mph. It is one of the windiest places on earth.

This, of course, is the extreme and flight operations are not attempted during such conditions. During the periods of severe winds unit helicopters are secured to deadmen dug in the glacier surface. Ropes and tiedowns are also used over the Jamesways to prevent them from being blown away. Winds of 40 to 60 knots are not at all uncommon, and 180° changes in direction are quite frequent and unpredictable.

There are, however, certain advantages the men enjoy. Because of the temperature and an estimated relative humidity of about 3 percent, there is a density altitude of approximately minus 2,000 feet. The cold is ideal for turbine operation, and happy hour drinks can be made with million-year-old ice (literally).

Living conditions are not plush, but due to imagination are comfortable. The typical camp consists of three Jamesway huts, a two-seater, and a combined operations-shower building made of used plywood. The plywood is used to support barrels of JP-4 delivered to the detachment by the Navy in ski-equipped C-130s (Hercules).

Entertainment and recreation consist of games the men bring with them, motion pictures flown in by the Navy Hercs and volley ball games played with a bright red ball. Unfortunately the C-130s can't always get through, and after the third or fourth rerun movies are out until a new batch arrives.

Showers are accomplished through use of a shovel for snow, an immersion heater in a barrel, a bucket for transport, another barrel indoors with a hurdy gurdy pump running to a third barrel suspended from the ceiling with a shower head in the bottom. Though the device looks like a Rube Goldberg creation, it is one of the most cherished items in the camp.

On extra special occasions, such as Thanksgiving, Christmas and New Year's Day, the men stage an "Antarctic 500," racing Polaris motorized snowsleds.

Special services has provided them with a stereo tape recorder and one of the finest single-sideband ham radio units made.

The radio is their only link with the United States, and phone patches, as infrequent as they are, prove to be more dependable communication with home than mail. The mail, like the films, must be flown in and sometimes comes as much as three to four weeks apart.

The unit strength is somewhat unique in itself. There are two majors, four rated warrants, an E-6 medical specialist, an E-6 technical inspector, three E-6 crew-chiefs, an E-5 avionics repairman, and one E-6 mess sergeant. The Navy provides an E-6 weather man

A Byrd Expedition aircraft is moved by dog teams in the Antarctic in about November 1929

and two mess cooks. CONARC granted authority to fill the authorized slots with one grade higher than normally would be allowed, to achieve the skill level and experience necessary for such remote operations.

Each man serves for a minimum of two years, with a staggering of personnel so that at all times half of the men will have had one tour on the ice. For instance, the major serving as executive officer one year will be the unit commander the following year. He has the authority to select his own executive officer who will be commander during his second year, and so on down the line. The continuity achieved through this method of assignment affords the experience needed to make sound decisions.

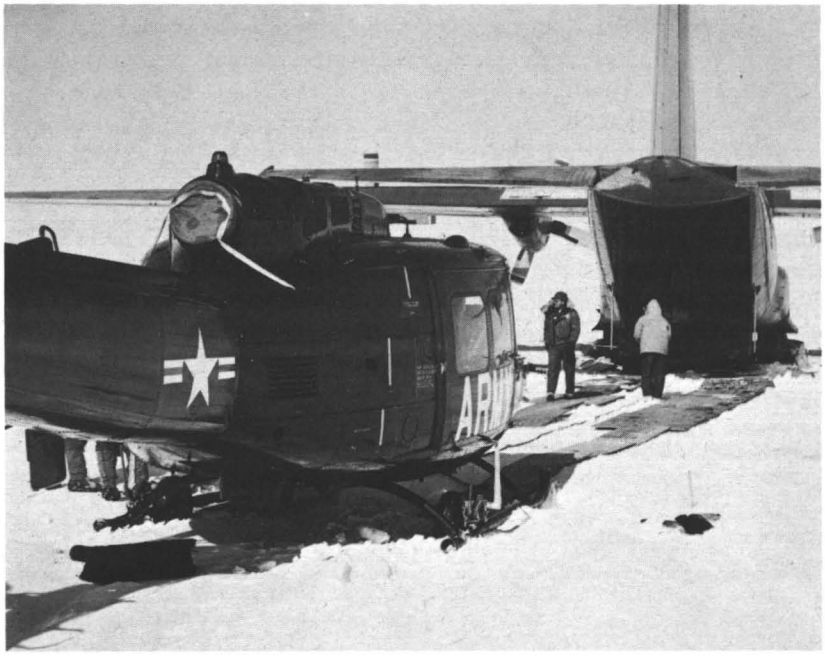
Personnel are selected not only on the basis of their skill but also for personality and family health. It would be catastrophic to have a man who cannot get along well with others, or a man who is burdened with problems of his family at home.

From October through February they seldom see anyone other than the unit personnel and the scientists they are supporting — a total of less than 30 people.

Though a man may be a specialist in every sense of the word, while in Antarctica he will do many things he never even dreamed of doing.

For instance, during the 1967-68 season, the mess sergeant found

A Navy Herc moves an Army Huey (right) to a camp site similar to the one at left



himself helping install the rotor on one of the Hueys. On the other hand, one of the crewchiefs served as mess sergeant for a portion of the unit that was stranded for two weeks due to the weather.

When the medical specialist isn't caring for the sick and injured, he serves as the unit carpenter and is in charge of the motion pictures.

All of the men must play the dual role of soldier and ambassador of good will since top scientists from other countries are frequently assigned to the camp on an exchange basis. During the past season there were geologists from South Africa and Russia and a volcanologist from Chile.

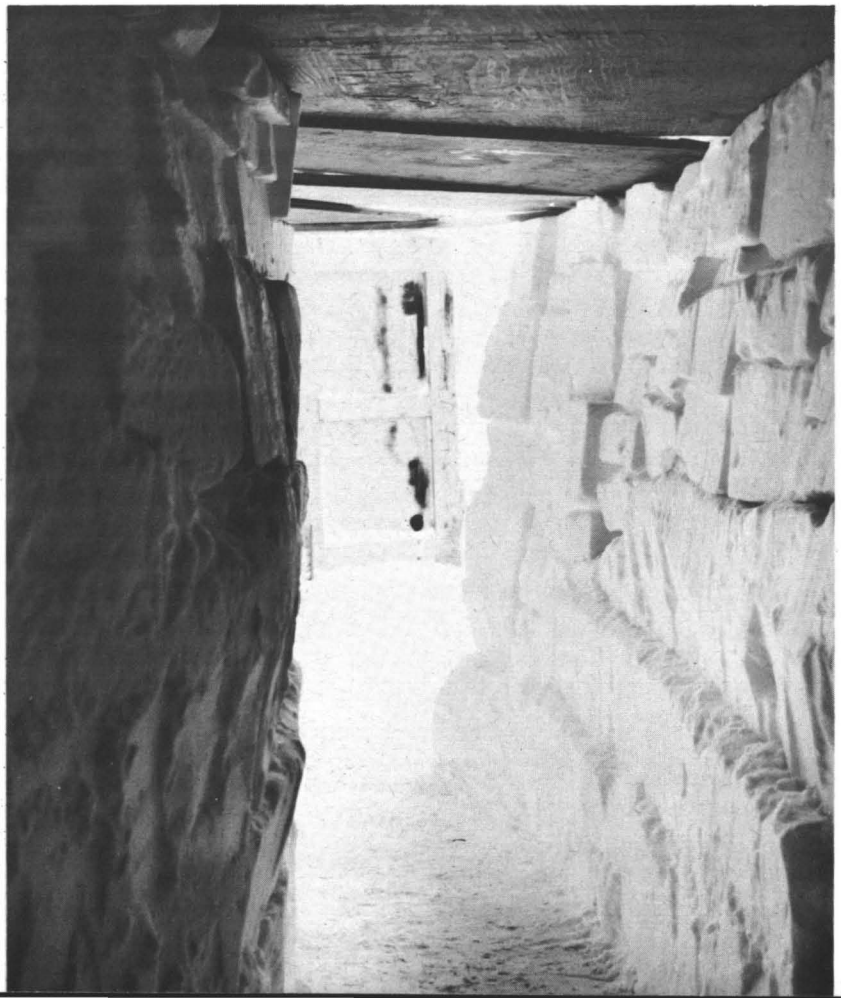
While any mature person can maintain good relations for a short period of time, it must be remembered that these men have to work, eat, sleep and socialize with these foreign dignitaries 24 hours a day, 7 days a week for 4 to 5 months.

Dr. F. Alton Wade of Texas Technical College, the senior scientist with the expedition, said the mobility provided by the unit allows the scientists to accomplish in a single season what otherwise would require up to five years.

Wade made his first two trips to the ice with the late Admiral Richard E. Byrd and has been the victim of two aircraft crashes — one in a fixed-wing aircraft and one in a Huey. He made his sixth

Above: U. S. Army UH-1B Hueys become the first helicopters to arrive at the South Pole in January 1963. Below: Pilots and copilots of the three Hueys which made the historic flight to the South Pole. The men are (L to R kneeling): SP-5 Paul George, 1LT Charles Beaman, CPT Neal E. Earley, CWO John P. D'Angelo, SP-5 Louis J. Harrison. (L to R standing): SP-5 James C. McCaslin, CPT Frank H. Radspinner, Jr., SSG Robert J. Anderson, CWO Joe R. Griffin, and SP-5 Frank L. MacPherson.

Large chunks of ice are cut (above) . . .
To build snow tunnels at camp sites (below)



trip to the ice during the 1967-68 season.

It takes a great deal of food and equipment to supply the unit — about 40,000 pounds including the aircraft. During a normal season they occupy as many as five different camp sites, either ferrying the UH-1s from camp to camp or disassembling and loading them aboard the ski equipped Hercs in the blustry cold elements.

Each time a new camp is occupied all the supplies must be raised on makeshift platforms so the snow can blow under them and not drift over. One night of blowing snow could completely cover all but the buildings. In two to three weeks even they are all but covered.

The term "night" is used only as a time reference. During the summer months (the seasons are reversed below the Equator) there is "eternal" sunlight. In mid-March the sun will finally set, shrouding the continent in a treacherous midnight blue that will last until it is autumn in the northern hemisphere.

During the 1962-63 season two Army Hueys were the first helicopters ever flown to the South Pole. [See "UH-1Bs Reach the South Pole," May 1963 DIGEST.] The crewmen received the Distinguished Flying Cross. As a result of service performed during the 1964-65 season, the Army aviators received the Navy's Unit Commendation Medal (this Navy award goes only to the personnel in the unit at the time the award is made). They also receive the Antarctic Service Medal each year they are there.

None of the aircraft fly alone. The detachment utilizes a flight following system and previously established emergency procedures on every mission. Each aircraft is equipped with two weeks' rations and survival gear.

The Hueys carry scientists to

mountain peaks and place U. S. Geological Survey personnel in strategic places to shoot astronomical positions for mapping. The men frequently are the first to ever set foot on much of the continent.

Dr. Wade pointed out that helicopters make exploration safer. With the ability to land the scientists within a very short distance of their goals, the chances of falling into a crevasse or off an icy ledge are kept at a minimum. Also, if an accident does occur, the Hueys can get the victim to medical aid in a much shorter period of time than by land vehicles.

Every man is given first aid training when he first arrives on the ice. A team of first aid and survival experts from New Zealand instruct them on survival shelter construction and rescue procedure.

Because weather allows only a limited time for operations (an average of 47 percent of the time), flights are conducted on a continuous basis during periods of good weather. With the relatively short operating season available to accomplish the programmed scientific objectives it is necessary that required spare aircraft be readily available.

Although the Hueys may be cold soaked in 40° below temperatures for as much as a week at a time, the unit has experienced outstanding success in getting them started.

The only protection against the elements is blankets tied around vents and openings to prevent blowing snow from entering the engine and gear boxes.

The tiny unit has done such an outstanding job in Antarctica that scientists and Navy aviators alike speak of "the Army Helos" with a notable tinge of reverence.

It is a perfect example of the right talon of the Eagle symbolizing the Department of the Army. The olive branch of a productive peace could not be better represented.

The Army's Hueys enhance mapping operations (above)
Helicopter maintenance often is a "community" project

ARADMAC

Equipment specialists at the Army Aeronautical Depot Maintenance Center perform crash damage analyses for USABAAR. He also can work for you, and already may have saved your life – several times!

Ray Farley

Chief Quality Audits and Special Projects Branch

MANY OF YOU religiously read articles about accident investigations because that is where you learn about the accidents and their causes. This is one of those articles. You've been reading a great deal about how accidents happened. This article will tell you why some happened, and how we find out whether you or the machinery was faulty.

Some of you have been to the Army Aeronautical Depot Maintenance Center (ARADMAC), Corpus Christi, Texas, and have seen how the equipment specialists in the Special Projects Branch work. Others may have talked to those who perform the crash damage analyses for USABAAR. Whatever the connection, you know that these men really know their business. A look at a few analysis reports will convince you.

The helicopter had just leveled off when another pilot saw it virtually disintegrate before his eyes. USABAAR and the accident board worked hard to determine the cause. Each possibility ended in a blind alley. Finally, a lot of parts were bundled up, put aboard a C-47, and flown to ARADMAC. There an equipment specialist of the Special Projects Branch began working to find the accident cause. The work went on — and on. Still, everything seemed to end up in the same place: nowhere. One day the equipment specialist came in beaming from ear to ear — his diligence had paid off and he had the answer.

The damper mounting bracket on the main rotor mast had been installed wrong. Proper maintenance procedure hadn't been followed, and the first part to fail was the damper mounting bracket (fig. 1). The damper and a piece of bracket swung out by centrifugal force and struck the push-pull tube from the scissors to the stabilizer bar, causing it to break (fig. 2-4). Lift on the opposite blade caused the head to strike the mast — hard! The mast collapsed, the rotor head came off and went down through the cabin top. With no rotor head, the helicopter fell uncontrolled to the ground.

The key to this analysis was fitting the damper bracket into the break in the push-pull tube, and knowing enough about the helicopter to establish a sequence of events. The equipment specialist had both qualifications and he found the accident cause.

Further investigations proved that quite a few damper brackets were installed wrong. The problem was corrected, and some lives — maybe yours — were saved.

Here is another one. An instructor was giving a new student his first ride. They were near the field when the helicopter suddenly nosed down and dived into the ground. Again a USABAAR investigator was called in to assist the local board, but on-site work failed to turn up a cause. Suspect parts were carefully preserved and sent to ARADMAC for analysis. It was almost a month and a lot of work later that another equipment specialist found some marks on the tail rotor blade that started him on the right track. Analysis disclosed that the epoxy tip came out of the end of the blue tail rotor blade (fig. 5), causing severe bumping of the tail rotor hub and fork as-

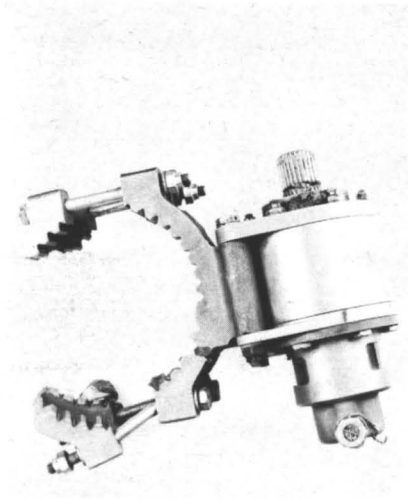


Figure 1 (above)

Figure 2 (below)

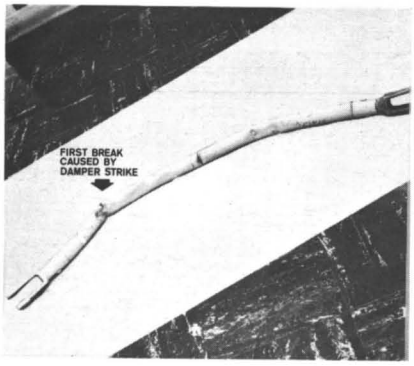


Figure 3 (below): the damper mounting bracket that struct the push pull tube

sembly, which in turn caused bending torsional overstress failure of the tail rotor shaft (fig. 6). When the tail rotor shaft failed, the tail rotor walked up the boom (fig. 7), cutting the tail rotor drive shaft and the clutch control cable (fig. 8 & 9). When the clutch cable was cut, power was lost to the main rotor. The helicopter tucked its nose, and having no power to recover went down.

Diligence and determination paid off again, but as before, good care of the parts had been taken and the analysis could be made. Little or nothing can be learned without the material to work with. If local investigators louse up the break or tear the part down, then we have a lot less chance to be able to help. We have the lab facilities, test facilities, equipment and experience needed to help find out what happened to your bird.

Let's talk just a few minutes about some of the problems we have encountered at ARADMAC. We got a project in the other day and there were four envelopes marked "paint samples #1, #2, #3, #4." The equipment specialist looked inside the envelopes, and all he could find was a little dust. We'll try to use these for analysis, but it's just about hopeless. If the people who sent those samples in had taken snips and cut out a chunk of metal, then we could have scraped our own paint samples. The one piece of metal they did send was scraped on also. It's very important to leave things as near as possible to the way you found them.

We receive hydraulic, fuel, and oil system components to check for contamination, but the fittings aren't capped. We get bolts, fittings, and such to determine the type of break, but the fracture surface is coated over with heavy rust. Probably one of the biggest problems is trying to determine how a part was put together before

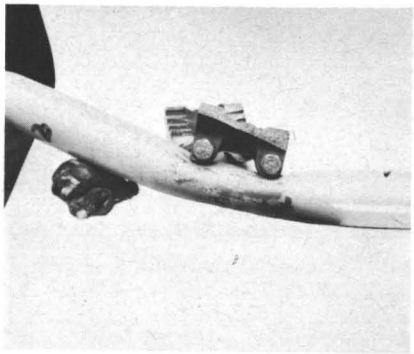


Figure 4 (above): how the damper bracket struck the push pull tube

Figure 5 (below): tip of blue tail rotor blade

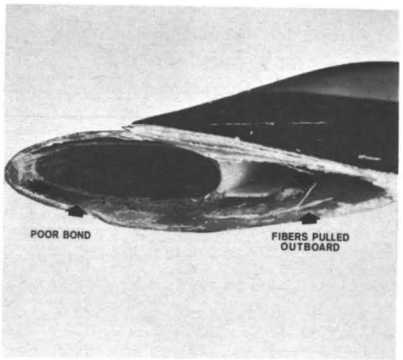


Figure 6 (below): tail rotor shaft failure

you disassembled it. We can't blame you for wanting to look at the part to determine the cause or type of failure, but write down or photograph in detail each step that you take if you feel you must tear it down.

It sounds like we might be saying that the people at ARADMAC know all of the answers, but that's not it at all. We are proud of our Quality Audit & Special Projects Branch. Every one of the eight equipment specialists has more than 20 years experience on aircraft. The four mechanics were carefully hand-picked for their mechanical ability and knowledge. Every man in the branch is devoted to better aircraft safety.

We have the support of the commanding officer, ARADMAC, and his entire staff and crew. Our laboratory is staffed by some of the best trained personnel available. We have the finest equipment, including an electron microscope capable of magnification of up to 250,000X. This piece of equipment is especially useful in identifying fractures, metal structure, etc. We also have a tensile test machine, a research model metallograph, atomic absorption analyzer, the very latest spectrographic equipment, equipment capable of measuring a dimension to 1/1,000,000 of an inch, optical comparators, and so forth.

Now let's talk about what you can do to help, and we do need your help. First, read your regulations on procedures for handling crash damaged items — AR 95-5, AVCOM Supply Letter 33-67, etc. Follow these like you're supposed to do. Proper marking will get the parts to us, so we don't run them through routine overhaul in the ARADMAC complex. But the main thing is: take care of the hardware! Cap all openings if at all possible; protect surfaces with oil or some compound to prevent corrosion; pack those broken parts

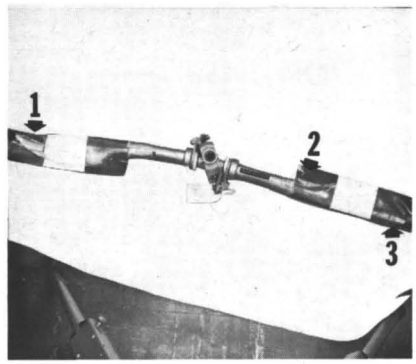


Figure 7 (above): 1, damage caused by contact with tail boom and tail rotor drive shaft; 2, orange point; 3, damage caused by impact with ground

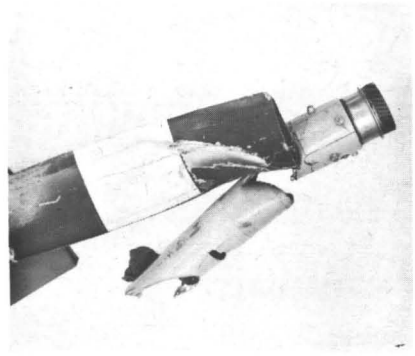
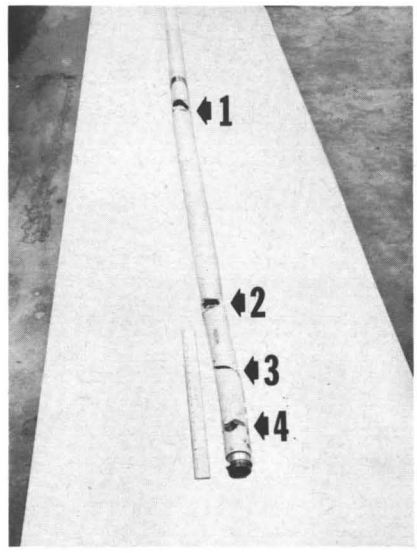


Figure 8 (above): tail rotor blade matches cut in drive shaft

Figure 9 (below): 1, 2, and 3 are secondary failures; 4, the impact area where red point and fiberglass were found from the tail rotor blade



carefully — splint them if necessary; then put them in a box, can, or crate that can withstand the rough treatment the freight handlers give it. Last, but certainly not least, MARK it like the AR or supply letter directs.

You can send the package several ways. Chances are that you want a quick answer, because you are supposed to have 30 days to get your accident report in, so send your package the quickest way. If you can't bring it yourself, then use air mail for the small items or air freight for the larger ones. Use truck freight only when the priority is low enough.

We'll get to work as soon as possible after it gets here. Right now, that's a couple of weeks. Very soon we will be able to start on your part within 72 hours after it arrives at ARADMAC. This will mean that you get a preliminary report by phone or TWX within 7 days and a formal report within 30 days. Sounds OK, doesn't it? We'll do it too; just help us by taking care of your part and shipping it right. If you want to know about your part, call us autovon 725-1553 or -1370. We'll tell you if we got your part and when to expect your report.

We'll even try to help you if you tear it down yourself and can't find the answer, but we could help a lot more if you would just let us help from the start. To prove that point, look at some of these figures. Every T-53 engine we save is worth $50,000; every UH-1 is worth $242,000; every CH-47 is worth $1,300,000; and the accident involving any one of these pieces of hardware might cost you a life. Yet one project on the CH-47 saved over 60 of these aircraft; one project on the Huey saved several hundred of their kind; one project on a T-53 engine saved over a hundred of these plants; and most important — one of them may have saved your life.

What Price Complacency?

The declining accident rate can lead to a false sense of security and the growth of complacency

Captain J. O. Estes

ARMY AVIATION today enjoys a most enviable safety record. Despite the growing number of aircraft in our inventory and their increasing complexity, our accident rate shows a steady decline. "Good," you say. "That shows we're good aviators."

We are. But if you feel this way, you've already committed the cardinal sin of safety — complacency. True, the accident rate is good, but no one can doubt that it can be better. Excluding Vietnam activities, the statistics for the past year indicate a new low of 15.3 accidents for each 100,000 hours flown.

In your own estimation, based on your knowledge as an aviator, how many of the accidents could have been prevented? How many do you think resulted because the pilot was not mentally alert when the emergency arose?

Have you ever headed out of your drive intending to go to the PX or post office and two blocks away discovered you had turned the wrong way, headed for the office instead? Why did you do this? Perhaps because of worry, preoccupation, or concentration on something else. Or perhaps a blithe sense of well being caused the momentary lapse. Regardless of the reason, you were complacent. Suppose this same situation happened during a flight. The many ramifications possible are too numerous to mention.

All of us know aviators who are more susceptible to this sort of behavior than others. One I have known exemplifies this complacent attitude. I was a passenger on a U-6 flight with him as pilot. We were IFR in the clouds, en route from Fort Benning to Atlanta, Ga. Everything progressed smoothly for about 45 minutes. As most pilots do, I found myself monitoring the instrument panel. Immediately I noticed the altimeter indicated we were 300 feet above our assigned level. After what seemed like an eternity, he finally corrected our flight path. Within a short time we were 200 feet low. This was to be the pattern for the balance of the trip.

Fortunately, the flight was completed without mishap. On the ground, conversation revealed that the pilot was pleased with his flying ability — convinced that he was an exemplary aviator. He was completely satisfied with his performance. This is a prime example of a complacent individual.

Several months later, I was a passenger once again with the same pilot, this time in a far different situation. We were on maneuvers, in the middle of the Mojave Desert in California. The month was May and the weather was beautiful.

After the first week, C-rations had become unappetizing. As lunch time approached on this particular day, we wondered how we might obtain something a little different to eat. My friend suggested perhaps his OH-13H could provide the means to a welcome respite. We immediately departed in search of a new menu.

Outbound, the flight was uneventful and eminently successful. About 15 miles north, we found a restaurant that provided the desired fare. The return flight was quite a different story. Our base camp was about 650 feet mean sea level. Our flight path outbound had been along a highway which ran along the mountain ridge upwards of 3,600 feet. We had flown along the eastern or windward side of the range. On the return passage we were about a quarter mile west; this placed us on the lee side of the same ridge.

Perhaps it was a full stomach, or a feeling that we had beaten the odds for a change — who knows? At any rate our old acquaintance crept into the cockpit with us. We were admiring the beautiful countryside when I noticed we were converging on the ridge line. I keyed the mike and mentioned that it would be a good idea to give the mountain a little wider berth as our altitude was just below the tops of the ridges.

"Maybe you're right," came the rejoinder, with a corresponding shallow bank to the right. We had turned almost 90° when suddenly without warning the aircraft started a steep and very rapid descent. He immediately applied full throttle and maximum collective in an attempt to remain level. As we continued to drop rapidly, he increased airspeed to 70 knots trying to get away from the mountain. In a few seconds it was apparent that we were not going anywhere but down.

About this point fate intervened.

What Price Complacency?

We found ourselves over a shallow valley with a wide dry river bed running through the bottom. The river bed was covered with 10 to 12 inches of loose sand, but no rocks or trees. Since we could not climb, this was about as good as could be hoped for. Have you ever attempted a running landing with full power, while desperately trying to stretch a glide into a takeoff? That is what happened. We terminated in the creek bed with no damage worse than red faces and a pair of much sadder but wiser pilots.

One month short of a year later I picked up the local paper and was shocked to read that this same aviator had been killed in a low-level wire strike while piloting an OH-13H. I have no idea of the findings of the official investigation. But having first-hand knowledge of this man's personal flying habits, I cannot help but wonder if our old enemy, complacency, did not play a great part in his fatal accident.

I can hear you say: "I am very careful. I pay close attention to every detail. I make it a precise business whenever I get into the cockpit. I know that could never happen to me as long as I am in command of the aircraft." These were my exact thoughts as I mulled these events over in my mind. I was convinced that I was as careful as anyone could be.

Later, as a member of the Third Army Standardization Board, I was responsible for administering a transition training program. Several aviators had recently returned from the "Q" course at Fort Wolters, Texas. Since the unit had only OH-13H models it was necessary to qualify everyone as soon as possible. A large scale maneuver was to begin in about three weeks, so every rotary wing qualified aviator was going to be needed.

By the time we arrived in the maneuver area most of the work was completed. But, as is usually the case, a few people were still returning from school as we were departing home station. These stragglers had to be transitioned in the field if we were to use their new skills to best advantage. So, I found myself an IP training newly qualified helicopter pilots in the maneuver area itself. This proved to be an advantage. The terrain was much more realistic for training than we had available previously.

Toward the end of the program we were out shooting pinnacle approaches to the flat top of a rugged, rocky craig, 3,300 feet above the surrounding desert floor. This particular incident occurred about 0900 on a beautiful, sunny day. The aircraft never performed better and the student was doing an excellent job. After he made the fourth consecutive approach without even a comment from me, I directed that he shoot one more. I had my camera in the aircraft and thought I would take a picture on the last trip around. Then we would return to our home base.

He executed a smooth takeoff and proceeded around the pattern. I adjusted the camera, and as we turned final everything looked normal. I leaned out the right side a little, intent on getting a good picture. Just as I snapped the shutter, I heard the rpm begin to drop off. I glanced at the tach as it passed through 3000 on its way down. The camera hit the floor as I grabbed for the throttle and looked ahead to see that we were 50 feet short of the rim and almost 75 feet short of the intended touchdown area.

At this moment we were less than 20 feet from the surface. I wrapped on full throttle, managed to coax the rpm back to 3000, pulled as much pitch as I dared, put almost full forward cyclic, and just barely managed to plant this Sioux on the side of the mountain, facing uphill. The terrain was all rock, large and small, with nothing for the skids to dig into. The slope was so steep the available power could not hold us stationary. Consequently, the aircraft started slipping backward. To say this was a critical situation is an understatement.

The only course available for us was to attempt to turn the aircraft around and hopefully nurse it back into the air. Using full right pedal, full left cyclic, full throttle, maximum pitch, much sweat and a couple of hasty prayers, a few seconds later we glanced off a boulder, bounced into the air and were airborne. We landed immediately (in a different location) and much to our relief no damage was sustained by the aircraft.

The damage to the aviators — that is another story. How do you measure scars on the inside? Once again a sense of "all is well," a false sense of security, had led down a nearly deadend trail.

In the incidents recounted here no accidents resulted. But how many times daily are similar situations encountered with not so fortunate a result? How many accidents are caused by complacency, directly or indirectly, is a matter for conjecture. Think what we could save on hardware, plus the immeasurable amount of wear and tear on aviators, simply by changing an attitude.

It has been proved that safety is, first, primarily a state of mind and second, a state of being. But this is also an adequate definition of complacency. To combat complacency in the cockpit, continually concentrate on the next five minutes of the flight.

How's your attitude?

Mail Order Instrument Ticket

(For Rotary Wing Types)

Complete kits of instruction material, instructor's guides, guides for standardization, and training overlay charts for the Helicopter Instrument Flight Course are now available by mail

A PACKET FOR a complete helicopter instrument flight course is now available for individual unit administration from the Extension Division, Department of Publications and Non-Resident Instruction, at USAAVNS. The course is identical to that given resident students and provides for the awarding of an instrument ticket upon completion.

A unique feature of the new program is that the academic portions have been adapted to programmed instruction. This takes much of the burden off the unit training officer and allows each student to pace himself. To date, students have been completing the instruction in four to nine weeks with an overall average of eight weeks.

While some of the 52 texts are of use to aviators on an individual basis, in order for the entire program to be effective it should be conducted and controlled on a unit basis. Complete kits of instruction material, instructor's guides, guides for standardization, and training overlay charts are available from the Extension Division.

One reason for encouraging unit instruction is the text material is closely integrated with synthetic trainer and flight programs. Most aviators will not have the direct access to trainers and aircraft that is desirable.

The previous helicopter instrument course was redesigned into the programmed format in 1965 under civilian contract. It was first used with the February 1967 instrument class at Fort Rucker and was so successful it has been followed since. The course length was reduced by an average of two weeks and the previous 63 hours of flying time has been cut to approximately 50 hours.

While instructions for administering the course specifically spells out the type aircraft, proper instructor to student ratio and model of synthetic trainer, it is intended to be flexible. For instance, a unit might not be able to have the ideal one IP to one student ratio. In this case, the total length for completion can be extended to meet individual needs. All that is required to adapt the course is a little foresight and imagination.

The course is divided into two phases, the first being academics and synthetic training, and the second includes the actual instrument flight training.

All materials complete with methods of instruction, grading, and other essentials for proper administration are sent. When requesting the unit kits it is important to include the number of students to be involved plus the number of instructors.

Requests should be signed by the commander and sent to the Extension Division, Dept of P&NRI, USAAVNS, Fort Rucker, Ala. 36360. The official title for the course is Helicopter Instrument Flying Course.

EROSION and YOU

Captain James M. Morris

ERODE — *to eat into; wear away; disintegrate; to form by wearing away gradually* is the way Mr. Webster defines this word. Most of us are fully familiar with the word as it applies to soil and nature, but are we fully familiar with its use as applied to aviation?

This was the lead statement by the guest speaker at the monthly safety meeting, and Captain Flynn considered it his cue to doze. He had heard this stuff before, but just in case he poked Lieutenant Newly and told him to make sure he paid attention as he could learn something.

As the speaker continued he started to recount pertinent incidents concerning erosion in aviation. ". . . It was a normal recon and the O-1E pilot had flown this same area at least 100 times. He spotted some movement near the river bank and went in closer for a better look. Sure enough, there was a group of Charlies. He could tell they were Charlies because they shot at the aircraft. He decided he'd make a second run and drop a white phosphorus grenade to give them a little to think about while he tried getting some artillery on the horn. During the run he observed cover by coming in low and from a different direction.

As he released the grenade out the window, he pulled up to observe its fall. He could not see the grenade! His wingman who was in an adjacent area said his last transmission was that his empennage was burning off and he couldn't control the aircraft — then radio silence. From the appearance of the wreckage most agree that he crashed into the hillside after losing control of the aircraft. . . ." Cause of the accident — erosion!

Lieutenant Newly didn't quite get the connection between erosion and the grenade incident. He wanted to ask Captain Flynn but thought better about it when he looked at the captain and saw he was dreaming, probably about airplanes.

Lieutenant Newly turned his attention again to the speaker just in time to hear, ". . . the lieutenant hadn't been into the strip before, so he decided to make a good recon before he went in. He couldn't pick out any wind indicators on the ground, so he decided he'd drop a smoke grenade for a wind indicator. It was perfect — the wind was right down the runway at about 3 knots — with nothing to worry about. He turned final from his teardrop approach and was at roundout when the cockpit went green. He had dropped the grenade on the side of the runway and now ran into the hanging cloud of green smoke. He applied power to go around, but he hit the barbed wire fence at the end of the strip and flipped over on his back." Cause of the accident — erosion!

Lieutenant Newly was still confused. His boss old Flynn was mumbling to himself, with half-closed eyes, about the new, more sophisticated aircraft that he should be flying instead of the old "no-challenge" machines he was flying.

The lieutenant returned his attention to the guest speaker as he said, ". . . the pilot was an old

hand and considered by all to be a smooth, experienced pilot. His quarter ton had been a little hard to start this morning and his roommate a little late so he was behind schedule before he got to the mess hall. By the time he got to the flight line the 30 minutes lead time had vanished and mission time was upon him. Add to this the facts that the aircraft was just being buttoned up after an intermediate and it was raining as it can rain only in Vietnam and you have a rush type situation.

"The pilot preflighted the aircraft, checked the book, and climbed in for his mission. Twenty minutes later word filtered back that the aircraft had made a forced landing after an engine failure. The aircraft had been damaged but the pilot had done a commendable job in putting it down in the area he did." Cause of the accident — erosion!

Lieutenant Newly still didn't see the erosion factor and wanted to ask Captain Flynn. He hesitated again as the good captain was now audibly dreaming about an outstanding maneuver he had performed in a challenging situation.

Turning his attention to the speaker again, he heard: ". . . In this instance the pilot was on an admin type flight and was very familiar with the strip, as it was only a short distance from company headquarters. The weather was very bad but the flight time should have been only about 10 minutes, so he attempted to perform the mission. He was on final for the strip and lost sight of the field so he went around. On his second attempt he caught a glimpse of the field and pushed through. He attempted to roundout but started to float and found his groundspeed was far above what he expected. He touched down but braking action was very poor so he decided to go around again. He applied power and ended up in a waterway." Cause of the accident — erosion!

The speaker started right in on another story, leaving Lieutenant Newly still confused. ". . . the pilot was on a two ship mission. He and his wingman were ready to head back to the main base from the camp they were supporting. His wingman had developed a bit of mag trouble, so being flight leader he elected to start out anyway and keep contact by radio. The weather was very bad and night was approaching, but they didn't want to stay out at the camp for the night, and they flew in weather like this most of the time anyway.

"When the wingman broke ground he made contact with his flight leader, who was about 10 minutes ahead of him according to the estimated position the leader gave him. After about 5 minutes the flight leader called back and said weather conditions were getting worse, that he had to deviate from his original route and that he wasn't sure of exactly where he was but could give an approximate position. The next call stated that the flight leader was attempting to climb since he wasn't sure of his location and couldn't maintain visual references. They looked for that flight leader for 2 weeks and never found him." Cause of the accident — erosion!

Lieutenant Newly still didn't get the complete picture but was sure that it would all tie in very soon. The guest speaker continued and recounted the tales of pilots taxiing into foxholes, losing all engine oil because an oil cap came off, and losing airspeed, altitude and manifold pressure while reconning at treetop level. All had the same cause—erosion!

The speaker started his summation. Captain Flynn perked up a little, he was ready to leave. The speaker stated that in every case recounted the aviator had about 500 hours in the aircraft; that he was at or approaching the point where he was wearing the aircraft like an old pair of pants and really could fly it — or thought he could.

Captain Flynn was wide awake at this time and squirming around. He didn't like the sound of this talk. The speaker continued, ". . . Having known every aviator described here, I can say that each was doing what caused his mishap for at least the second time. They had slowly moved away from accepted practice into the realm of what some have misguidedly called 'pilot technique.'

The cause of each mishap was different and won't be discussed here. But among the things common to each was the fact that something was done which deviated from the normal.

"Accepted practices, good common sense, and adherence to safety rules are not written for new aviators alone; they belong to every aviator as long as he flies — and especially when he begins to feel he is part of the airplane. It is the persistent flow of water that over the years has eroded the walls of the Colorado River until today we have a Grand Canyon. It is the persistent routine of performing missions until they become overfamiliar that can erode your adherence to safe procedures and accepted practices. So be careful when you get that feeling 'you can fly this bird like you wear your pants."

The speaker thanked the audience and departed. As the swell of aviators pushed toward the doors, Captain Flynn nudged Lieutenant Newly and said ". . . I hope you caught all that stuff lieutenant. It will really help you until you get to know what to do from experience and don't have to rely on crutches. . . . Hey, look at that Mohawk. What a beautiful bird. Too bad we can't fly something like that instead of these old O-1s and U-6s!"

THE FIRE TEAM

We made two passes, expending 50 percent of our ordnance on each run

CW2 John M. Barber

THE FIRE TEAM had been briefed at 2100 hours for the next day's mission. It was a routine mission: flying cover for a convoy. Takeoff time was set for 0700 hours the next morning.

The members of the fire team (which consists of two armed Hueys) went to bed expecting to get plenty of sleep. At 0300 hours the next morning the quarters were in turmoil. Someone said, "Hit the deck; they've been hit." We fell out about half asleep, trying to find out what all the commotion was about. Then we found out. Charlie had hit Dong Xoai; they are being overrun.

While the pilot was in operations, the aircraft commander got the aircraft started. In less than 10 minutes the fire team was airborne. Twenty-five minutes later the fire team landed at a staging area. After getting all the information available, the fire team was in the air again. At first light the fire team was over Dong Xoai. Due to heavy tactical air support we had to remain over the east end of the village.

From our station, we could see Charlie charging the compound. They were coming out of a treeline, across a small open area, and into the compound. Tactical air was hitting Charlie in the clearing with 500 and 750 pound bombs, napalm, and 20 millimeter cannons. The treeline was being hit with the same firepower.

When the dust from the bombs and the smoke from the napalm cleared, Charlie was still coming.

The troops in the compound began to pull back into the village. They numbered less than a platoon, and the number of the Viet Cong was more than they could handle. During the withdrawal, the troops stopped by the artillery pits and took the firing mechanism out of the 105s.

Back at the staging area, other fire teams that had been called were ready to take their turn on station. Word was sent back that the compound had been evacuated and that Charlie had the compound. Now came the task of getting the troops out of the village. Troop lift helicopters were given their mission. Two fire teams were to fly cover, and to get maximum cover eight A-1Es were to join up over the village.

The flight approached the village from the east. The armed helicopters worked inside the A-1Es, and the A-1s kept the west end under constant fire. The troops were returned to the staging area. The mission was a success; there were no personnel or aircraft losses.

After the Viet Cong were in the compound, they took two armored cars and stationed them on a bridge 2 miles southwest of the village. Each car had a .50 caliber machinegun mounted on it. The Viet Cong were now in the process of destroying the compound.

The order was given to bomb the compound. The Air Force, Navy, and Vietnamese Air Force hit the compound with everything they had.

We were now low on fuel and ammo, so we were replaced on station by another fire team. Back at the staging area, which by this time was loaded with aircraft, we refueled and rearmed our helicopter. We were also briefed on our next mission. We were to prestrike an area 2 miles to the north. Our responsibility was the east side of the landing zone. Another fire team had the west side.

We took off only minutes ahead of the troop lift. Our firing passes were made from the north. We made two passes, expending 50 percent of our ordnance on each pass. As we were making our last pass, the troop lift was close behind on final. When the wingman of each fire team broke from the target, the armed escort took over. The helicopters landed and the relief force was on the ground. The relief force

The Fire Team

was on its own; no one thought that within 10 minutes it would be annihilated. Charlie had waited until the armed ships left, then he hit the relief column with such force that help could not get there in time.

We had returned to the staging area to refuel and rearm. Shortly thereafter we were on our way to replace a fire team on station. On the way out we were told that troops had been spotted in the east end of the village, but it had not been determined whether they were friend or foe.

We joined with a "Hog" (a Huey armed with forty-eight 2.75" rockets) and were shown the location of the troops. We decided to make a low-level reconnaissance and try to identify the troops. At that time we were 3,000 feet high, which was a fairly safe altitude since there were fifties (.50 cal. machineguns) in the area.

We started our letdown and made a wide sweep to the north to make our pass from that direction. On our first pass we found a fifty that had not been reported. Thanks to our being at a low level, he did not have a clear field of fire. We also received a large volume of fire from the west end of the village.

After completion, we were not sure of the identity of the troops, so we got set up for another pass. On each pass the troops were throwing red smoke, waving and motioning for us to land. We had made seven low-level passes before we felt sure they were friendly. We made all the passes from the same direction for there was only one safe way in and one out.

After we had identified the troops, we called the Hog. He told us to pick him up and escort him in. He landed in a small schoolyard. There were 60 troopers on the ground, part of a "striker force" that had been cut off in the village. They said they could hold out and all they wanted was to get two wounded out.

The Hog took on the two wounded and called to tell us he was ready to come out. We told him to wait one as we got in position to pick him up and that we would tell him when to lift off. We gave him the pull sign, he lifted off, and we escorted him out of the village and up to a safe altitude. After reaching altitude, we broke off and the wounded were carried to the staging area.

We took up an orbit to the southwest of the village. Upon arriving in this area, we immediately spotted the two armored cars. We marked the target and called for tactical support which was orbiting overhead. Four F-100 Super Sabres hit the armored cars with 20-millimeter cannons, 500-pound bombs, and napalm. On the first pass the two armored cars were destroyed. That gave us two less fifties to worry about. As we began to widen our orbit, we picked up more fifty fire just south of the compound. The area was hit by four more F-100s.

Our fuel was getting low, so another fire team replaced us, and we returned to the staging area and refueled. After a short breather, we were airborne again. This time we were to get into position for a troop lift to be put in a rubber plantation to the north of Dong Xoai.

When the troop lift was on short final, Charlie let us know he was there. Only five of the troop lift helicopters were able to land. The helicopters took off as Charlie started firing mortars. The fifth ship was hit by a mortar round after it had ascended about 40 feet. The aircraft crashed and burned and a crew of four was lost. The troops of the relief force were killed in a matter of minutes. After our second attempt to put in a relief force failed we began to wonder if there was anyplace we could put one with any hope at all of a chance to fight.

The Air Force, Navy, and Vietnamese Air Force were given the order to destroy the plantation. We were told to return to the staging area. The Army and Air Force transports had been busy bringing in troops and ammunition. We were getting ready for a long, hard fight.

As late afternoon came, it was decided we would put in a large lift in a soccer field immediately to the south of the compound. As the plans were being made, the aircraft were being refueled and rearmed. The troops were put in groups of eight each and were standing by to board the aircraft.

After we were briefed on the mission and given the chances of success, which were slim, we then went to our aircraft. With about one hour of sunlight left, we lifted off. We were followed by the troop lift helicopters and their escort. We had two heavy fire teams (two gunships and a Hog in each team) to prestrike the landing zone.

Once again we made two passes. We hit the LZ with everything we had. The timing of the troop lift was perfect; they were on final as we were making our final pass. With the exception of one troop ship being shot down (he was hit by a fifty and all personnel lost) the mission was a success. As night fell on Dong Xoai, the village and compound were in friendly hands again.

The job was not over. Now there was the evacuation of the wounded and dead, resupply, counting of the enemy dead, and rebuilding the compound.

To those of us who were in the battle, Dong Xoai will never be forgotten. For those on the ground when Dong Xoai was hit, they will always be thankful they are able to say, "I was there."

FM Homing as an Instrument Navaid

CW2 John R. Fox

SOUNDS DARN LEERY, doesn't it? But it can be plenty helpful when in a dire need of a place to land. Can you imagine encountering a broken cloud layer at 1,500 feet at 1000 hours somewhere between Saigon and Muc Hoa? Sure you can; anyone who's been there can tell the time of day by the altitude of the cloud layer. Would you climb to 2,500 feet or 3,000 feet VFR on top and continue your mission to Muc Hoa? Yep, as long as there was good visibility both on top and below, which there always is.

You are being radar vectored to Muc Hoa to help avoid the Cambodian border. After 25 minutes of flight, radar advises that it is unable to maintain radar contact due to a line of thunderstorms building between you and Saigon. Visibility remains good and no thunderstorms are in your route. You are able to determine the border by sight. Onward to Muc Hoa and completion of another mission.

The cloud layer has risen and you are now 3,500 feet with thunderstorms building rapidly to the south. Your VOR is tuned to Saigon, the only station available. The ADF is tuned to Vinh Long, but is not accurate due to electrical storms in the vicinity. The broken condition is not as broken as you would wish and ground navigation is getting more difficult. So you say, "Let's have a look behind us." Yep, you were right, that's worse yet and *no* broken condition.

By this time you are disoriented, but know that your last general heading to Muc Hoa was 270 and location about 10 minutes east of Muc Hoa. After rolling out on that heading, you and your copilot devise a plan of action: contact Muc Hoa on FM and home into it. Then an actual instrument letdown will have to be made through the cloud layer. Understand, of course, this will be only as a final solution, after contact with center for some other possible solution to your dilemma has been made.

Let's review how this equipment works. The AN/ARC-44 with the ARA-31 homing antenna enables us to home to any FM transmitter operating in the range of 24.0 to 49.0 megacycles.

After voice contact with our destination and confirming the height of the cloud base, we asked them to key the mike for 15 seconds with 10 second pauses to converse in. During the 15 seconds of transmission the homing switch must be turned on. A Morse code signal is produced by whichever antenna picks up the transmitting signal first. It is reproduced into either the Morse code letter D (- • •), left antenna, or letter U (• • -), right antenna. A simple way to remember which is which is to remember "Step on the dash," or associate the dash as pointing left or pointing right.

When a signal is received and the direction to turn has been determined, turn that direction until a steady signal is received. This is the on course tone. The station will be directly in front of us. While flying towards the station, the aircraft may be either slipped with pedals or a cyclic turn may be made in either direction to constantly check the heading and on course signal to the station.

Upon station passage, no signal will be received. Then you are directly over the transmitter. When the signal returns it will be the opposite Morse code letter, last received. You might be able to fix an intersection at this time by using the ADF and VOR. This will be helpful in relocating the transmitter.

To continue with our dilemma, we might turn to a heading of north, fly for 1 minute, then return to the FM transmitter on a general heading of south, letting down until we are at the tops of the clouds. Then at station passage we start a descent to reach VFR below the cloud layer. The heading of south should take us away from the Cambodian border. If your hood time has been up to date, then a straight and level descent for about 6 minutes shouldn't be bad at all.

It is not intended that FM homing be considered the ideal method of reaching your destination under instrument conditions. It will, however, be of considerable assistance if you have no better means of navigation. It certainly is more accurate than dead reckoning in the soup; and when it's all you've got, it's better than nothing. All it requires is that you know how to use it.

Photos by CW4 J. P. ERVIN

Captain Frank Gall

Night Flight

Preflight, procedure, teamwork and proficiency are four important ingredients in good flight operations. At night they become much more significant. The author discusses how to contribute to the success of night flights

PREFLIGHT, PROCEDURE, teamwork and proficiency are an unbeatable combination for flight, to say the least, and this combination becomes increasingly important during the hours of darkness. Would you omit or be lacking in one of these categories and still be able to relax and feel reasonably secure during the performance of your mission in daylight hours? Probably so, since you're just an average outstanding aviator. You may feel your deficiency in one area is more than made up for by your achievements in other areas. Right? You bet fella. After all, you are an aviator.

Now, let's take a look at preflight, procedure, teamwork, and proficiency under conditions of darkness and see if you attach more importance to them. Yes? Well, since you're the average outstanding aviator, you probably do and you're correct in doing so. Night operations are inherently more hazardous than the same operation performed during daylight. Still, for a more complete understanding of how important these categories are to us, let us take each individually and see how it can contribute to the success of a night flight.

Preflight — A thorough preflight should be accomplished before every flight. How many times has this been said? Of course it's important, but at night it becomes even more critical and should be performed with the greatest care. Discrepancies which are easily spotted in daylight may be overlooked at night or found only after the most careful examination of the aircraft. The inconvenience, alone, of having to climb over the aircraft with a flashlight in one hand while holding on with the other may be enough to contribute to forgetfulness or for omissions of portions of the preflight.

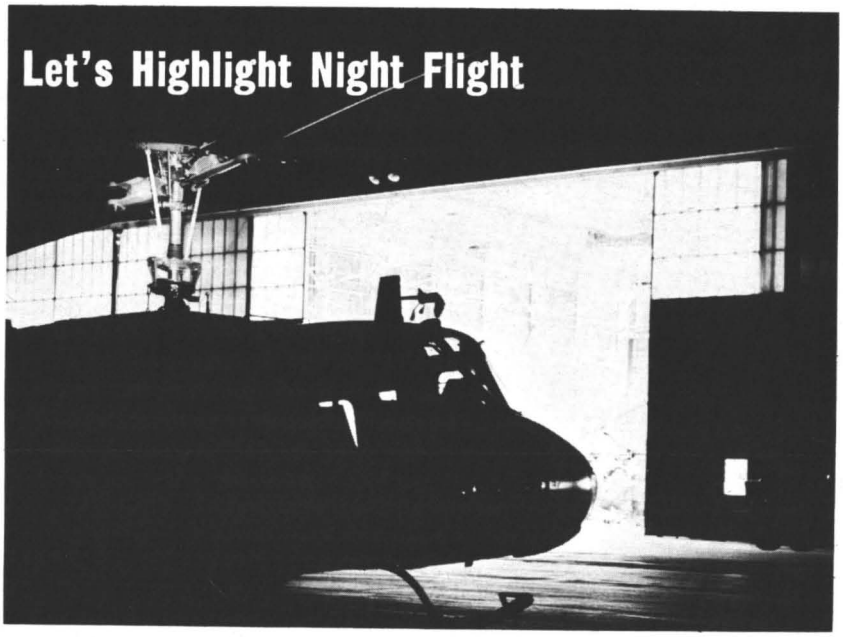
Remember, the night preflight attaches importance to some items not normally covered in a daylight inspection. For example, your mission is a passenger pickup in the field at 1000 hours. The weather is ideal for VFR flight, estimated flight time is 00 + 45 minutes, and your aircraft is a UH-1B. Would you check your searchlight, landing light, position lights and your anticollision light to see if they are functioning properly? Would you check them before a night flight?

Let's assume you did check them before the daylight mission and found your searchlight and landing light inoperative, would you go anyway? What if this were a night mission, would you go then? Give yourself an honest answer.

Procedure — Cockpit procedure, starting procedure, shutdown procedure, emergency procedure — how many procedures do you have to know? Well, you should know all of them and then some. The only function of procedures is to serve you, the aviator, by providing an appropriate course of action that is devoid of confusion and contradiction as it applies to a particular set of circumstances.

Going one step further, put yourself in a situation that isn't covered by a specific procedure and have an accident because of it. Are you going to remember what you did or didn't do that may have caused the accident? Suppose it happens again, will you already have a definite course of action to take to prevent an unhappy ending? Probably so!

What if you had an engine failure at night in a UH-1, altitude



1,500 feet absolute and a rated copilot on board. When would you turn on your lights? Would you turn on both the landing light and the searchlight? If the pilot was in the right seat would he both fly the aircraft and work the lights, or would the copilot fly the aircraft while the pilot worked the lights? Suppose the pilot was in the left seat, who would fly the aircraft and who would work the lights now? Night emergency procedure — how important is it?

Teamwork — Pilot and copilot should work together as a team. Sure they should; everybody knows that. Why bother to even mention it? The reason it's mentioned is that maybe you and your copilot don't work well together. What's worse, maybe you don't even know it — and won't until you're in a critical situation and your copilot doesn't react the way you thought he would.

Is there any reason for a copilot to be more apprehensive about the pilot's ability to perform a night autorotation as opposed to daylight? You bet there is. Have the pilot develop fixation and see what happens if you don't help out.

Proficiency — Last but not least is proficiency. Yes, I'm going to say it again: How important is proficiency? How important is night proficiency? It's always important, but just how critical it is depends on the situation. Would you rather go into a minimum lighted area in the field with a student aviator, this being his first time, or go into a minimum lighted helipad on a ridge line in Vietnam with a combat proved aviator?

Just how does an aviator become proficient in the first place? He must take what he learned in flight school and continue to build upon it. He must practice all aspects of flight technique, and when he feels almost perfect take a deep breath, look himself in the eye, and begin again. Proficiency results only from constant prodding. Stop pushing, and proficiency begins to slide.

So we've refreshed our knowledge of the importance of night preflight, procedure, teamwork and proficiency. So what! You've heard that umpteen times before and absorbed it all on the first go. Now remember, you're the average outstanding aviator, but there are others who may only be average. For their benefit I've listed a few major nighttime accidents caused by the aviator's deficiency in one or more of the categories discussed.

Why don't you go over this list of accidents and tell the average aviator why you believe it happened? You may prevent the accident board from convening after the next night flight you take, with the average guy acting as your copilot.

CH-21. The pilot was attempting to make a landing through fog and haze at night. He became disoriented due to loss of visual horizon and began making a climbing left turn while attempting to use visual references when none were available. The pilot's attitude indicator had been "spilled" due to the steepness of his turn during the approach. There was no copilot on board. Goodbye one CH-21.

UH-19C. After checking weather and finding that thunderstorms were in the area, the pilot planned a VFR flight. Approximately 15 minutes in flight he encountered severe weather conditions, including updrafts and downdrafts which made the aircraft difficult to control. The pilot turned on his landing light at least twice to try to get ground reference. The aircraft flew into the ground, crashed and burned. No copilot was on board and the aircraft was not equipped for instrument flight. Three persons later died as a result of their injuries, including the pilot.

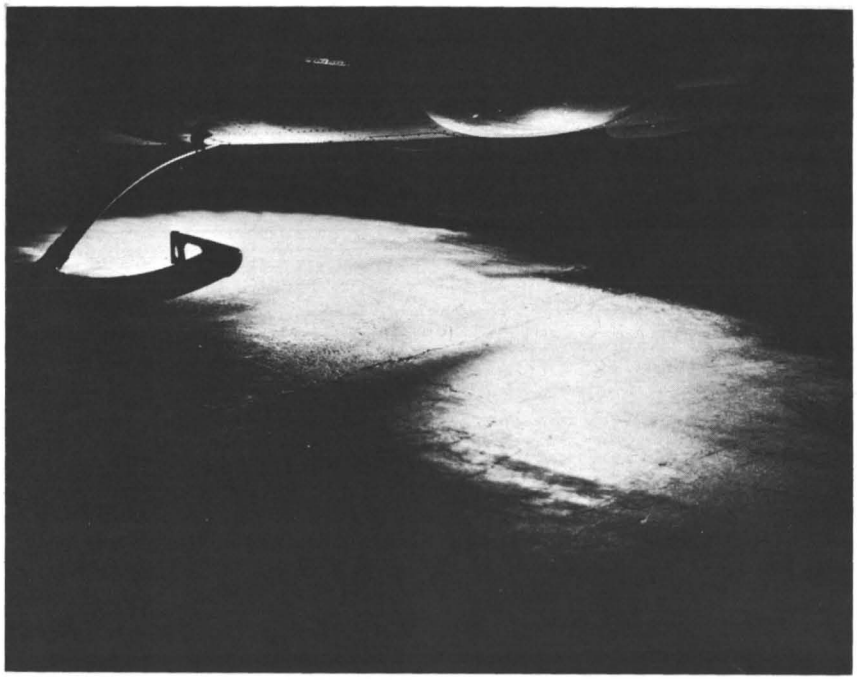
UH-1D. During a 180° approach to a landing area a searchlight on the ground was first turned on and then off again, momentarily blinding the pilot. Because of the aircraft's fast rate of descent, the pilot was unable to recover in sufficient time to prevent major damage to the cross tubes, fuselage belly, and bulkheads. No coordination was made between pilot and ground personnel concerning use of the ground searchlight.

UH-1D. A landing to a lighted "T" was being attempted under conditions of scattered fog which extended up to 150 feet. The first two attempts were aborted. On the third attempt the pilot and copilot lost sight of the T as they entered on a heading 20° from what the T was set up for. The aircraft broke out of the fog just above the trees and was flared. The tail boom struck the trees and the aircraft crashed into the ground, coming to rest on its right side. There was no coordination between pilot and copilot as to who was in control of the aircraft, and doubt as to who was in control at the time of crash.

UH-1B. During an approach to a minimum lighted field, the pilot developed fixation while approaching at a shallow angle. The aircraft struck the ground at a point of incline and flipped over on its right side. The blades struck the ground and chopped off the tail boom, and the main mast broke off. Check of the unit SOP revealed no requirement for proficiency to be maintained for approach to a minimum lighted area.

UH-1B. During preflight, the copilot checked the book and noticed that the bright-dim switch was written up. He did not mention this to the pilot for he assumed the pilot would also check the book. The aircraft was runup and picked up to a hover. At this time the pilot told the copilot to switch to steady-bright. The copilot flipped the switch and it malfunctioned, causing the lights to go out, the pilot to lose ground reference, and loss of one aircraft.

This list can go on and on, but why bother? Others are just repeats of the four basic items — preflight, procedure, teamwork, and proficiency. One more thing; before going on your next flight, meet your night minimums. You'll be doing everybody a favor.



When preflighting for a night flight the landing and searchlights should be checked in both the normal landing position (above) and with the searchlight extended for autorotation (below). The searchlight should be extended during autorotation to afford vision in front of the aircraft to allow for the flair

"Wood" That

ANNUAL AWARD Monthly Winner CONTEST

Being a splinter in a Texas had its compen hit by an airplane was

Lieutenant Colonel

I WAS DELICATELY wrapped in cotton, placed in a small wooden box, and plunged into a world of darkness as the lid was closed in my face. But after the terrifying events of the past few days I actually faced my impending journey with a sigh of relief and a feeling of security. I desperately needed the rest so I lay back, closed my eyes, and fell into a deep sleep.

"What in the world is this?" The soft feminine voice awakened me as I was suddenly tumbled from the quiet security of my soft, cotton-padded world and placed in a delicate, engagement-ringed hand. Then the gentle voice continued, "It's just about the cutest little piece of something I ever did see." I smiled to myself, hardly daring to laugh and possibly offend the attractive young lady; however, I'm sure that I must have blushed.

Then she handed me to someone named Bill who commented, "The accompanying letter says the investigation can't be completed until they know exactly what this thing is. I'll start right now." Then Bill placed me between his right thumb and forefinger, held me close to two of the prettiest blue eyes I had ever seen and said, "All right whatever you are, within an hour we'll know exactly what you are and where you came from."

Before I had time to grasp what was happening I was placed flat on my back on a round glass object and subjected to a dazzling ray of light that fairly blinded me. But not before I caught a fleeting glance into a highly polished glass bead and saw one of those pretty blue eyes staring intently at me — only for some strange reason it appeared to be no larger than the head of a pin. Then Bill turned me every which way, laid me momentarily next to someone I thought I recognized, and finally said to the attractive young lady, "That's about all I can do with the microscope. The fibrous structure and cellular organization exactly match the comparison charts and identification samples. There's no question that this is a splinter of Georgia white pine."

"My gosh," I gasped, "I could have told them that an hour ago."

I heard Bill say, "Darling, will you answer the letter and tell the investigation board that it's a piece of Georgia white pine?" Then Bill said the words I hardly dared to anticipate, "I'm going to send this little splinter back to the investigation board. They may want to save it as a souvenir or display it in an exhibit."

My heart leaped with joy as I eagerly contemplated my trip back — and just a bit closer to Texas, too.

The next voice I heard was my old friend the president of the Aircraft Accident Investigation Board. I listened intently from my perch on the shelf as he addressed the other board members. "Gentlemen, the splinter of wood has been returned. It was examined and analyzed and, as we suspected, it's a different species of wood from the trees in the immediate area of the crash site. I feel confident that this gives us the evidence to establish that the pilot did, in fact, get so close to the ground that he hit a wooden object approximately 8 inches square, was able to become temporarily airborne for a distance we are unable to determine, and finally crashed out of control at the base of a tree and burned.

"But it still bothers me that we have so many unanswered questions. For example, what, specifically, was the wooden object? What was its height? Where was it and is it still there? How far was it from the crash site? Why did the pilot permit himself to get so low at night that he could hit an object on the ground? Somewhere out there on that Texas prairie there's a post or something that could tell us a good story — could at least tell us a part of what happened. Anyhow, it's interesting conjecture."

This series of questions made me sit up abruptly, bumping my head on the lid of the box! I could answer most of their questions. I was there, I saw what happened.

I Could Talk

Georgia pine post in ations . . . but being n't one of them

Charles W. Sills

I was a part of it. Yes, I remember the night well. As I thought back the whole horrible scene unfolded once again across my mind. . . .

The night was cool and a gentle breeze was blowing across the prairie. I could hear the howl of a coyote in the distance, and I chuckled to myself as one of his lovers returned the call. I enjoyed the peace and quiet of those desert nights and sighed with contentment as I prepared to retire for the night. Yep, being a splinter in a Georgia pine post in Texas had its compensations. Even though I was only the 138th post from the main gate, I enjoyed the close barbed-wire attachment of my many friends to the left and right.

I had almost fallen asleep, dreaming of my youthful, carefree days back in Georgia, when I heard the familiar sound of an airplane to the southeast. The engine was running smoothly, but as it came closer, I could tell by the bright, blinking red and green lights on the wings that it was rapidly losing altitude. In fact, it was coming straight toward me! I stared in fascinated disbelief as the distance between us narrowed. Now I could see the bright blue exhaust flames and the dim red cockpit lights. If I only could yell a warning to the pilot! But before I could open my mouth to scream, there was a tremendous roar as the pilot suddenly added full throttle and the propeller bit hungrily into the cool night air.

The impact of being struck by the tail of the airplane had temporarily incapacitated me, and it was an instant before I regained consciousness. But what was this? I was airborne! From my vantage point I could see the desert below and I could see the airplane number on the tail. I immediately recognzied it as an old friend that had flown over me many times in the past. How often I had wished that I could join him up there in the clear, blue Texas sky and get a really good look at my surroundings.

What irony, I thought — but events were happening so rapidly that I had no more time to dream of the past. My present appeared to be drawing to a rapid conclusion! I quickly glanced toward the cabin where I could see the pilot struggling with the controls that had jammed when the tail hit my post. The pilot was fighting for his very life. He was, unfortunately, much too close to the ground to use his parachute and he knew it. Above the roar of the engine I heard him scream, "Why didn't I get more sleep!"

Then with a sickening shudder the aircraft seemed to give up. She started a slow gliding turn to the left as the pilot took actions which only a well trained person would take in the final moments before he knew a crash was imminent: battery switch off, magnetos off, gas off, tighten safety belt, adjust shoulder harness, flaps down, throttle to the rear. And I thought I could hear him say a quiet prayer.

We both saw the tree at the same time as the left wing knifed through the small upper arms of the tall cactus at a perfect 45° angle. Almost simultaneously, the nose of the airplane hit the base of what was probably the largest cottonwood tree in my part of Texas. Fuel tanks exploded and the pilot and airplane were engulfed in flames. I watched in silent horror and I thanked God that I had survived the crash. Then I became asphyxiated by the fumes and smoke.

I was abruptly brought to my senses 6 hours later when I heard a voice say, "Hey, Charlie, look at this odd-shaped indentation in the tail. Almost a perfect 8-inch square. Strange that we didn't find a thing in all that wreckage that could possibly account for this damage — especially the shape.

"Well, look at this little piece of something or other imbedded in the damaged area. No telling what it is, but it looks like a splinter. It could be a valuable clue. You never can tell, but it may be able to tell us something."

And I thought, "How right he is . . . if I could only talk!"

When you fly more aircraft more hours you will have more accidents

How much is Fact or How much is Fiction?

Major Joe D. Jobe

ONE NEED NOT be exposed to exact statistics to recognize the tremendous expansion in the employment of Army aviation since the Vietnam buildup. Airmobile concept developments have resulted in a dramatic increase in the number of aircraft and crewmembers.

Unfortunately, with this rapid growth, there has also been a significant increase in Army aircraft accidents and incidents. In some areas, unhappily, this increase has been accepted as simply an unavoidable fact — that is, "when you fly more aircraft more hours you will have more accidents." I agree that there is a certain amount of logic in that statement, but how much of it is fact and how much is fiction?

I think you will agree that even with this increase in exposure, today we should be in much better shape from a flight safety standpoint than we have ever been before. The equipment, although more complex, is much more reliable, and has been designed for increased crew safety. Where pilots in the old days had to cross-check everything in the cockpit to determine if everything was functioning properly, today's machines light up, blink, beep, and shake the controls. And I've heard rumors that plans are to program them to eject the pilot and land themselves if he doesn't react within 5 minutes.

The flight safety program within the Army has also come a long way the last few years. I can remember several years ago hearing a young aviator define the unit safety program as "that old captain who hangs around operations and talks to us once a month." The vast majority of today's unit commanders are not only extremely interested in flight safety within their units, as I am sure they have always been, but they are much better trained to participate in and supervise an effective flight safety program.

Much of this can be attributed directly to the fine training so many of our aviators have received at the Aviation Safety Officers Course at the University of Southern California, and to the contributions of United States Army Board for Aviation Accident Research in this vital area. Fortunately, most of this training and education has been directed at the man who must be the real safety officer of the unit, the commanding officer. He is the only man who can demand and achieve desired standards in a unit's training, operations and maintenance. Any degree of complacency on his part in any area will soon show up in today's fast moving, around the clock operations.

Another area where there has been considerable improvement is the information available to the aviator on the mistakes his contemporaries have made (aircraft accidents and incidents). This usually includes the reasons behind the error and how to avoid making the same mistake. This information is disseminated several ways. Two of the most common are the Weekly Accident Summary published by USABAAR, and unit safety meetings where local accidents are summarized and discussed. It has almost come to the point where it is difficult for an aviator to encounter a mechanical malfunction for which he hasn't either actually practiced the remedial procedure or read reams of material on its solution.

In consideration of these areas of improvements one would think we should be pretty well along the road to making the noncombat damage accident rate drop impressively, but would you believe we are not?

But let's get specific. In what areas are we goofing that we can eliminate? Before we get started, let me invite you to first look around the building and police up all the copies of the Weekly Accident Summary, this magazine, and any and all other publications that specify the cause factors for recent aircraft accidents. They should serve to emphasize the type of incident that happens all too often.

Let us start with fuel exhaustion, commonly referred to as "running out of gas." We still are able to experience this phenomenon in two ways: with no fuel on board, or with lots of fuel on board. Except for a rare mechanical problem in flight which drastically alters the fuel situation, not many aviators fly an aircraft without knowing its fuel endurance. They are also well aware of the reserve requirements. But look through the reports and see what you find. There are many reports of accidents due to failure to properly switch tanks when there was plenty of fuel aboard. If your preflight planning includes fuel management you will never have this problem.

Next let us explore that frowned upon area of taxiing into stationary objects. This is surely one of the most embarrassing situations an aviator can experience, exceeding in poor judgment even cases of taxiing into each other. In this case, the closer he gets, the better you *better* look. If you think I am pulling your leg, then it is time to stop and look through the reports again. While you are looking you might as well check another subject: the oversights on the preflight inspection which lead to a precautionary or forced landing, or worse. What does it cost to use a checklist and ensure completeness on preflight? Nothing. But how many aviators do you know who use this form of insurance religiously? Chances are, not as many as you should.

In the area of wire strikes the guilty party is the guy who shouldn't have been down there to begin with. This is not easy information to come by, but I am informed there are still many cases of this. One need only to be familiar with one such accident to be cured of low level hot-rodding for life.

There are many training accidents of all descriptions, and I will not attempt to generalize for fear of incurring the wrath of the IPs who must conduct realistic and effective training. I will say this about autorotations in particular. A large percentage of the autorotation training accidents and incidents can be attributed to one major factor: the helicopter was allowed to reach a rate of descent from which the collective pitch available was inadequate to cushion the touchdown. Having done a little instructing, I admit that I was never bashful about terminating with power. From the looks of the accident summaries, there are many who could benefit from the same.

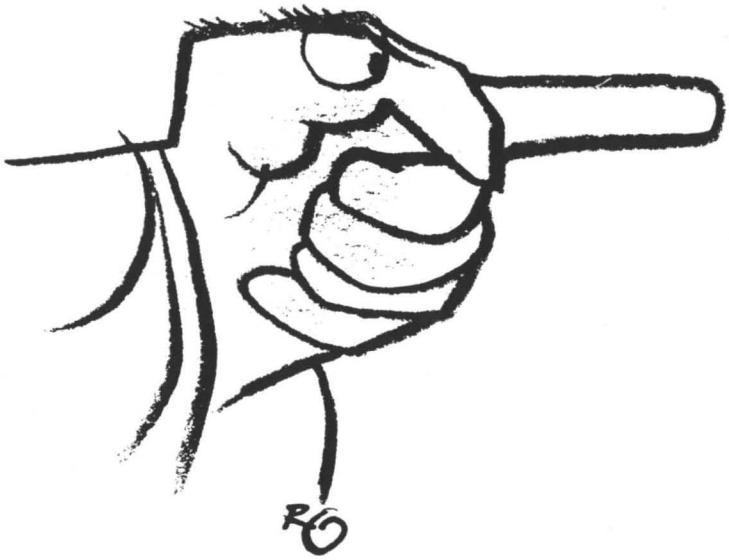
Another area which has received considerable publicity the last year or so is the problem of loose items of equipment in helicopters. Several major UH-1 accidents, some involving fatalities, were attributed directly to unsecured canvas covers in 1966. Still we find these type incidents occurring each month. The solution is obvious, and simple.

While we have a fine safety record in Army aviation today, we should by no means accept this rate as satisfactory. We should be aware of the opportunity to continue to lower our accident rate by continuously evaluating our individual methods and procedures, and striving to gain maximum benefit from the safety equipment and information made available to us. Let us be as professional in all our flight activities as we are in the execution of our combat mission in Vietnam, and we will prove that the statement "more exposure equals more accidents" contains more fiction than fact.

crash sense

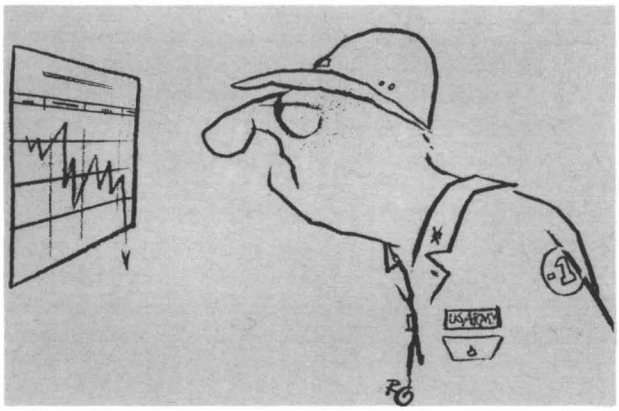
the following 28 pages prepared by the U. S. Army Board for Aviation Accident Research

GO NO-GO



LET'S BEGIN BY admitting that charts, graphs, diagrams, and tables do not make as exciting reading as the paperbacks you pick up in drug stores and airports. They lack the kind of punch which goes into Hollywood box office smashes.

All the same, they are sometimes not only useful but necessary. Anybody who dabbles in the stock market, bets on horses, or makes a living predicting the weather is generally up to his ears in statistics which would put the rest of us to sleep faster than a general anesthetic. It's a tough world. People who manage to stay ahead of the game are the ones who (a) know the facts and (b) stick by the rules the facts lay down. You don't acquire the cold dope, buster, by gazing into crystal balls, or girl-watching.



In Army aviation, when it comes to Go No-Go, books, rules, and — Go No-Go?

If you were to ask your Aunt Amanda about Go No-Go, she would probably hazard a guess it was some kind of toy you pulled along behind you on a string.

Miss Cynthia Pilkington, dean of women at Hiram W. Phogbound Female Seminary, has different ideas. "A girl should know *exactly* how far to go," she says firmly, "and no further."

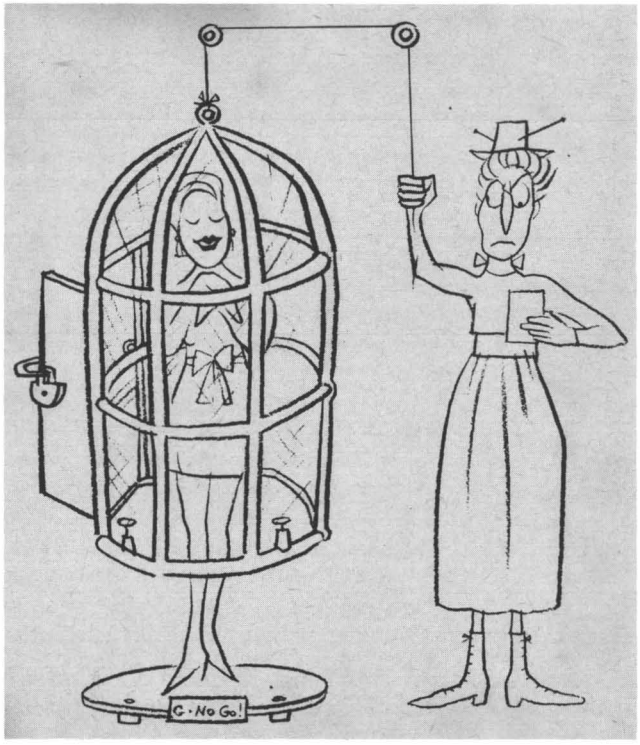
Bravo, Miss Pilkington! Well said, indeed! Small wonder parents across the land are battering down doors in efforts to get their daughters enrolled at dear old Phogbound.

What we can gather from all this is that Go No-Go means that to get ahead in life you have to deliver top performance within safe limits.

Miss Pilkington doesn't need any charts or graphs to spell out the facts of life for the dewey-eyed young lasses in her care, though you can bet that in Biology 101 the idea comes across loud and clear.

SENSE

Major Chester Goolrick



In the Army, Go No-Go — the real facts of life for aviators — is a little harder to grasp, almost as easy to ignore. When it comes to the question of what can happen when boy meets girl, nobody these days past the first grade needs to consult any charts, graphs, performance tables, or diagrams. Once the point is grasped, nobody is likely to forget.

In most polite circles, thanks be, temptation involving the facts of life doesn't raise its ugly head every day, else Heaven knows what the world would be like. On the other hand, Army airmen in all categories are constantly facing the problem of knowing just how far to go, and no further, with their aircraft, their physical and mental load limits, and their professional capabilities. All depend on good judgment, honest self-appraisal, and the ability to size up any given situation with the accuracy of a computer. It's also a hard fact that unless a man is *thoroughly* acquainted with and uses such guidelines as his -10, torque gauge, tachometer, pressure altitude reading, and such, *sooner or later he will go too far.*

Let's put it this way. If you thought you could find out where Captain Kidd buried his treasure by read-

Army airmen in all categories are constantly facing the problem of knowing just how far to go, and no further, with their aircraft . . .

ing your -10, you'd study it to the point where you could recite it backwards while standing on your head. Right?

You won't get rich studying a -10.

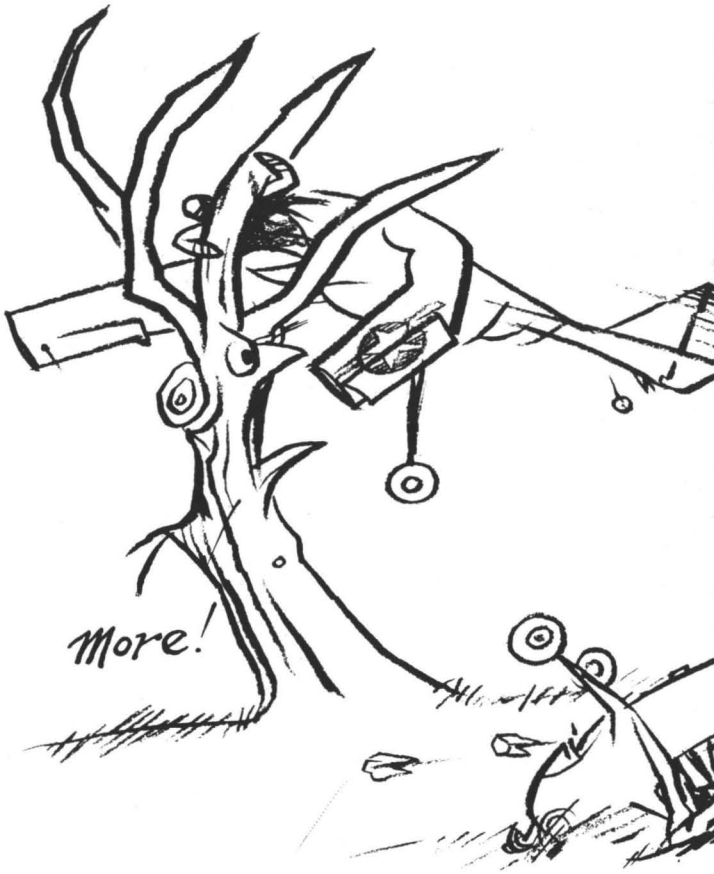
You'll just live longer, that's all.

IT DOESN'T FIGURE

All things considered, you'd think, wouldn't you, that once this fairly simple, but attractive, concept sank in, everybody would make a point of knowing the Go No-Go limitations in all directions and then would stay well within them a good hundred percent of the time.

You'd think so. You'd also think that Dean Pilkington's girls would stay on the straight and narrow. The unhappy fact is that every now and then one wanders down the primrose path a step or two further than the dean considers prudent. Aviators have been known to go astray as well. While the results aren't exactly the same, they can be equally disastrous and long-lasting.

We needn't go into what makes Dean Pilkington's students venture beyond their Go No-Go. Everybody has a fair idea of the effect a full moon can have



when it shines over Observatory Hill on a warm June night. Songwriters have been telling us about it for generations.

Go No-Go violations by Army airmen are a little harder to analyze. It's a fair guess, though, that violations of limitations these days aren't much different in background from the ones 50 years ago in World War I when pilots in combat with the Red Baron sometimes tore the wings off their rickety aircraft attempting maneuvers no sensible aviator would try in a jet fighter today.

When a Go No-Go violation takes place, you can almost always bet it was caused by —

INDIFFERENCE TO THE LIMITS

or

IGNORANCE OF THE LIMITS

Neither, of course, is the kind of excuse anybody would want to present to an accident board. Indifference is a pretty harsh word, covering a multitude of sins. Nobody ever gets an official commendation from the Pentagon for his ignorance of a subject he was supposed to know all about. But there it is, friends, laid out on the table for everybody to have a look at. Nobody has succeeded in working out a depressing table of statistics which would tell us exactly how many Army aircraft accidents have a built-in Go No-Go cause factor. Rest assured it is a good hefty percentage.

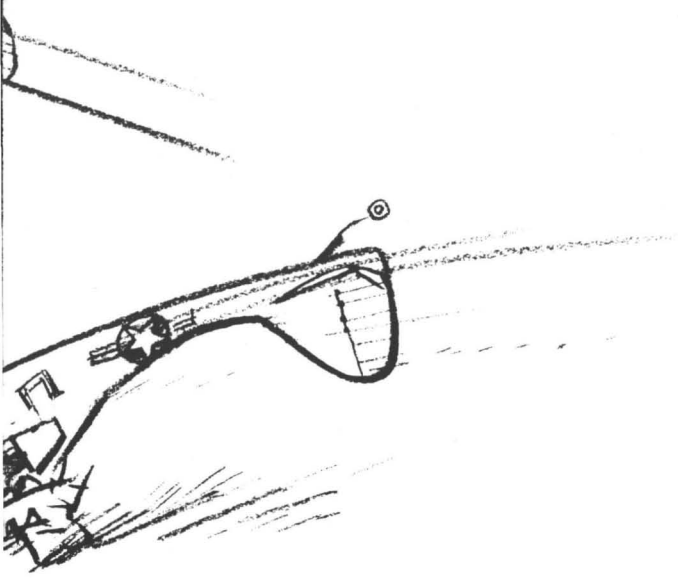
Just about any aircraft accident *can* be caused by Go No-Go.

- A noninstrument-rated pilot flies too far into marginal weather.
- A mechanic, exhausted, fails to pay proper attention to his manual, and carries out Murphy's Law to the letter.
- A pilot overloads his aircraft.

Or he flies at excessive airspeeds, storing up trouble as he does. Or he tries a downwind barrier takeoff or landing under temperature and wind conditions which make it extra risky, if not impossible.

Or — but why go on? You name it and it can be done. What's more, it has been done. What is still more, you can do it too, without half trying.

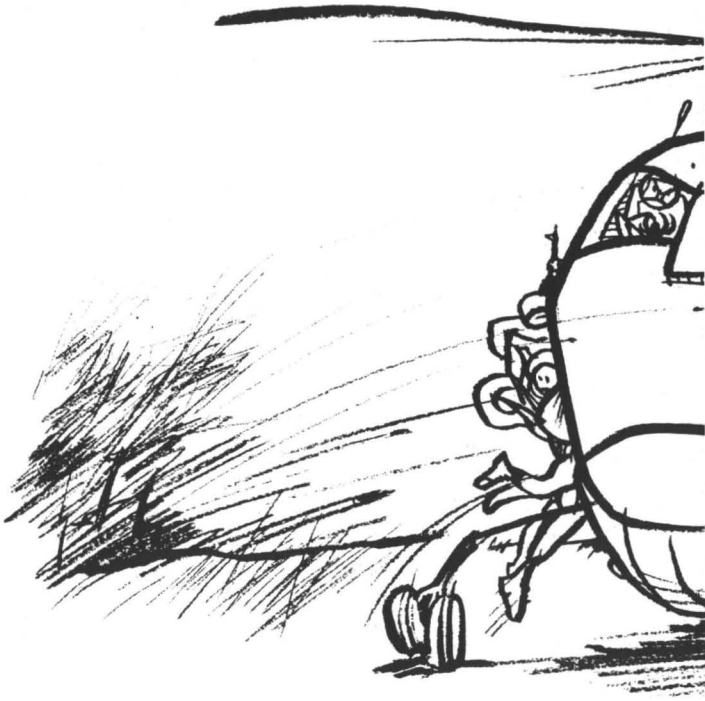
Half trying is just about it. When you are involved in a Go No-Go mishap, you basically either don't *know* what you are supposed to, or you are being



Unless a man is THOROUGHLY acquainted with and uses his -10, torque gauge, tachometer, pressure altitude reading, and such, sooner or later he will go too far

GO NO-GO SENSE

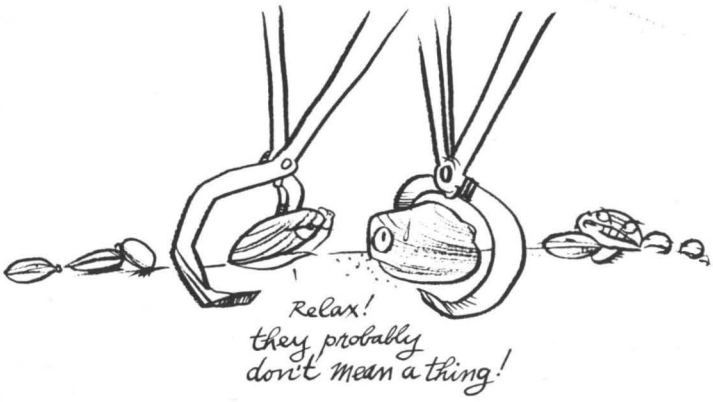
. . . Army airmen are under all kinds of constant pressure to overlook or deliberately exceed their Go No-Go limitations



foolish enough to attempt something beyond your capabilities, or you are not paying proper attention to *what* you are doing. As far as your self-respect is concerned, when you start hunting around for an excuse after the fat is in the fire you haven't very much choice.

MANY A SLIP

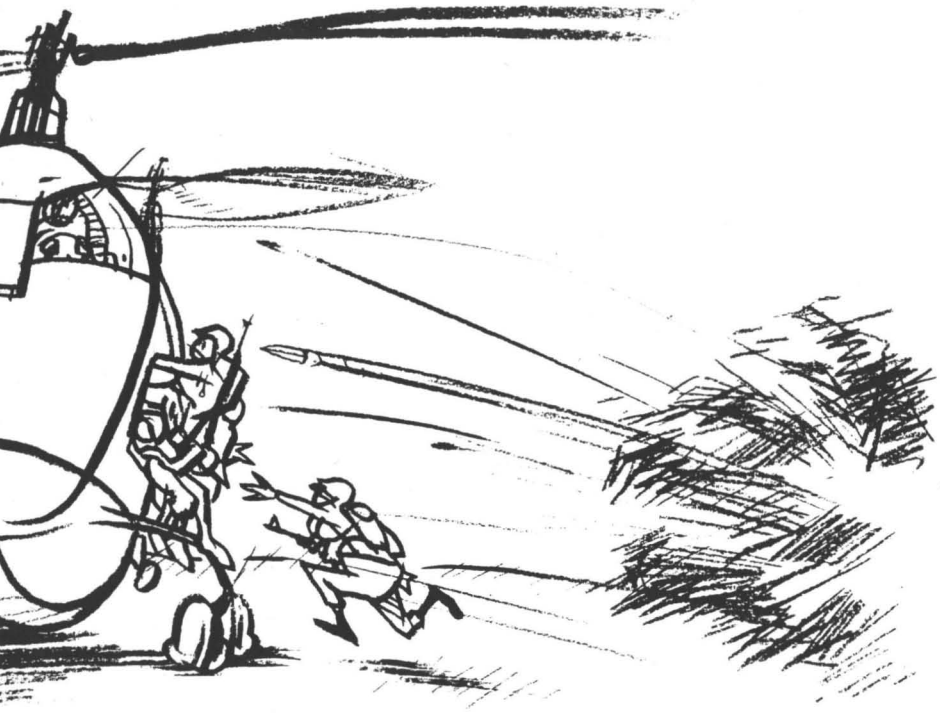
To be as kind as possible, it is true Army airmen are under all kinds of constant pressure to overlook or deliberately exceed their Go No-Go limitations. The average commuter, headed for the office in the morning, isn't offered many inducements to ignore traffic signs, speed past hospitals and school zones, or leapfrog little old ladies on safety islands. The chap driving the getaway car after the heist at the First National Bank isn't going to pull up at a stop light, even though he risks a headon collision with a fire engine. The police car siren behind him has him under more pressure than he can take care of as it is.



When a Go No-Go-caused crash takes place and you find the pilot has ignored something he knows as well as he does the monthly grocery bill, pressure of some sort is almost always involved. Pressure comes in all kinds of shapes and sizes. What is more, what is pressure to some people is a piece of cake with whipped cream topping for others.

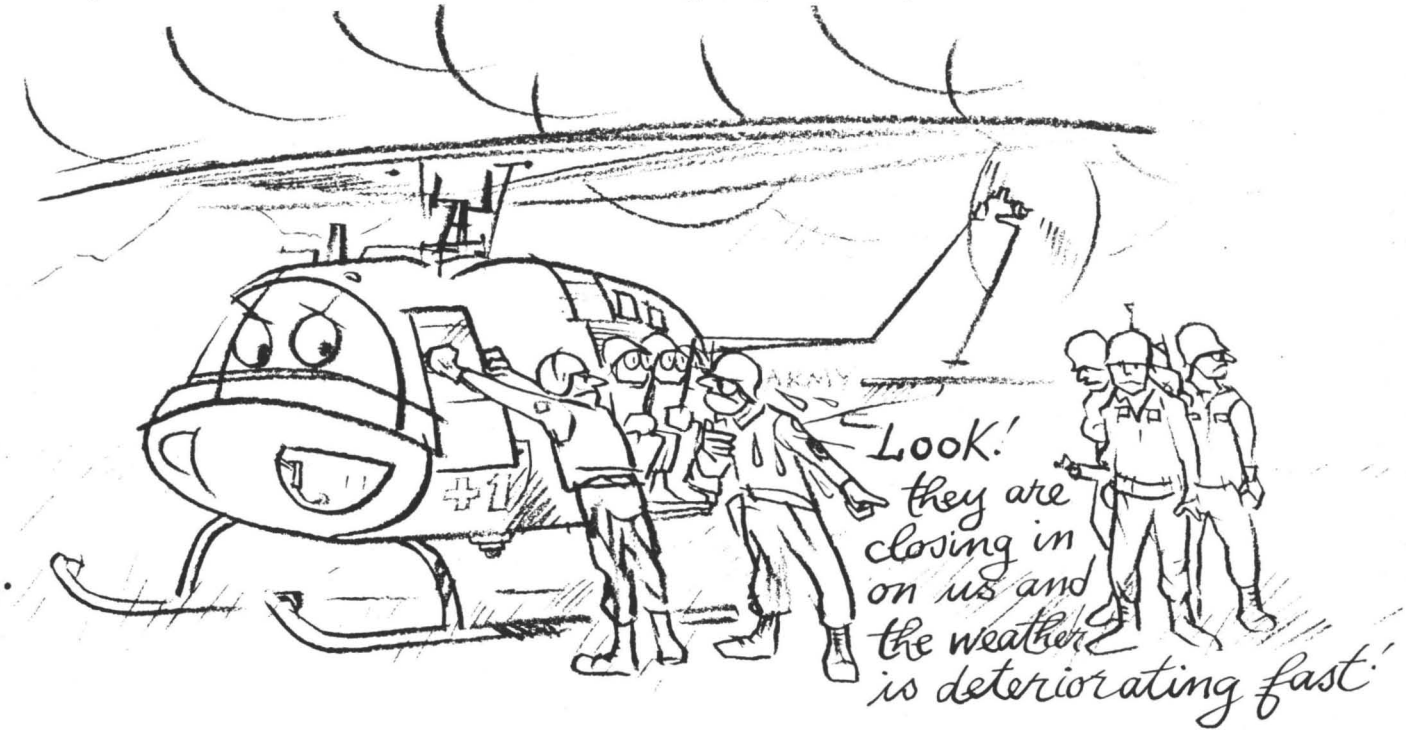
Very few people can keep their cool in the thick of combat. It's hard not to forgive the fellow who ignores density altitude and tries to take off with an overload when various unfriendly people are shooting at him with everything from recoilless rifles to slingshots. Under such dismal circumstances, you can at least understand an airman who overlooked the fact that at a 2-foot hover he needed 2 percent more N_1 than his placard showed (to boost him when he got out of ground effect). Men in combat are usually in a hurry. Haste is a sworn opponent of careful action.

About the best to be hoped for here is that sound training in emergencies will shift a man's procedures into automatic overdrive. A pilot who thoroughly understands what Go No-Go limitations really amount to knows that if he loads one too many men aboard it isn't going to help the extra man, the other passengers, the crew, or the aircraft if he can't get properly airborne. The really trained Go No-Go-



accustomed man never forgets under *any* circumstance that *every* aircraft has its prescribed safe margins and its absolute limits and that you can't do anything about them, anymore than you can repeal the law of gravitation or grow a 6-foot beard on a pool ball.

Still, combat has a way of demanding more of men and machines than they were built to deliver under "normal" circumstances. But what are "normal" circumstances in Army aviation? Field maneuvers? Ordinary, day-to-day operations? Schooling? It's a good question. Maybe the answer is that there is no



such thing as a normal situation. To put it another way, there is hardly any circumstance in which a careless or inexperienced man can't find a way to push himself or his machine past safe operating limits.

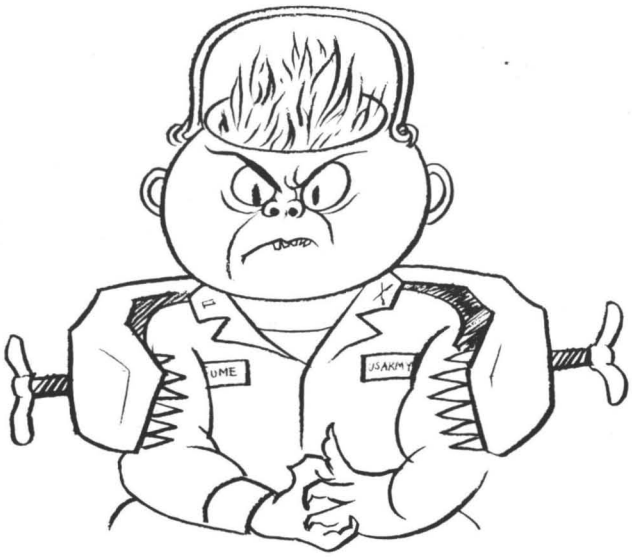
BODY CHECK

It might be a good idea at this point to take a look at the human side of the equation. After all, no Huey ever goaded itself into exceeding its own Go No-Go all by itself.

Well — aside from simple inexperience — what makes an intelligent man push *himself* past safe operating limits?

We come back to that business of pressure again. A man is a pretty complex piece of mental and physical machinery. The more intelligent he is, the more complex he is. If you had an IQ of around 12 —

. . . you won't be surprised to hear that there have been accidents involving airmen who were trying to hide some physical ailment . . .



You won't be surprised either, to find that a man's emotional level is equally as important, maybe more so, than his physical state . . .

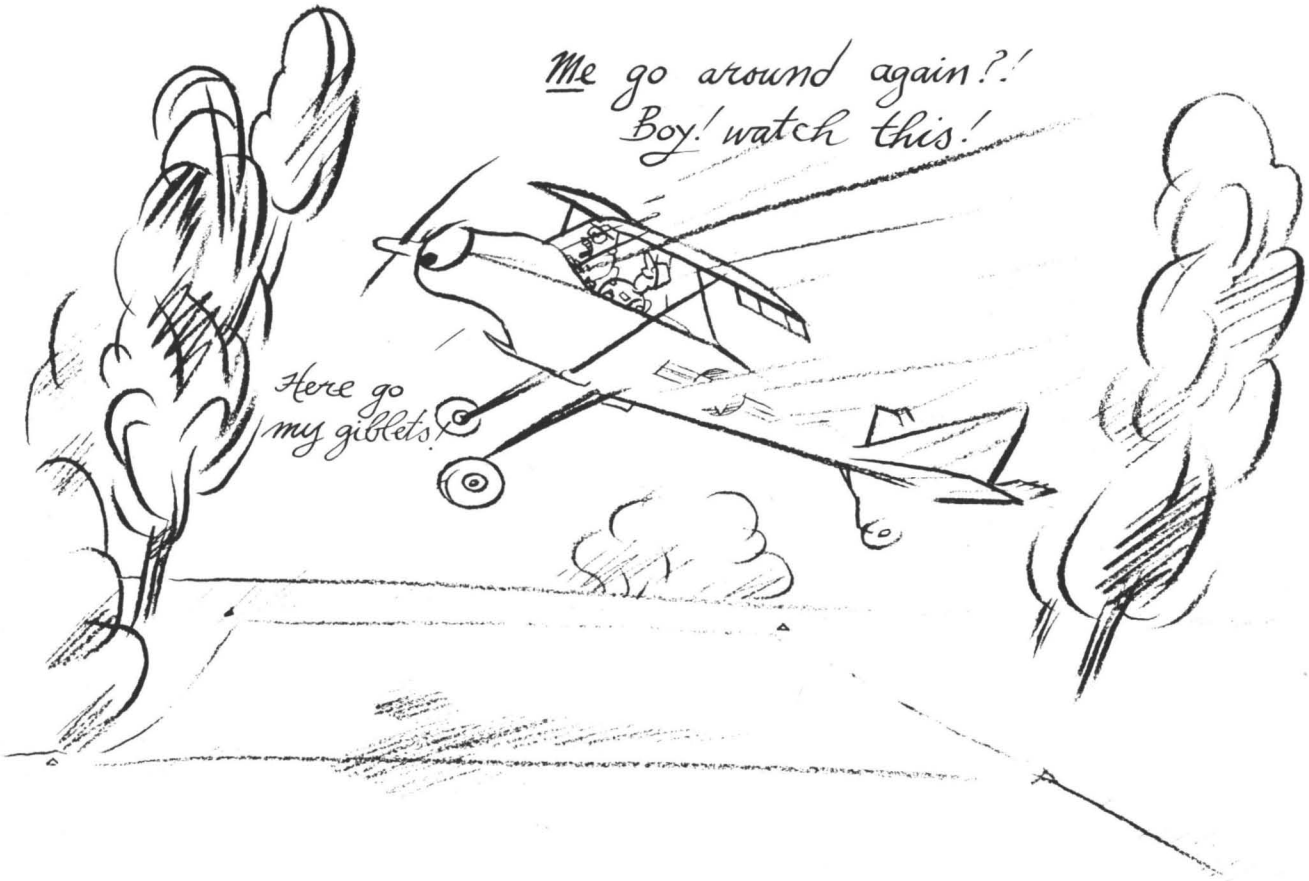
two more than an oyster — you probably couldn't be rattled into taking a hasty, ill advised action. You wouldn't be in the Army either. We wouldn't have to worry about you.

Army airmen *are* intelligent. But keep this in mind. *Even a smart, mature man can be thrown off stride by pressure unless he keeps his guard up.* They haven't yet turned out the human being who isn't at least *capable* of going overboard with a foolish act at just the wrong time.

A truly mature man has himself under constant surveillance on a round-the-clock basis, the way a private eye trails a suspect. A man who has himself under guard knows that if he has an aching wisdom tooth, an ingrown toenail, a feeling that somebody is driving a hot iron into him down where his appendix lives, he has no business in the cockpit, period. He is aware that his flying capabilities are roughly those of a helicopter fueled half with JP-4 and half with Mississippi mud.

Yet you won't be surprised to hear that there have been accidents involving airmen who were trying to hide some physical ailment.

You won't be surprised, either, to find that a man's emotional level is equally as important, maybe more so, than his physical state. You don't have to be a candidate for the Laughing Academy to be just enough off your mental stride to make a slip if your guard is out to lunch. Maybe you're just tired. You are in a hurry to get home. Your wife has just put a dent in the fender of your new car and you have a few pounds of steam to let off. How about that phone call from the bank about the note coming due? See what we mean? If your mind is a seething witch's brew of worry, frustration, indecision, and impatience, your Go No-Go resistance is lower than the temperature in Great Falls, Minn., on New Year's Day. If you're undertaking anything much more important than tieing your shoelace, you'd do well to



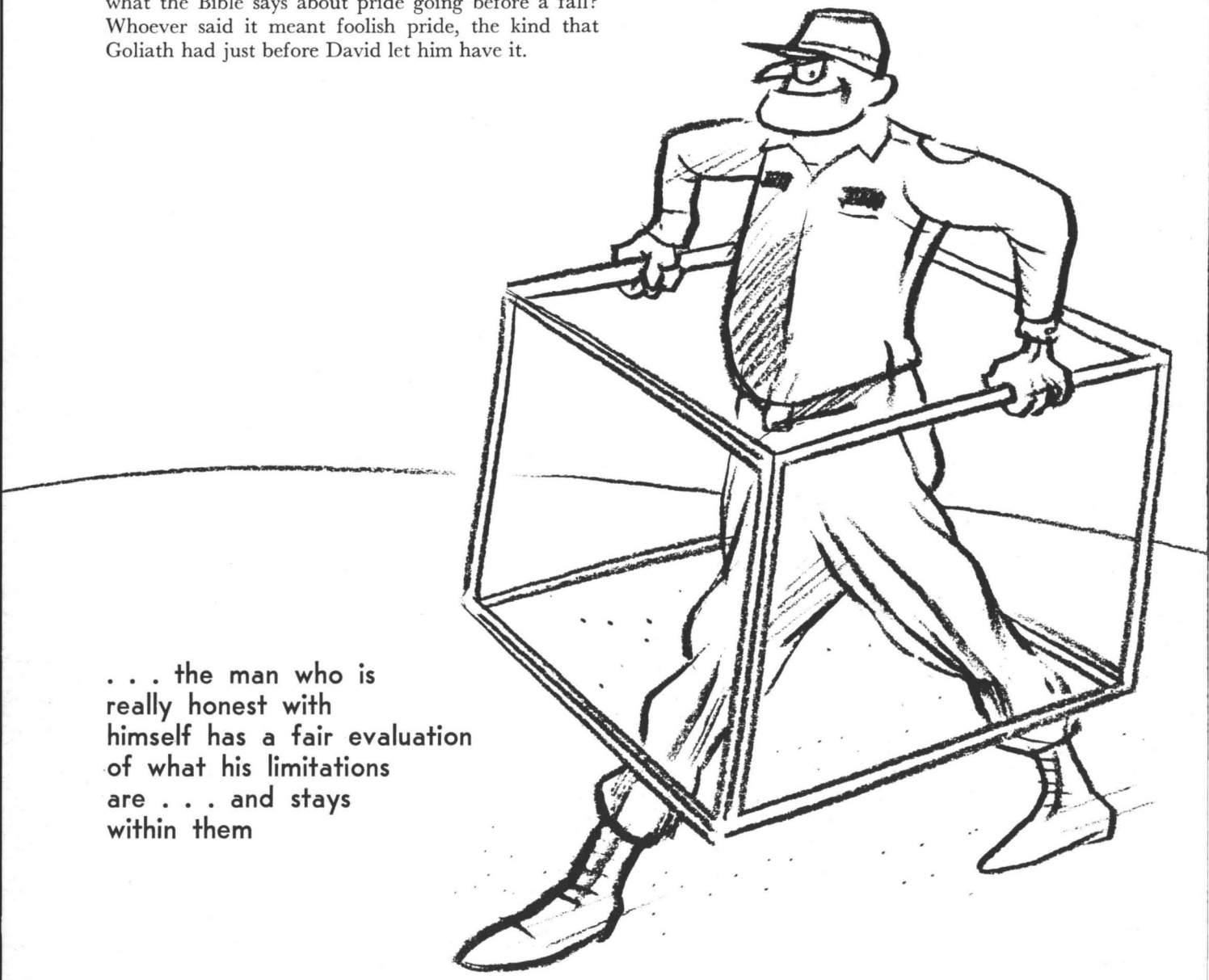
Don't get the idea that you have to be sick or worried to commit a Go No-Go blunder. Misplaced pride can do it

proceed with more caution flags than they fly at Indianapolis after a five-car smash.

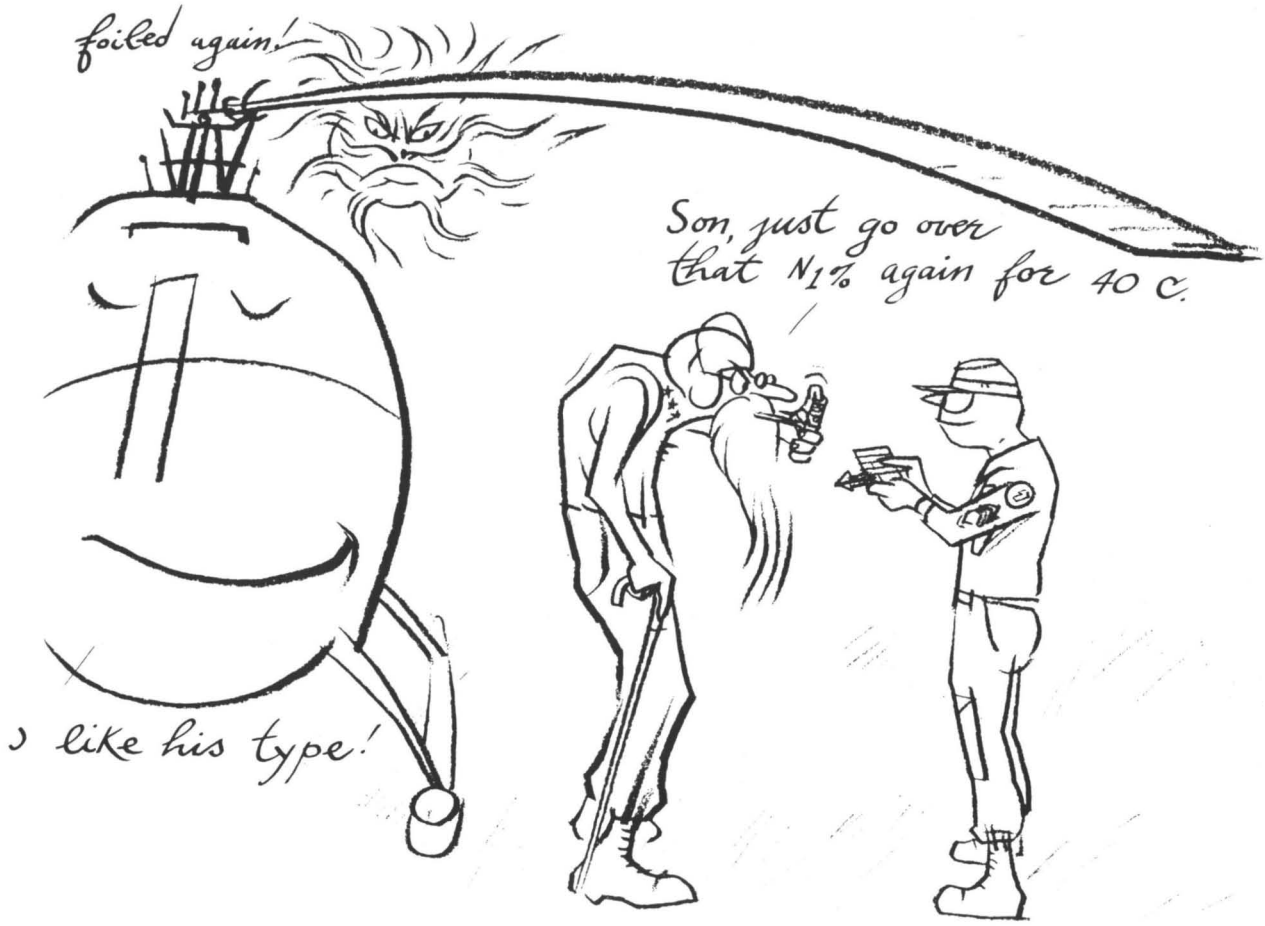
Don't get the idea, either, that you have to be sick, worried, tired, or sore enough at somebody to bite the head off a railroad spike to commit a Go No-Go blunder. Misplaced pride can do it just as effectively.

Everybody has a right to take honest pride in a job well done — *after* it is done. Misplaced pride in your own abilities — overconfidence, if you want another word — is something else again. Remember what the Bible says about pride going before a fall? Whoever said it meant foolish pride, the kind that Goliath had just before David let him have it.

An extra helping of pride often comes tied in with a man's desire to prove something to somebody — himself, his CO, his flying mates, or the girl back home. Psychiatrists could explain it to you with a lot of high-flown phrases, if you had a couple of hours to listen. The fact is that when anybody goes beyond safe limits to impress other people he is



. . . the man who is really honest with himself has a fair evaluation of what his limitations are . . . and stays within them



really demonstrating that deep down where he keeps his secret thoughts locked up he isn't so sure himself of his status as a hotshot. Whatever it is that is bugging him, he is ripe for the kind of Go No-Go violation which can make hairy reading. Pilots pushing themselves this way, for instance, have been known to set up plans for night flights long enough to tax the endurance of Superman. On more than one occasion they have wound up plastered against a mountain, murdered by their own self-esteem.

All of us fall a little short of what we'd like to be. But the man who is really honest with himself has a fair evaluation of what his limitations are and settles down to stay within them for the rest of his life.

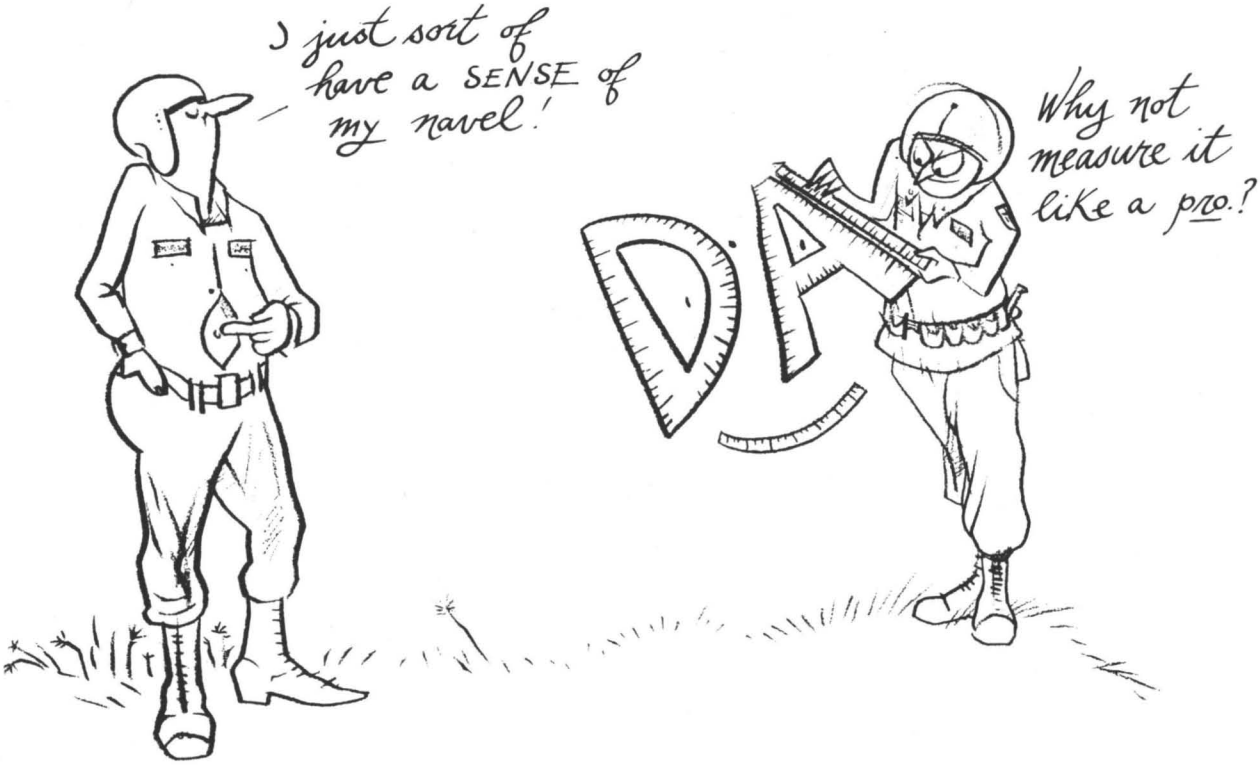
He generally lives a little longer, too.

BIGGER AND BETTER

The longer he lives, the better he becomes at his job, unless he is one of those characters who resist learning anything from the day they enter the first grade until the people who are trying to teach them finally give in and surrender. You won't find very many people like this hanging around Army aircraft. Army airmen, from the guard at the gate to the chaps with stars on their shoulders are expected to, and do, gain in proficiency as their experience grows. No matter at what stage of his aviation career he happens to be or what job in the Army he is holding down, every responsible airman realizes there are a lot of questions he doesn't have the answer to and skills he hasn't yet acquired.

But even experience can trick you into a Go No-Go situation. Accidents sometimes have taken place when highly skilled senior pilots with thousands of hours in the air have been handed a new type of aircraft. A year or so ago, a veteran pilot, flying a new helicopter, exceeded the prescribed g limit. When he tried a 90° bank, he overloaded the rotor to the point beyond which the aircraft could not maintain altitude or airspeed or make safe recovery below 100 feet — which is where he happened to be. The result was a fatal crash which could have been avoided if the pilot had thoroughly learned the flight limitations of his aircraft.

GO NO-GO SENSE



Here was a clear case where long experience — and maybe a touch or two of overconfidence — overruled good judgment and got in the way of sound performance. There isn't a lot you can say about it except that it was a great pity, but nobody's fault except the pilot concerned. The passenger never got a chance to offer an opinion.

You can say the same thing about the pilot who makes a hasty, by-guess-and-by-God stab at his load capacity and attempts to take off with more cargo than a sea captain would permit in the hold of a fair-sized freighter. The pilot knows his load should always be calculated precisely. He *knows,* and chances are good he's seen, what can happen when excess loads are ignored or guessed at. So what happens? He lets his experience trick him into believing he can get off with extra ammo and another passenger.

The thing is that he might be right. For a while.

There'll come a day when he will be wrong.

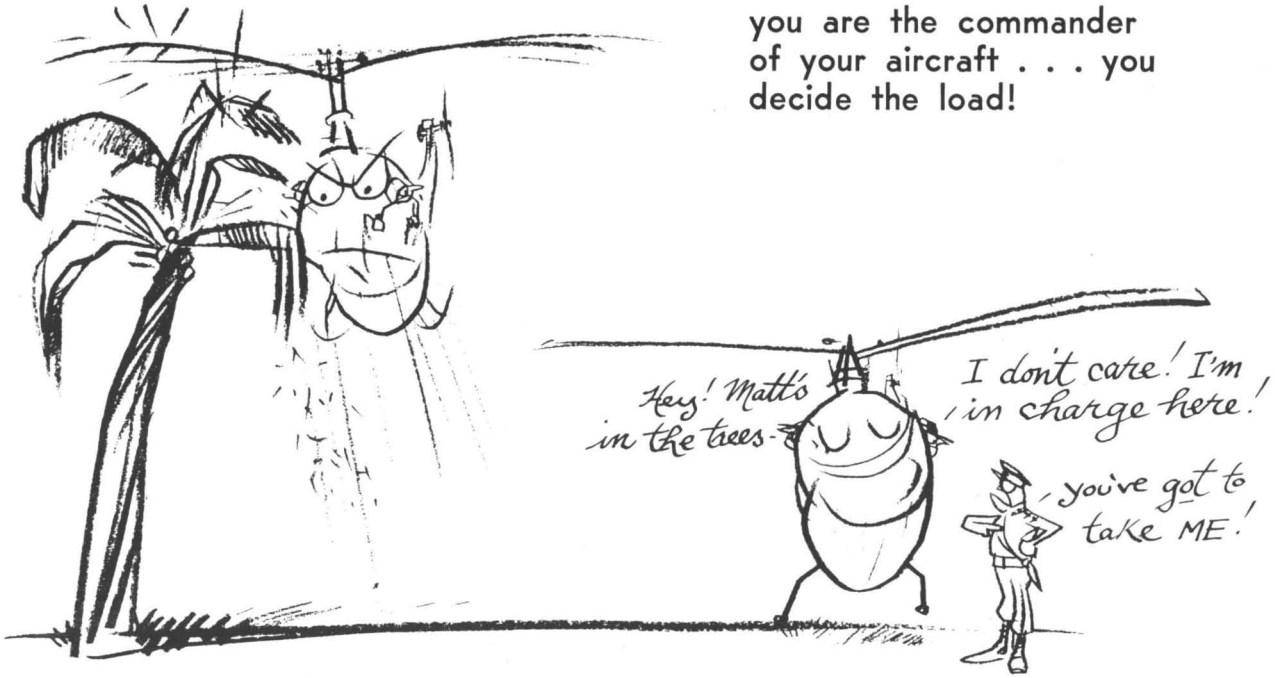
Dead wrong, probably.

GRADE SCHOOL

Simple inexperience is another matter. A youngster fresh out of flight school is naturally as cautious as an Arctic explorer crossing thin ice, but this caution is likely to be mixed with a natural amount of beginner's uncertainty as to what he can or can't do. He is a ripe candidate to be tricked by what we can call the follow-the-leader principle, the kind of thing which got him a broken arm at the age of 10 when he tried some daredevil stunt the bigger kids down the block could pull off with no strain.

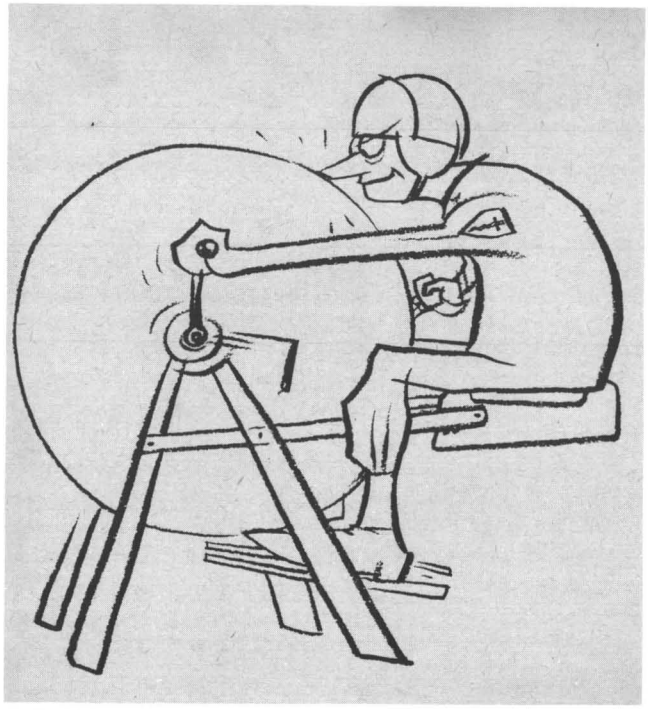
To illustrate, it may be that no accident exactly like this one has ever occurred. There have been any number in which the same principle was involved. Suppose you are a warrant officer with relatively few hours behind you. You are part of a flight led by a major with more experience than Methusaleh. Okay, the major takes off in the lead aircraft with six persons aboard — and gets airborne. What about you? Do you try to handle six, or do you kick off one man because the engine of your aircraft is old and tired and the lead aircraft has a new one?

There's another dandy follow-the-leader game, involving dust, which has only one disadvantage — the last man in always loses. The rules call for the lead helicopter to kick up a cloud of dust and land. The second chopper stirs up more dust and lands. The next one in adds to the confusion and lands. The last man adds to the duststorm, but he doesn't land. He crashes. If he is lucky he only breaks a skid, or a rotor blade or two.



Follow-the-leader is like crack-the-whip. It's not always fun if you are at the end of the line. Any pilot, young or old, has to keep in mind the fact that what another chap has just done successfully might not apply to him. Conditions vary. So do aircraft and so do the men aboard them. An experienced man with his Go No-Go barricade safely in place never forgets that a pilot is the commander of an aircraft and the sole judge of his and its operating limits. The limits applying to another aircraft are somebody *else's business.*

No matter how you earn your living in life, you've gone a long way toward success when you have learned to keep your own nose to your own particular grindstone.



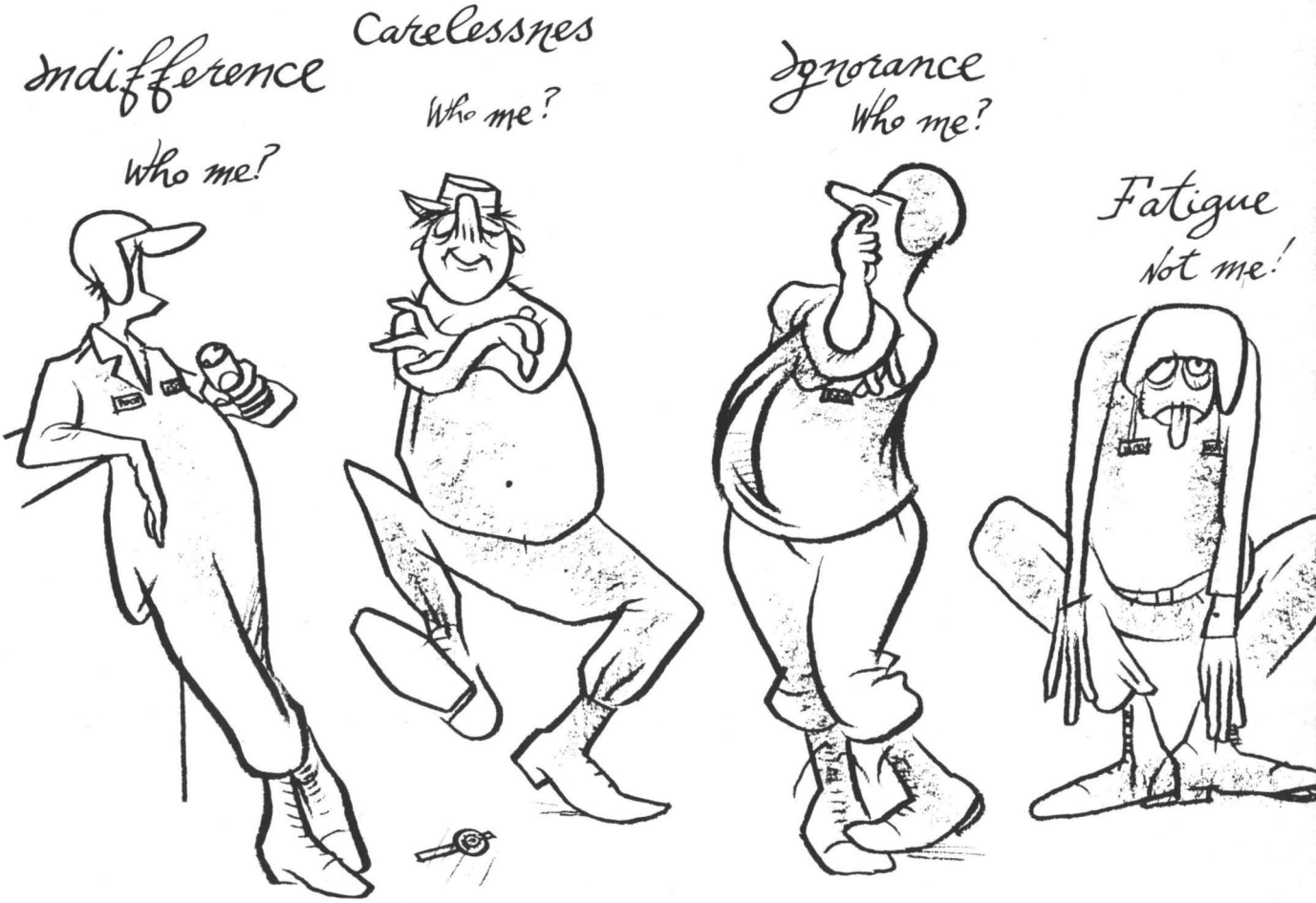
INDIANS IN AMBUSH

Make no mistake about it.

In Army aviation, keeping your nose on the grindstone every second you are on the job is the one sure way of avoiding a Go No-Go violation. The Go No-Go factor is likely to be a hidden factor, one ready to trip you at any time, *if you are not alert for it in all its guises.*

Younger pilots, for instance, might not appreciate the fact that N_1 is as important as N_2 when it comes

GO NO-GO SENSE



to determining a UH-1's ability to take off from a confined area, and the weight limitations for a particular situation. N_1 isn't as obvious as an elephant in a line of chorus girls or a Swedish brunette.

All the more reason to watch out for the dangers in ambush. Nobody ever got bit by a rattler in the middle of Main Street. It's the one hiding in the bushes which will get you every time. If you were to explain to your Aunt Amanda about pressure altitude and then go on to tell her that even experienced pilots sometimes overlook it, she would throw up her hands and inquire, "Laws-a-mercy, what is the world coming to?"

It's a fact, Aunty. If inexperienced pilots get in the habit of ignoring altitude computations, *even on days they don't need to,* they'll keep on doing the same thing even after they've gained experience. So, what happens? Need you be told?

There are plenty of other Go No-Go areas you can overlook a sight easier than you would pass a man on the street with two heads. When you start poking around to find out the cause of a crash and you run into improper preflights, exceeding weight limitations, fuel exhaustion, excessive loads, out-of-cg, or any one of a baker's dozen or so other pilot-induced errors, you can usually spot somebody who

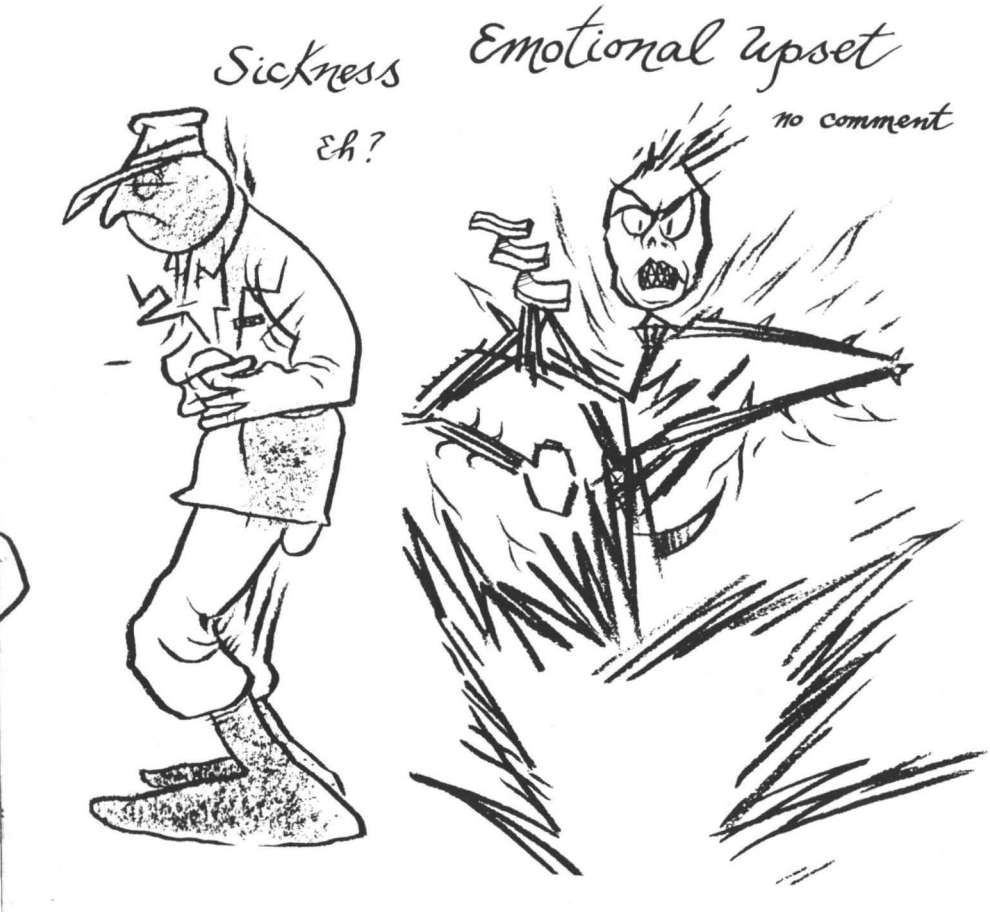
1. HADN'T STUDIED HIS -10 AND THEREFORE DIDN'T KNOW WHERE THE BOOBY TRAPS WERE

   and

2. WHETHER HE KNEW IT OR NOT, WAS OPERATING UNDER THE GOOD OLD THEORY THAT WHAT YOU DON'T KNOW, OR CAN'T SEE, WON'T HURT YOU.

The one trouble with it as a theory is that it just doesn't happen to work. If you've been overlooking pressure altitude, ignoring N_1, going beyond your own limitations, or you don't know your -10, you've been trying to make it work, all the same.

You're living in a fool's paradise — for the time being.



If you've been overlooking pressure altitude, ignoring N_1, going beyond your limitations, or don't know your -10, you've been living in a fool's paradise

RIGHT, MISS PILKINGTON?

There's no denying a fool's paradise can be an attractive place — too attractive, as Miss Pilkington keeps telling her girls. As everybody who has been in such a paradise for any length of time sorrowfully knows, the day comes when you have to pay up.

In Army aviation, the price can be higher than most people like to fork over — especially when the Go No-Go violations which lead to accidents don't seem very serious by themselves. When an airman allows carelessness, indifference, ignorance, fatigue, sickness, or emotional upset to push him past the point of safe performance limits, he doesn't have to go *much* past the point of no return. Any distance at all is enough to guarantee results.

The fact is that in all its aspects, Go No-Go means exactly what it says. Violate the limits often enough and eventually you're going to find yourself in more trouble than you can handle.

Right, Miss Pilkington?

Right, Miss Pilkington!

Advance of Tornadic Turbulence

SOME RECENT observations and studies indicate that vortices, or "tubes," of tornadic or near-tornadic intensity may be encountered in and under innocent looking lines of clouds extending from thunderstorms. Visible tornado (or waterspout) funnels may not be present to alert the unwary pilot but it appears that these vortices may exist up to 20 nautical miles from the associated thunderstorm. The precipitation of lightning, and the ambient turbulence in their vicinity is only light to moderate. Invisible vortices below the cloud bases may sometimes be evidenced by dust-whirls at the surface (or "sworls" on a water surface).

Deductions from some accidents in the vicinity of thunderstorms indicate that these "tubes" may extend to great heights within the flanking cloud lines (at least to about 18,000 feet msl — and theoretically as high as 35,000 feet near the thunderstorm). Neither the "tubes" nor the embedding clouds appear to be reliably detectable on airborne radar, although the cloud line may be picked up by ground radar when viewed within about 30 miles if there is no intervening heavy precipitation. The cloud line may be detected on airborne radars below 8,000 feet msl and within some 20 nautical miles. Typically the echo shows a sharp first iso-echo contour with a relatively "dry" interior. It is likely that these cloud lines give rise to the longer appendage echoes sometimes seen with tornadoes.

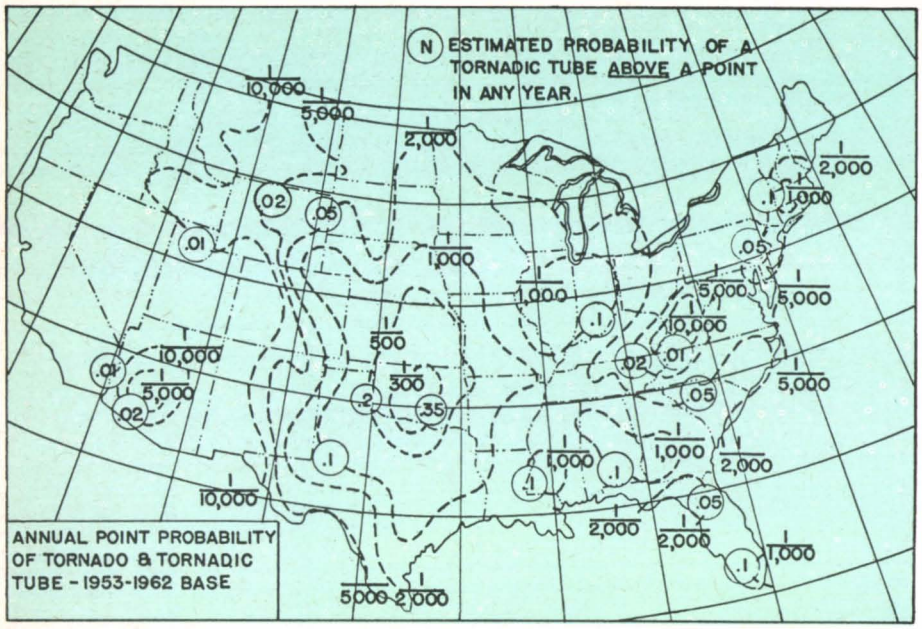
One important aspect of this hazard is the great distance from the associated thunderstorm at which these "tubes" may exist. Ten miles is an average value for audibility of thunder, so that a thunderstorm might not be reported at the coincident ground station. Since there are no completely reliable local indications of the existence of the vortices, avoidance must be based upon a knowledge of the presence of the thunderstorms with which these cloud lines and "tubes" are frequently associated, and flight procedures to avoid the cloud lines.

The meteorological conditions under which the hazard exists are similar to those for the tornado. Thunderstorms in tornado forecast areas should be suspected. It also appears that these "tubes" are much more frequent than observed and reported tornadoes, so that thunderstorms, other than those well known to be of an "air-mass" nature, also should be suspect. A good first rule for absolute safety from this hazard is *to avoid all suspected thunderstorms by at least 20 nautical miles on any line bearing and at any altitude.*

Thunderstorms in squall lines over smoother terrain are likely candidates, especially when there is appreciable windspeed change greater than about 30 knots with altitude to about 20,000 feet. A preferred orientation of the cloud line is into the storm-related wind. To estimate this, take the storm-motion vector (as from a radar observation) and *subtract* the mean wind vector in the lower 20,000 feet. The resultant vector will point in the direction from the thunderstorm in which these cloud lines with related "tubes" frequently tend to form. Avoid flying in or under clouds, especially lines of clouds, in the quadrant about this vector. Under IFR conditions, "build in" an avoidance of 20 nautical miles up to 5,000 feet above the surface, 15 miles at 15,000 feet, and about 7 miles at 25,000 feet.

Caution is especially advised on landing and take-off, descent and climbout, under or through these lines of clouds. Because of a possible convergence of the "tubes" upward in the cloud line, the hazard tends to increase with altitude in the clouds.

Effects upon aircraft encountering these "tubes" may range from a hard "bump" of several g's upon a direct encounter with a weaker "tube," through an unusual "thump" in grazing incidence with the circulation of the "tube," and vigorous upsets in other grazing encounters with fully developed "tubes." *No aircraft has ever been built that can be expected to take the loads possible in a tornado and survive.* These fully developed "tubes" even with no tornado



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Geophysical Engineering
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funnel to the surface below, are of such a nature and intensity as to preclude passing through unscathed.

Preliminary estimates of probability of encounter with these "tubes" *in random flight* (no avoidance skill) below 35,000 feet in the United States east of the Rocky Mountains indicate that an air transport might encounter a "tube" once every 3,000 hours (approximately). The probability of this encounter being of a major or catastrophic nature has been estimated at about one chance in eight. Thus, if no avoidance is practiced, a major or catastrophic incident may be expected in 24,000 hours of indicated operation. Skill in avoidance can increase this "waiting time" by a factor of 10 or more. *Note, however, that close avoidance of a heavy thunderstorm echo to the south or southwest may produce a negative avoidance skill.* The old rule of "out of echo, out of trouble" is definitely *out* for these phenomena (see chart above).

Some further suggestions for flight safety with respect to these hazards are:

1. Under visual flight rules, do not fly *below* lines of clouds extending from an intense thunderstorm and often on a common base with the thunderstorm. If flight is absolutely necessary, circumnavigate or overfly with adequate clearance. Remember how far from the thunderstorm the hazard may exist and how innocent the related airspeed may appear.

2. If inadvertently caught under one of these lines, watch for dust whirls (or water sworls on a water surface) and avoid overflying these. Get out from under fast.

3. Use a local ground weather-surveillance radar to best advantage in preflight briefing. The type of thunderstorm which often produces these "tubes" appears to have a typical echo (extensive anvil return, a scallop, sometimes an appendage coincident with a cloud line). A similar look at your airborne set before takeoff and below 8,000 feet can be helpful. Use gain settings higher than those for best delineation of thunderstorm echoes to bring up the weaker cloud echoes.

4. If no information is available for estimating the storm-relative wind vector, the most frequent orientation of the flanking cloud lines from the associated thunderstorm is from southeast through southwest to northwest.

5. Under instrument flight rules, note carefully that the orientation of the related cloud lines may not coincide with the orientation of the thunderstorm line itself. Use the basis of estimate given to find the probable cloud line orientation. In using ground-radar vectors, be sure the set used either has the capability of detecting these cloud lines or is backed up by such a set.

6. Close avoidance on the opposite flank of the thunderstorm is not suggested. It must be remembered that there are other hazards, e.g., large hail, which must be avoided.

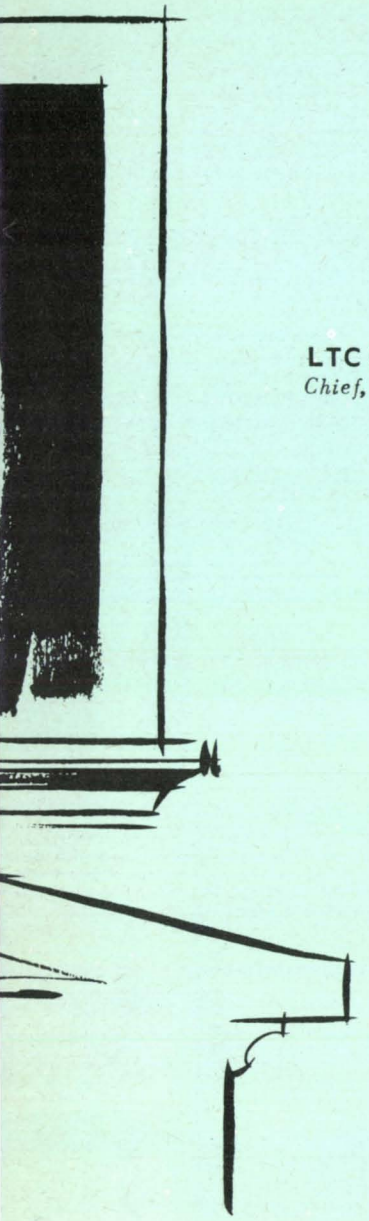
From a paper presented to the Institute of Aerospace Safety and Management at the University of Southern California by the author

THIS PAPER IS PRESENTED to introduce the uninitiated to the *system safety* effort and promote its consideration through all phases of materiel development. Although safety has historically been a consideration in the development of industrial and military systems, unfortunately it has been after the fact. The evolution of the systems approach within the safety spectrum is the first tangible effort to cope with this deficiency. It is important to our military posture that system components be provided with minimum probability of failures which result in catastrophic events.

There is an equally important moral requirement. In *A Safety Policy for the Federal Service,* President Johnson stated: "Americans have always placed the highest value on human life, in accord with the worth of every individual. As the public repository of our social ideas, government has direct obligation to express our regard for human life in every measure necessary to safeguard and protect it."[3]

Management take heed!

The system safety concept is not new. Its present evolution spans some 50 years. As early as 1913, a National Safety Council was formed and 25 years later, in 1938, the Civil Aeronautics Act established a Bureau of Safety. As far as we know, this was the



LTC Clement A. Wyllie
Chief, Engineering Branch
USABAAR

first activity of this nature specifically aligned with aerospace programs.[5]

At the Fourteenth Annual Meeting of the Institute of Aeronautical Sciences in New York in January 1946, Amos L. Wood presented a paper entitled "The Organization of an Aircraft Manufacturer's Air Safety Program."[14] He emphasized the importance of looking at design concepts and safety analyses.

In 1948, another paper was published by William I. Stieglitz in the *Aeronautical Engineering Review,* entitled "Engineering for Safety."[9] He, too, stressed the need for safety in design.

In 1960, the first military Systems Safety Office was established by the USAF Missile Division in Inglewood, Calif.[5]

In 1962, as an outgrowth of work done by the U.S. Navy, the Ballistic Missile Division of the USAF published its first specification for system safety, entitled "System Safety Engineering: Military Specification for the Development of Air Force Ballistics Missiles."[5] Later in 1963, MIL-S-38130, "General Requirements for Safety Engineers of Systems and Equipment," was published. This was the first safety specification that could be applied to all systems in the Air Force.[10]

The Army monitored the Air Force effort and published MIL-S-58077 30 June 1964. The Army specification was identical to the Air Force MIL-S-38130, except that it applied exclusively to aircraft.[13] During Phase 1B of Project Definition, the Army formally implemented MIL-S-58077 on the Advanced Aerial Fire Support System (AAFSS) 1 March 1965. It is interesting to note that, although the Air Force was first to publish a system safety specification, the Army was first to implement it. However, the Air Force subsequently implemented MIL-S-38130 on the C-5 and C-141 programs.[6]

In June 1966, the Army, Air Force, and Navy joined forces and, in a tri-service agreement, published MIL-S-38130A, entitled: "General Requirements for System Safety Engineering of Systems and Associated Subsystem and Equipment." This specification superseded MIL-S-38130 and MIL-S-58077. In the near future, MIL-STD-882, now in the proposal stage, will replace MIL-S-38130A.

Before proceeding, it is necessary to define certain terms which will be mentioned throughout this paper. The following may be considered "operationally defined" as indicated:

Accident — An event occurring by chance or from unknown causes.[4 11]

Hazard — Source of danger or risk.[4 12]

Safety — Freedom from those conditions which can cause injury or death to personnel and damage to, or loss of, equipment or property.[4 12]

System — A system is the unification of all component parts of a whole, necessary to achieve a desired result with effective control . . . Therefore it is incumbent for a person using the word *system* to precisely define or bind the limits in which the system operates. As an example, the earth may be a system when limited to the earth's bounds. However, when viewed in relation to the solar system, the earth becomes a subsystem.[5 12]

System Safety — The optimum degree of safety within the constraints of operational. effectiveness, time, and cost, attained through application of man-

...the Army, Air Force, and Navy joined forces and, in a tri-service agreement, published MIL-S-38130A, entitled: "General Requirements for System Safety Engineering of Systems and Associated Subsystem and Equipment"

agement, scientific and engineering criteria, and techniques and procedures, throughout all phases of system development.[8]

FUNDAMENTALS OF SYSTEM SAFETY

Previously, in systems development, the emphasis has been on accident prevention *after completion of the design.* A review of U.S. Army accident rates for new aircraft disclosed extremely high initial rates, which tended to decrease and level off after a number of years of use.[6] High initial losses can be reduced by an effective system safety program, implemented early in the conceptual phases, and operated throughout the life cycle of the system.

The development cost of any system will be slightly increased by the system safety effort. However, a substantial reduction in retrofit and training costs will more than offset the initial investment. The prevention of only one or two major accidents through better design resulting from the system safety effort can pay for the entire system safety program.

In today's technology, materiel procurement processes normally follow a road map of management procedures called the "life cycle." This cycle is divided into four major phases: Conceptual, Definition, Acquisition, and Operational.[4] They are not necessarily sequential and they may well overlap. Also, depending upon the particular product, the time frame may vary from days to years. To further expand these phases into more meaningful steps, we can consider a product to follow these phases:[5]

Evaluation of customer requirement.
Conceptual design.
Prototype development.
Product design.

Test and qualification.
Manufacturing.
Use.
Ultimate disposal.

Implementation of system safety principals involves assignment of specific safety tasks within the framework of these life cycle processes. These tasks must be astutely planned, organized, staffed, and controlled if the safety job is to be efficiently accomplished. They must be universally accepted by management as vital functions and a necessary extension of the increasingly complex technology facing industry today.

THE SAFETY TASK CHECKLIST

Unless a specific task can be clearly identified with a given objective, it will present management with a difficult problem of integration with no meaningful function. Listed are some fundamental tasks that have been derived from military specifications and other sources. These have stood the test of time and considerable discussion since first presented.[4 5 12] Common sense may imply others.

Conceptual Phase

1. Establish and integrate safety requirements. Design checklists, design handbooks, military specifications, and experience factors are valuable sources for these requirements.

2. Conduct gross hazard analyses and provide safety input to preliminary technical development plans.

Definition Phase

Prepare a schedule of safety milestones in consonance with total system effort. This schedule should be included in the Request for Proposal (RFP) to development contractors.

Contractor Definition

Following the contract award for systems definition, major system safety program milestones must be agreed upon. Efficiency during this phase can prevent costly design changes and retrofit programs later. The following are considered absolute necessities:

Develop and approve system safety plan.
Identify safety requirements and update source documentation.
Compile system safety standards.
Complete detail safety analyses.
Review system requirements.
Participate in trade-off studies.
Establish maintenance safety requirements.
Provide input into test plans.
Establish training safety requirements.
Review of detailed system specifications for safety requirements.
Identify safety documentation requirements.
Provide inputs to final reports.

the prevention of only one or two major accidents through better design resulting from the system safety effort can pay for the entire system safety program

System safety is not intended to be a replacement for any of the other system effectiveness disciplines . . . it must be recognized as a separate discipline which equally bears on system effectiveness

Acquisition Phase

In this phase, systems elements are developed against end item detailed specifications resulting from the Definition Phase. Here again, system safety milestones must be established:

Modify and approve system safety plan as required.
Complete design reviews.
Approve test plans for safety.
Complete ECP reviews.
Complete facility design reviews.
Complete safety analyses.
Approve safety documentation.
Validate safety items in Technical Orders.
Complete safety requirement reviews.
Review test reports.

Operational Phase

This phase overlaps the acquisition phase and a gradual transition from one to the other occurs. During this phase, it is particularly important that special attention be given the customer/contractor relationship. As user problems occur, corrective action is taken and its effectiveness measured. Both parties can contribute from previous experience gained during earlier development phases.

Accident Investigation

It may seem superfluous to cite accident investigation as a separate safety task. Unfortunately, experience has proven otherwise. The preparation and implementation of an effective accident investigation plan is essential to the system safety effort. When a catastrophic event occurs, future prevention efforts can be seriously hampered by inaccurate or premature actions from inadequate investigation planning. Provisions for the use of contractor technical personnel most knowledgeable about the system concerned are essential to investigation teams. The recording and maintenance of accident investigation records are especially important to the system safety feedback loop. Appropriate corrective action to prevent recurrence of similar accidents is largely dependent on the adequacy of accident investigation reporting procedures.

MG Joseph D. Caldara (USAF, Ret), president of the Flight Safety Foundation and past Director of Aerospace Safety, USAF, said: "I think it's mandatory that there is no single key for safety — no grand or magic formula to insure that everyone involved in any activity does what he is supposed to do the way he is supposed to do it. Safety must be the product of many people, dynamic — not static, the sum of many activities."[1]

To my way of thinking, General Caldara has expressed the premise upon which system safety must evolve. It is an assuring function of management and certainly the sum of many activities.

System safety is not intended to be a replacement for any of the other system effectiveness disciplines (i.e., reliability, maintainability, human factors, quality assurance, etc.). On the contrary, it must be recognized as a separate discipline which equally bears on system effectiveness. System safety assures management that sufficient consideration is given to impending failures.

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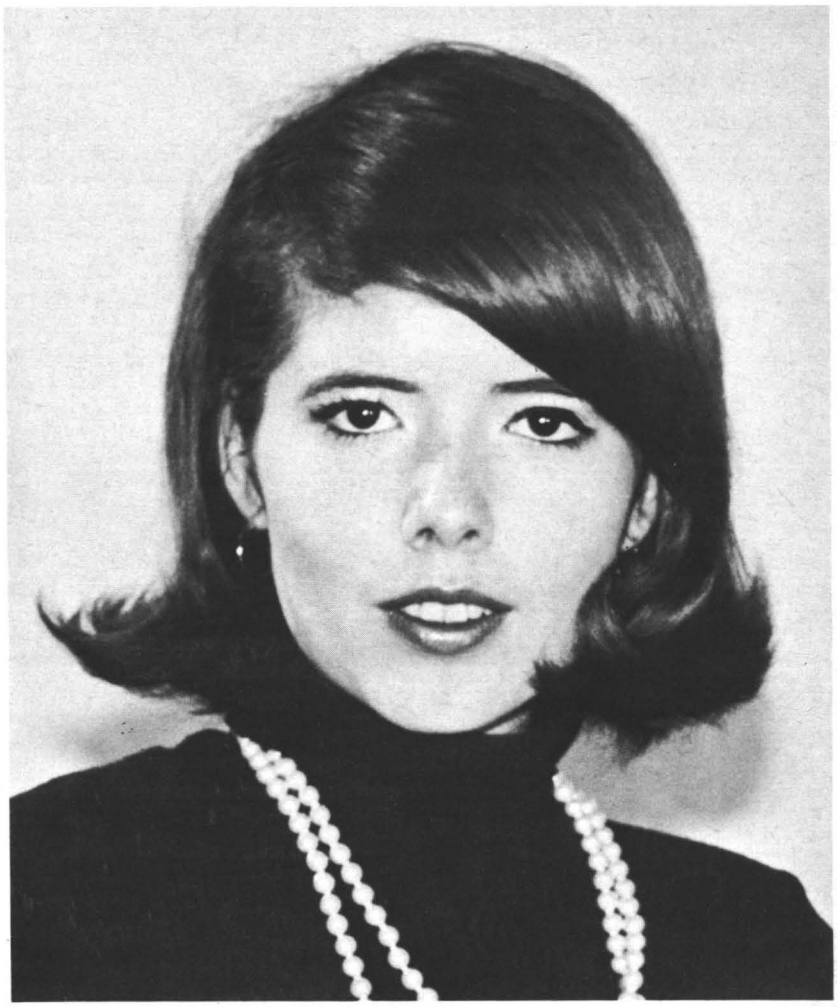
Pearl's

personal equipment and rescue / survival lowdown



If you have a question about personal equipment or rescue and survival, write Pearl, U.S. Army Board for Aviation Accident Research, Fort Rucker, Alabama 36360

NEW "BRAIN BUCKET"

A NEW PROTECTIVE helmet is in the offing for Army aviators.

The helmet—tentatively called the SPH-3B (Modified)—will offer a number of distinct advantages over the helmets presently in use, according to LTC Robert W. Bailey, commanding officer, U.S. Army Medical Research Unit, Fort Rucker, Ala.

Distinctive advantages the new helmet offers are:

- Greater noise attenuation.
- Lighter weight.
- Improved boom microphone.
- Improved helmet-to-head attachment.

LTC Bailey said the new helmet evolved from U.S. Navy SPH-3 helmet which was originally designed for use by Navy helicopter pilots. The Navy designed the original helmet with two prime goals in mind: crash protection and acoustic attenuation to prevent hearing loss in a high noise environment.

USAARU improvements over the Navy version include beefing up the primary shell of the helmet from 0.065 inches to 0.10 inches, a move which will significantly increase both the crash and acoustic protection offered by the helmet.

The new helmet weighs significantly less than both the APH-5 used by Army aviators in the U.S., and a great deal less than the AFH-1 ballistic helmet issued to Army aviators in Vietnam. The lighter weight is expected to significantly reduce helmet fatigue on aviators.

Although the new helmet weighs less than any presently in use, LTC Bailey reported that its ballistic characteristics were nearly as good as the specially designed and heavy AFH-1. This is attributed to the use of Epoxy One resin in the primary shell.

The old commo harness common to the APH-5 was scrapped in favor of a direct mike positioned in front of the wearer's lips. The new mike offers a lower noise-to-human speech ratio as compared with the old mike whose hollow boom indiscriminantly picked up and amplified noise.

The helmet-to-head attachment suspension of the SPH-3B (Mod) consists of a fire-resistant, synthetic fabric web which is easily adjustable. Aside from affording the wearer ventilation — which was unheard of in the APH-5 — the web suspension is designed to keep the helmet on the aviator's head at high impact forces to give maximum crash protection.

USAARU plans also call for the use of the shatterproof, nonbreakable polycarbonate visors with the new helmet to give aviators greater face and eye protection.

LTC Bailey said also that logistic groundwork for the introduction of the helmet was laid in consonance with Army Materiel Command. He also pointed out that, while USAARU was the proponent of the new helmet, U.S. Army Board for Aviation Accident Research, AMC, and the U.S. Navy Aero-Space Research Laboratories all worked closely on the project.

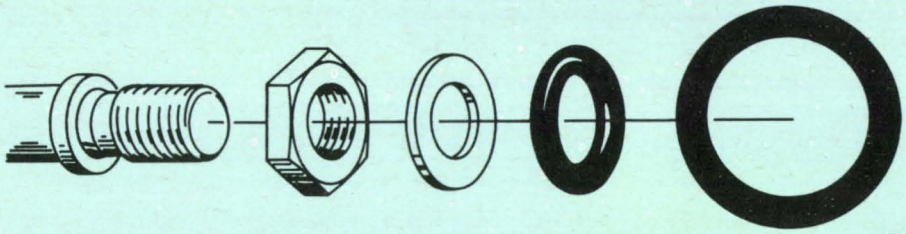
LTC Bailey also paid tribute to the U.S. Army Combat Development Command Aviation Agency at Fort Rucker for their swift development of the necessary Qualitative Materiel Requirement (QMR) to pave the way for speedy helmet procurement.

Forty new helmets were recently received by USAARU for testing. Twenty are earmarked for user testing by the Department of Rotary Wing and the Department of Tactics at the U.S. Army Aviation School. The balance will be laboratory tested by a civilian contract agency.

Pending modifications which may arise as a result of testing, the new helmets are expected to be introduced into the Army supply system around the turn of the year. Issue is expected to be on a one-for-one exchange basis.

From Bell Helicopter ROTOR BREEZE

The Gentle Art of O-ring Installation



O-RINGS, from a maintenance standpoint, involve problems of hydraulic gland leakage and pneumatic gland lubrication. Maintenance inspection of O-ring seals presents two questions: (1) How many drops of fluid must seep past hydraulic O-ring before an objectionable leak is indicated? (2) How much air must seep past a pneumatic O-ring before there is an indication of a damaged O-ring or of a need for lubrication to reduce wear by friction?

To understand the hydraulic problem of lubrication, it is necessary to study the general purpose, design, and function of O-rings, and to consider separately the special features of hydraulic and pneumatic system O-rings. With this background, the mechanic can tell the difference between a seep and a leak.

The principal purpose of the O-ring is to act as a seal. The O-ring depends primarily upon its resiliency (ability to adjust by deforming and springing back) for accomplishing its sealing action.

The simplest O-ring installation is a static seal. Figure 1 shows an O-ring on a bolt, which could be a hydraulic tank plug. Generally, the design of the groove, into which the O-ring fits, is such that the O-ring is squeezed approximately 10 percent to effect sealing action. Thus, when the surfaces to be sealed are brought together, they compress the O-ring and it serves as a gasket. The resiliency of the O-ring also allows it to stretch out under pressure so that the ring contacts the outer face of its confining groove to provide additional sealing action. It is important to note that the under surface of the bolthead fits tightly on the boss. Any crack will allow the O-ring to extrude.

In the static type and, for that matter, in all O-ring installations, it is important that just the proper size O-ring be used, that the O-ring and the parts contacted be smooth and free of irregularities, and that all of the parts be clean. Slight imperfections and/or contamination can be instrumental in causing leakage. An imperfection or a bit of foreign matter can create an opening (past the O-ring) through which fluid can flow.

The O-ring must also be of a material that is compatible with the particular fluid in the system. If the wrong material is used, the O-ring may swell excessively and deteriorate.

A fresh O-ring when installed may normally swell as much as 10 percent when exposed to the fluid and working operation. Allowance is made for this in the design of the O-ring groove. Excessive swelling, however, indicates that the O-ring and fluid may not be compatible. In components that must remain at very low friction values to properly function, excessive swelling of O-ring seals may increase fric-

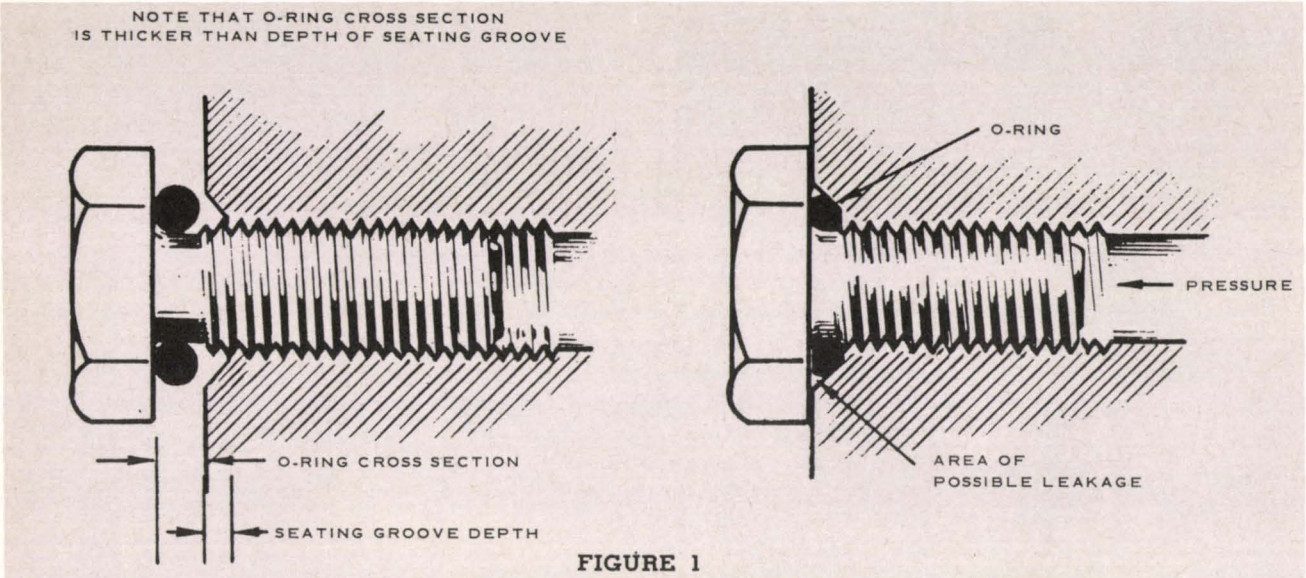


FIGURE 1
Static seal—no moving parts

tion many times beyond the maximum allowable value.

A proper O-ring installation generally results in a diametral squeeze of approximately 10 percent of the O-ring cross section. The volume of the O-ring is also slightly less than the volume of the groove. The initial squeezing is to facilitate a proper seal: the slight "left-over" area in the groove is to accommodate slight normal swelling and to permit a sliding, rolling, and kneading action of the O-ring under pressure and movement. The rolling aids in working fluid under the O-ring, and thus keeps it lubricated.

A simple O-ring installation involving moving parts (running seal) is shown in figure 2. This is a common type of application used where the pressures to be restrained run from zero to about 1500 psi.

Where movement is involved, the installation specification generally defines an amount of leakage that is permissible. A slightly moist surface is an indication that the system fluid is lubricating the O-ring as necessary. The specification will generally stipulate that there shall be no leakage when the assembly is static, and will allow a few drops of fluid to form per minute during operation. Permissible leakage will vary, depending on whether the seal encounters intermittent or continuous motion.

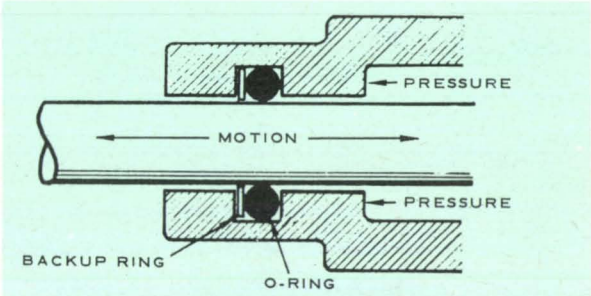


FIGURE 2
Running seal with single backup ring

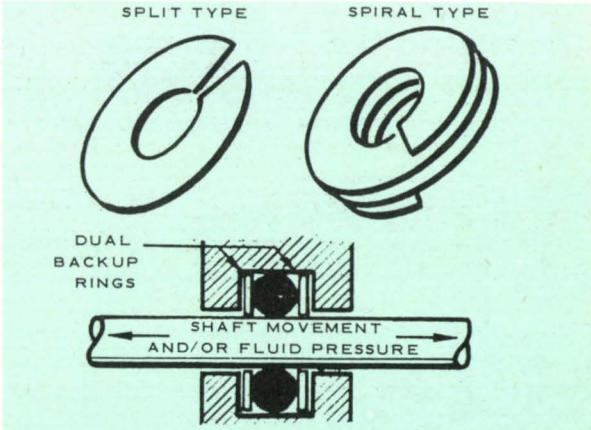


FIGURE 3
Running seal with dual backup rings

The Gentle Art of O-ring Installation

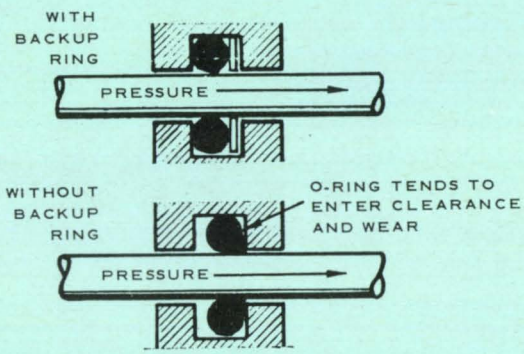


FIGURE 4
Installation of backup rings

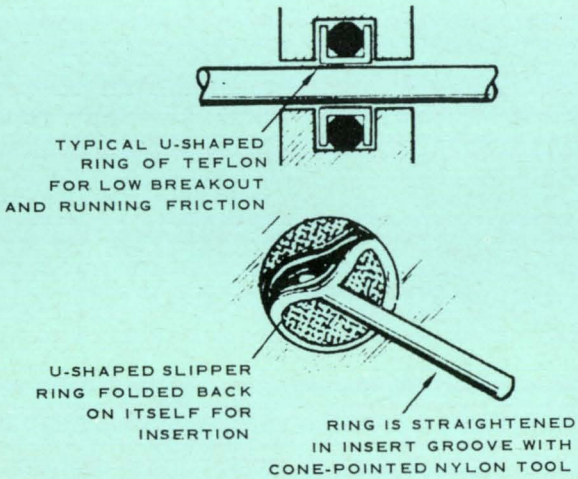


FIGURE 5
Installation of U-shaped seal

More than the specified maximum number of drops per minute, however, indicates (1) a fault in the installation, (2) nicked or scratched sealing surfaces, (3) foreign particle contamination, or (4) worn or damaged O-rings.

Where the higher pressures are being sealed off with O-rings (operating pressure generally above 1500 psi), backup rings may be used with O-rings. Two types of backup rings are shown in figure 3—the "split washer" and "spiral" types.

Backup rings provide a firm surface against which the O-ring can press to avoid being extruded, under high pressures into the clearance between the surfaces being sealed. If these backup rings were not provided, the high pressures could "squeeze out," or extrude, some of the O-ring into the clearance space. Any movement between the surfaces, when the O-ring is thus deformed, would result in a high rate of O-ring wear, and the ability of the O-ring to provide an effective seal is soon lost (see fig. 4).

With O-rings properly fitted, the breakout force (effort needed to start movement) is not generally large. Breakout friction or force is higher than running friction, and is the largest factor that must be considered in the design of O-ring seals.

To prevent grabbing or seizing of smooth surfaces under high pressure, slipper rings are provided. These, in cross section, may be U-shaped, L-shaped, or plain bands, and they are usually made of Teflon (see fig. 5 and 6).

The Teflon material has a very low coefficient of friction, which means that it will start out with a low breakout force and run with relatively no friction under load, even in the absence of lubrication. The free-sliding slipper rings thus adopt the sealing resilience of the O-rings to the higher working pressure.

A different technique is required for installing slipper rings because the Teflon material does not "deform" as easily. It is sometimes necessary to "double check" the Teflon portion of the high-pressure O-ring assembly, as shown in figure 5. Once positioned, it requires working or "ironing" the Teflon ring back into its original shape in the O-ring groove. This is accomplished with a smooth nylon tool to preclude scratching and marring of the metal and the slipper rings.

Particular care must be taken with all O-ring installations to avoid damaging the rings. All parts with which the O-ring is likely to come in contact during assembly should be smooth to prevent cutting or shearing of any parts of the O-ring. The tools used to aid in positioning the O-ring should be made of nylon or similar material so that the ring and its mating groove are in no way scratched or nicked.

This practically rules out the use of metallic tools. Lubricating the O-ring with the system fluid or with a grease compatible with the system will assist in sliding the O-ring into place.

Pneumatic seal lubrication is more difficult to control than is hydraulic seal lubrication. The pressurized air that enters the pneumatic seal from the system does not lubricate; in fact, it dries out the seal and any lubricant that may be on the packing.

To maintain an effective seal with a pneumatic system O-ring, lubrication is usually provided by a felt wiper. During overhaul, this wiper is serviced with MIL-L-4343A lubricating grease. The wiper is thoroughly impregnated with this grease, not superficially smeared. Tests to date indicate that, in pneumatic systems, grease is a better lubricant than hydraulic fluid, both in dynamic and static seals. Service experience indicates that a unit can be operated 50,000 continuous cycles without additional lubrication.

In some installations it is necessary that the O-rings be passed over sharp edges, such as screw threads. In such instances, it has been found practical to cover these raw edges tightly with a thin plastic tape, then to lubricate the O-ring and work it into position, after which the tape is removed (see fig. 7).

O-rings in service undergo a slight swelling and softening and may be subjected to wear that is not always apparent to the eye; these O-rings are prone to inadvertent damage upon reinstallation. It is recommended, therefore, that only new rings be used upon reassembly of a unit. This can do much to preclude and eliminate difficulties.

In summary, proper O-ring maintenance necessitates periodic inspection and keen observance. The line mechanic must determine these things:

Is the dripping fluid hazardous (damaging another component) or creating a fire danger?

Is the drip rate excessive?

Has there been any increase in the rate of drip since the last inspection? (Since an increase may indicate the beginning of trouble, the component should be carefully checked at frequent intervals.)

Is the drip rate normal for this type of installation?

Is any air escaping from the pneumatic system? If so, is the hourly leakage rate high enough to require a closer check on all seals?

If the line mechanic understands the purpose of the O-ring and if he realizes that it is not a perfect seal, he will have little trouble making a practical appraisal of how many drops of fluid must leak past a hydraulic seal before the seep becomes an objectionable leak – and he will also know how important it is to replace pneumatic system components that have dry O-rings.

proper O-ring maintenance necessitates periodic inspection and keen observation . . .

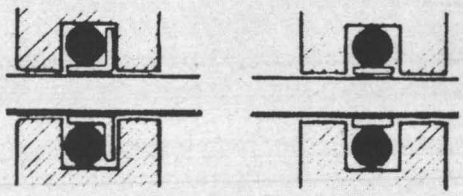


FIGURE 6
L-shaped seal on left: plain on right

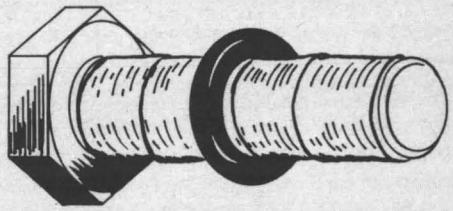


FIGURE 7
Tape protects O-ring during installation

USAASO Sez

The U. S. Army Aeronautical Service Office discusses

what to look for on the NOTAM tapes
if you really are short of air traffic controllers
the air traffic control MOS changes

On flight information: We have had a near overboost condition of rumbling about NOTAM identifiers associated with Army airfields. However, the situation is in the green now. It seems that most CONUS Army airfields do not have their own identifiers on the various FSS NOTAM circuits. So how do you know what to look for on the NOTAM tapes? The quick fix is to check page 2 of the 10 July *Flight Information Bulletin.* The identifiers for all CONUS AAFs are all listed there.

What's the *Flight Information Bulletin?* Thought some of you might ask. It was that white, brief (two to four pages or so) letter size bulletin that you have usually not been able to locate in the flight planning room, because it so effectively blended in with all the other white flight planning publications. We've solved the camouflage problem though, so now it should stand out — Army green, all the way.

In case you haven't missed it, you might have a look at it. Basically, the bulletin is a weekly compilation of NOTAM information of relative permanence, which gets the word out in one handy document in advance of FLIP changes. The item on NOTAM identifiers, for example, will be dropped when the FLIP IFR and VFR supplements are revised to incorporate this information.
On air traffic controllers: Say you're short air traffic controllers? This is not an uncommon condition lately, but are you really? Short, that is. USAASO found 130 qualified air traffic controllers in one Army area alone who were not being used in ATC positions. It may be an attestation to the unlimited flexibility of our Army air traffic controllers that they can also serve capably as mechanics, grass cutters, cooks, drivers, etc., but it's no consolation to the aviator who has to figure out the traffic pattern, avoid the construction on short final and make the right turnoff after rollout, all on his own.

So, the next time you see a particularly busy, bright-eyed young latrine orderly, you might do well to stop and question him. He might be an air traffic controller — demonstrating his flexibility.

More on controllers: If you haven't seen OPO letter, OPOMO, dated 14 May 1968, subject: Revision of AR 611-201 (MOS 93B, Air Traffic Controller), it is recommended reading for air traffic control supervisors and airfield operations officers and commanders. What it does is "shred out" the 93B MOS into four MOSs:

93H	ATC Tower Operator
93J	ATC Ground Control Approach (GCA) Specialist
93K	ATC En route Specialist
93L	Air Traffic Control Chief

Although not effective until 1 January 1969, it requires some serious thought and planning now, some training and retraining soon, and some extensive TDA revision eventually. We might add that the air traffic controller personnel career potential is greatly enhanced by the shred out. Implementing instructions will be forthcoming soon.

IN AN EFFORT to better coordinate the development, procurement and use of Life Support Equipment (LSE) within Army aviation, a Department of Army Systems Staff Officers (DASSO) has been authorized.

LSE includes body armor, survival kits and the various other Army aviation equipment designed for use in an emergency. Since this is a subject that is near and dear to all Army aviators, the Army needs your recommendations and suggestions concerning:

How we can improve current Life Support Equipment.
What new Life Support Equipment is needed.

Please send your LSE recommendations to the following address:

Headquarters, DA
Army Aviation, OACSFOR
ATTN: LTC F. D. Whiting
Room 3D469, Pentagon
Washington, D. C. 20310
Telephone - Area Code 202 - OXford 73158 or OXford 73165

The Antarctic Support Detachment refuels its aircraft by hand at a fuel caches stocked with drums air dropped by Navy C-130 aircraft (front cover). Radio contact is maintained at the base camp's makeshift operations building. With the 24-hour sunlight the unit flies whenever the weather will allow it. The cover photos were taken at 0300 hours.