DECEMBER 1962

UNITED STATES ARMY AVIATION DIGEST

COLD WEATHER OPERATIONS - PAGE 7

UNITED STATES ARMY AVIATION DIGEST

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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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LETTERS

Sir:

Reference the article in the October issue, "Transponder Set AN/APX-44."

I have the privilege of being the USAREUR project officer for IFF, and have presented orientations and briefings on the AN/APX-44 equipment (concentrating upon the airborne equipment aspect) to almost half of the US Army aviators in USAREUR.

I can think of no other electronic device in Army aircraft that is surrounded with more half-baked notions, conjecture, and plain misunderstanding than the US Army's version of Mark X IFF. This confusion on the part of the aviator can be readily and easily understood when you take a long and careful look at the TM. Yep, the very TM that you mention in the article, ole' 11-5895-217-12, for in its original version it contains many small and some large errors. Unfortunately, and here is where it stings, the writer of your article fell into the same trap as many a good man before him. For example: One of the features of the operation of the AN/APX-44 that is commonly misunderstood, and this is compounded by the TM, is its operation in EMERGENCY. Your writer in his careful cribbing of the contents of the TM was not aware of Change No. 1, dated 31 March 1960 [Change No. 2, dtd 11 Sep 61, supersedes and repeats this portion of Change 1] which corrects the text to read as follows:

"The transponder set can also be used to transmit specially coded emergency *replies* or position identifying *replies, after* the set *has been* interrogated by a ground-based IFF system." (I have underlined [italicized] the changes in the text.)

I can think of no briefing that I have given on this subject for over a year and a half where a question relative to this particular capability of the AN/APX-44 was not raised. If you will consider for a moment the difference between the original and the corrected text, you will see the frightening possibilities. As originally stated, the aviator faced with an emergency situation manipulates the set control to squawk EMERGENCY and then concentrates on the emergency at hand, secure in the knowledge that *someone, somewhere* is receiving *automatically* his electronic cry for help. But the truth of the matter is considerably different, *for if he is not being interrogated, he is not transmitting, and his situation goes without notice, at least IFF-wise.*

This is a point which I have learned to stress, advising aviators to use the EMERGENCY control but to also realize that it cannot replace the more conventional voice contact by radio, and at best, can only supplant it. "Suppose my radios have failed along with the emergency situation?" someone is always certain to ask. I answer that the use of the EMERGENCY function of the AN/APX-44 can then be of some assistance in announcing to any interrogator in the area that they are in some sort of trouble, and at least other air traffic can be diverted away from the flight path of the aircraft.

I know how popular the AVIATION DIGEST is over here, and it is required reading for all of my flight clearance officers in AFOF, the US Army Flight Service for USAREUR. Will you please, in the interests of clarifying an already fuzzy area, please publish an early correction to this article? I will bet you ten hours of weather time that I will hear from a dozen aviators in the next week that I have been giving them a bum steer; for everyone knows, if it is in the AVIATION DIGEST it must be the gospel truth.

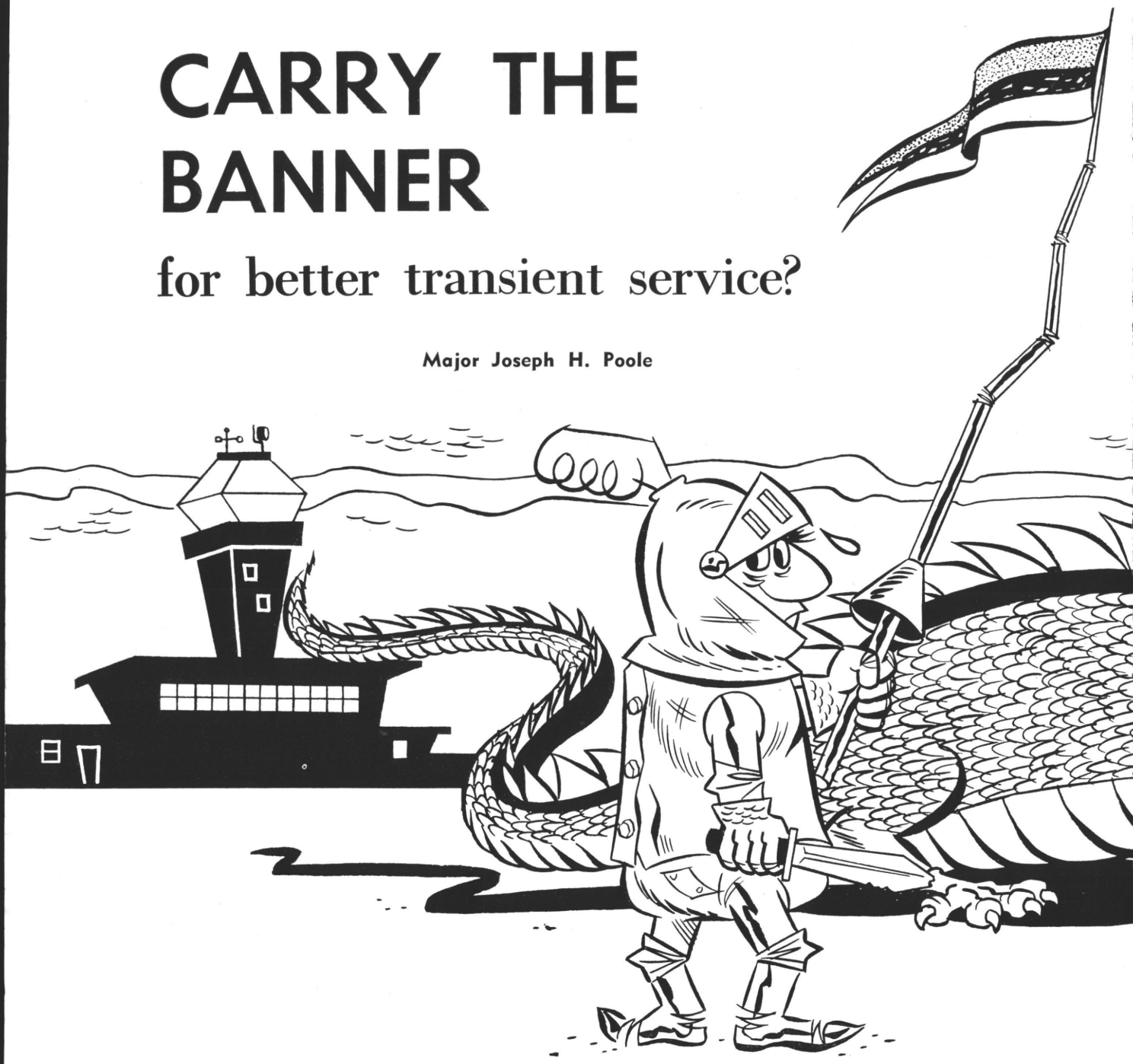
For your information, in May 1962 I had an opportunity to discuss this TM with the publications people. I am certain that I was not the first to bring the shortcomings of this TM to their attention, but I learned that although other changes are in the mill, the most likely result will

Continued on page 17

WHO'S GOING TO CARRY THE BANNER

for better transient service?

Major Joseph H. Poole



EVER WONDER HOW the story of "Let George do it" got started? Seems there was this Dragon, a run-of-the-mill sort of dragon. You know, one green eye, one red eye, two heads, breathed fire. Been around for quite awhile, burning houses, devouring maidens out of season. Quite a nuisance, but after all, nothing to worry about—until it was YOUR house or YOUR girl friend.

Then it happened. It WAS your house. Your dander rose a little. Of course it was impossible for YOU to pick up the banner and go dragon hunting. After all, there was some guy who was supposed to take care of things like this. Let's see, what WAS his name? Frank? Bill? Fred? George? That's it, GEORGE! LET GEORGE DO IT. After all, the do-it-yourself dragon killing kit was a thing of the future.

On making a check it was discovered that good ole George was presently 15 dragons behind. IF he was successful and still AVAILABLE, he might get to yours next month. So what now? WHO'S GOING TO CARRY THE BANNER? WHO'S GOING TO SLAY THE DRAGON?

How does our moss-covered parable relate to transient service? Simple.

* * *

It started when I called Fort Dragon tower about 15 out. The reply was prompt; the transmission clear and lacking that unnecessarily rapid pace which requires a second transmission.

On entering downwind the tower operator again gave me wind information and, recognizing a transient, informed me that the last 500 feet of the active was unusuable due to construction. On rollout he directed a right turnoff at the next available taxiway and gave me ground control frequency.

Coming up on ground, I was told the "follow me" vehicle would direct me to a parking spot in front of operations. On arrival a member of the alert crew was already standing by, wands in hand, to direct me to a parking space. His movements were accurate and deft. After I shut down he quickly chocked the wheels and tied down the aircraft.

As I alighted he met me with a flashlight.

"Good evening, sir. Do you need servicing?"

"Yes, I'll be here overnight. Are you familiar with this model aircraft?"

"Yes sir, we had a class on servicing it last week. We won't be getting any of these new models, but our operations officer figured we'd be servicing them."

I knew I was leaving the old girl in good hands. After filling out the forms I was surprised to see that the crewman had gathered up my gear and had my chute over his shoulder. I picked up by Jeppesen kit and overnight bag and we walked toward operations. The ramp was exceptionally clean and had plenty of room between tie-down points. No crowding here.

The operations officer drove up in a jeep about this time and hopped out with a cheery, "Good evening, sir. Would have met you, but I've been out checking the flares marking the construction on the active and taxiways. Here, let me help you with some of that gear."

As we entered operations I noted the duty sergeant busy decoding the recent NOTAMS. Operations was neat, orderly, and business like. The operations officer inquired, "Have you closed out 37664?"

Glancing up, the duty sergeant replied, "Yes sir, I closed him out at 2010."

"I made arrangements with your alert crew for refueling," I said. "A sharp crew. Knew all about the latest model. Said you ran a class on servicing it last week."

"We try to keep up with the latest poop, sir. We won't be getting any of those aircraft here, but figured we would be servicing some of them."

"Good deal. Wish some other places I've been into lately were as sharp."

"By the way, sir, the dining room at our mess only stays open until 2100. If you hurry you can still make it. Since you're transient, Greens are OK."

"Thanks for mentioning it. I had only a cup of line shack coffee at my last stop. Their snack bar was closed for inventory."

Since the airfield and the main post are some distance apart at Fort Dragon and I knew I'd arrive after duty hours, I had requested transportation on my flight plan. I wasn't surprised to find it standing by—considering the fine service I'd already received.

While riding into the post, I couldn't help thinking about my last RON flight here. What a change!

* * *

On my previous flight the tower operator at Fort Dragon spoke at supersonic speed and acted irritated if you couldn't read him. He was also quite impartial — locals and transients got the same poor service.

There was no "follow me" vehicle, nor did I receive any taxi instructions after landing—except when I asked for them. No free advice was offered. Ask a question, get an answer. When I arrived at the ramp, after taxiing off the taxiway twice due to burned-out bulbs (always at intersections), no alert crewman greeted me at the tie-down point. Calling the tower I was told "Leave it right there" in a voice which sounded both sarcastic and impatient. I did.

I was three-quarters of a mile from operations, even though I had informed them I was a transient and would be departing early the next morning.

After filling out the forms, I made two trips to operations to bring in my gear. The duty sergeant was talking with someone from the alert crew and no offer of assistance was made.

Just to be sure, I asked if I had been closed out.

I could have interrupted a session of the United Nations with less effect. Receiving a curt "Will do," the discussion of the relative merits of Sophia versus Brigitte continued.

With this sort of reception I really didn't expect to find my requested transportation (or RON accommodations) awaiting me. I wasn't disappointed; they ran true to form. I had a 45-minute wait. No chairs were available, since all were occupied by sleeping alert crew members. After finally making it into the transient billets, I discovered that billeting personnel had not been notified either. It took another 15 minutes of waiting before a room could be cleaned and made ready. Arriving at the mess, I discovered that the dining room closed 15 minutes before I arrived, but I was comforted by the words of a fellow officer who said, "You can't eat here in Greens anyhow. Everybody has to be either in dress uniform or civvies with coat and tie after six."

After thanking him for his kind words, I went back to the transient officers' quarters and made do with a soft drink and cheese crackers. Munching thoughtfully on my tasty supper I pondered the problem. Why is transient service so poor? Why doesn't somebody do something about it?

The key word seemed to be "somebody" — *somebody* else. George. Let George do it. Let good ole George carry the banner.

What about the people running this field? Don't they know

that their transient service is poor? Unfortunately, all too often a beautiful airfield is built with wonderful accommodations and is well staffed—yet no one implements the accommodations properly or really checks transient service to see if it is effective.

Everyone *assumes* that transients are getting good service. Base personnel don't complain. Transients themselves don't complain.

False logic, I mused, as my last cracker fell on the floor before I could grab it. Only a few chronic gripers really *like* to complain. The average transient hesitates to gripe or even offer constructive suggestions. After all, it's easy to rationalize that your case is the exception to the rule. Then, too, you don't want to be thought of as a griper—or get anyone into hot water.

How about the airfield commander? He must be a conscientious commander. Surely he knows what goes on at his own airfield!

Finishing off my soft drink, I leaned back in my chair, lit an after dinner cigarette and thought about it.

Probably on paper his operation looks good. He has competent people. After a grueling 8-10 hour day he's ready to go home. About the only time he sees the transient operation is when he's standing by waiting for some VIP to arrive. Of course, everything looks good then. It's easy to fall into that trap.

Suppose I don't let "George do it." Suppose *I* take up the banner and go forth to slay the dragon? Suppose *everyone* did? Maybe somebody does need to be shook up!

But how? Not by complaining to the alert crew or dressing them down. That's only a temporary expedient. Besides, that's the job of their superiors.

Aha! the operations officer! Notify him—not with a complaint, but a *suggestion,* a matter of possible command concern! Lighting another cigarette I mused, "I'll start *my* campaign in the morning. I'll pick up the banner here at Fort Dragon. It's as good a place as any to start; in fact, I can't think of a better place!"

The next morning, after a troubled night's sleep (brought on by the transient pilots' complaint, "lackachow") I purposefully set off, banner in hand, to see the airfield operations officer. Presenting him with a list of discrepancies I noted yesterday, along with my suggestions as to how they could be rectified, surprise of surprises, he thanked me!

"I didn't realize that quite a few of these things were going on. There is no excuse, I know, but it is pretty hard to take care of all the paper work on hand and still get out and make continuing inspections on all phases of our operations. If only more people would give me such an informal report when they find something wrong—as you have —I think we could lick this problem. Having been a transient myself, I've found this situation at many other airfields, but like you said, 'Why should I carry the banner?' By George, I see what you mean. I will check into these items right away."

While getting ready to leave Fort Dragon, I found other discrepancies. My gassing instructions had been ignored and 25 gallons had to be pumped out of the tanks before I could depart. The aircraft looked worse than it had when I arrived. It had been moved down the ramp even further away from operations. The wing also glistened from spilled oil. The ashtrays had not been emptied and the cockpit floor was dirty; in fact, it was dirtier than I had left it. From the looks of the floor, the alert crewman who moved it must have been wading in the swamp. The windshield was as grimy as ever.

Sighing, I took my own chamois and can of cleaner from my Jep kit. Handing them to the crewman, who had finally arrived, I asked him to clean up the windshield while I preflighted. Looking hurt, he made a few desultory passes and handed back the chamois. Having finished the preflight, I motioned the crewman to the fire extinguisher, after calling him back to reclaim my can of cleaner. He didn't have the extinguisher at ready as I cranked up, but was leaning on it, apparently looking at another aircraft taking off. Oh well, having glanced at the extinguisher when I walked up, I doubted that it would work anyhow. The seal was broken and the handle was twisted and bent. Its pressure was probably as low as the morale on the airfield.

I almost shut down after five minutes of trying vainly to get either the tower or ground control. The pilot of another aircraft got on the horn and told me I was in a "dead" spot. After moving up the ramp, I finally received taxi instructions: "Clearedtorunwaysix,wind outofthesoutheastfivegustingto ten,altimeter29'er9'er6time46clea redtotaxi."

The DD 175 had no airfield diagram on the back, so I had to flip through my Jep, find the plate and figure it out for myself. I also called ground control for a repeat on the wind, altimeter and time.

Clearance copying was a con-

test. The tower took on a challenging attitude; it was apparent the "game" was in progress. Could I copy as fast as he could talk? Here it came again: "Army 37664isclearedtoFortServiceairfieldviaVictor297toBurningHouseintersection,Victor423FleeingMaidenintersectionV95FortServiceclimbtoandmaintain4,000feetcontactGeorgeCenteron289.4overBurningHouseOver."

I lost.

After two more attempts, I was ready. On getting airborne, it was a pleasure to inform him I was leaving his frequency. On arriving at home station, I sat down and wrote a short letter to the operations officer at Fort Dragon, mentioning our conversation. I said I had a few more points I would like to add.

Surprisingly enough, in a few days I received a nice letter from him saying that my comments were appreciated and my suggestions were being put into effect.

I thought no more of Fort Dragon until my flight here today.

After a satisfying dinner at the club (Greens were acceptable now), a comfortable night's sleep in the transient billets and being transported back to the field the next morning with no foul-ups, I reflected that this trip was certainly a pleasant one. Everybody had done everything in their power to assist me. There was a fully equipped pilot's planning room, a stack of pencils on the planning desk for those who inevitably lose theirs, a handy pencil sharpener, decoded, up-to-the-minute NOTAMs—a smooth operation all around. DD 175s had an accurate diagram of the taxiways and runways on the back and listed the local frequencies.

The weather briefing was excellent, and when I filed my flight plan it was checked carefully by the operations officer. Not being a paragon of virtue myself, he found an error. But instead of embarrassing me in front of strange pilots, he merely pointed at it with his finger. That was enough. I filled in the blank block on the 175 and was quickly on my way to the aircraft. An alert crewman assisted me with my usual cumbersome load, brief case, overnight bag, Jeppesen case, parachute, etc. He also helped secure them while I looked over the aircraft.

I found that fuel and oil entries had been made and that a battery check, having fallen due, was completed and written off.

A crewman furnished a ladder to check the outboard tanks and a *clean* jar in which to check the drained fuel. He also had a rag handy to wipe the dipstick. With all of this service I hated to look at the windshield—the supreme test. After all, look at what they had done already. No one *ever* cleans a windshield for you, at least not completely clean. I could ignore this supreme test. But then . . . I glanced upward. IT GLISTENED! I was awestruck. Climbing aboard, I could not help offering a parting congratulation.

"Best transient service I've ever had anywhere."

Grinning, the crewman said, "That's what we're here for, sir," standing by smartly with the fire bottle.

The interior of the aircraft was spotless and the ashtrays had been emptied. A copy of the forms I had filled out for gas and oil lay neatly on the seat.

On arrival at home base I sat down and wrote another letter to the operations officer at Fort Dragon, this time, through channels. I pointed out the many fine features of their transient service and what a fine job they were doing.

The return letter from the airfield commander thanked me for my interest, and it was a solid satisfaction to know that I had made a contribution, however small, in improving the transient service picture.

* * *

What can YOU do to improve transient service? Work at it from two directions.

AT YOUR AIRFIELD

The gateway to your post, camp, station or field CP nowadays is your airfield. VIPs as well as transients are prone to make their initial (and sometimes long lasting) judgment of your installation by the first impression they receive.

Check your local facilities. Question transients. Ask for their comments. You may be spoonfeeding a dragon and not know it.

Make continuing checks on transient service. Standards slip without supervision.

WHEN A TRANSIENT YOURSELF

Suggest and praise. Complaints, such as those made over a cup of coffee to other aviators, may evoke sympathy but seldom produce results. Suggestions on how service can be improved, however, are favorably received and, in most cases, action is taken. Praise good service received. Nothing helps in holding up high standards more than a word of praise when deserved.

It's a little bit harder to make a suggestion than to make a complaint. The first word of praise is the hardest; however, better transient service will come only when everyone gets into the act. Pick up the banner yourself. George may never get around to our particular dragons. Using this do-it-yourself dragon killing kit will produce results. Let's have a go at it!

COLD WEATHER OPERATIONS

Lieutenant James W. Hendrickson

ANNUAL AWARD Monthly Winner CONTEST

IT IS BITTER cold as you leave flight operations. The high wind, often reaching gusts of 45 knots, makes it almost impossible to stay warm. The ice crusted snow impedes all modes of travel, even the age old use of foot and animal. In the −20° F temperature, you could close your eyes and easily imagine yourself located in a desolate section of Alaska . . . the Arctic. . . even Siberia.

But you are not in the Arctic. You do not have to be close to the Arctic to experience such conditions. Within the United States, Europe, Korea and Japan are many Army airfields that operate under the most severe winter conditions imaginable. Many of these AAFs should be designated as cold weather areas. Reference to the world temperature chart extracted from TM 1-300, METEOROLOGY FOR ARMY AVIATION, shows that many areas of the CONUS, Europe, and Asia have temperatures corresponding to those in Alaska. Yet, we refer to Alaska as a severe cold weather area but not the other locales. This is a costly mistake. No winterization equipment for cold weather operations is authorized or issued.

Many newly graduated aviators fresh from Camp Wolters and Fort Rucker report to units operating in cold weather areas.

Lt Hendrickson is an instructor, Rotary Wing Branch, Dept of Maintenance, USAAVNS.

Pilot didn't know or realize how deep the snow was on runway

We have jungle, cold weather, and mountain warfare specialized and separate schooling for the soldier, but no such prior training is included in the POI for Army Aviators assigned to units operating in areas with vastly different environments from Texas and Alabama. Under maintenance subjects, ORWAC and WORWAC students at USAAVNS receive 1 hour of classroom instruction on adverse weather (arctic, desert, jungle). Under special operations they receive 2 hours of classroom instruction on amphibious, jungle, mountain, desert and arctic operations. Two hours instruction of air mass cold fronts is also taught. These 5 hours constitute the cold weather training given students at Fort Rucker.

Statistics at USABAAR confirm that such inexperience and lack of knowledge concerning cold weather operations caused 78 accidents and cost $899,911 from 1 July 1957 to 31 May 1962. These accidents resulted in six injuries and two fatalities.

COLD WEATHER OPERATIONS ARE DANGEROUS AND CRITICAL. The average Army Aviator does not know the problems that result from low temperatures. And he usually overcomes the problems he encounters through trial and error. But why not use the information gained from previous experience? Prepare yourself by learning from the mistakes others have made. Trial and error in the aviation field can be painful and deadly.

Some will argue that it is the manufacturer's responsibility to produce an aircraft so dependable that the pilot can perform his mission without worrying about the operation of his aircraft. This is what our tax money is used for. But let's stop for a minute and examine this theory. Regardless of some prejudiced thinking, the manufacturers and chemists are constantly searching for and creating better metals, lubricants, fuels, and associated equipment. Until such advancements are achieved the aviator must fill the gap between the performance of the manufacturer's best product and the worst handicap created by nature.

Assuming that you know all about cold weather flying, what can you do about the cold air, high winds and moisture-laden air? Nothing! You can do absolutely nothing about conditions created by nature. But you can prepare yourself and your equipment to accomplish your mission under the most severe winter conditions. You will find that your minimum physical efforts will be exhausting and lengthy.

Your first step is mental self-conditioning: *Don't fight the cold!* Working under the conditions created by severe cold is just another duty to an Army Aviator and one you can expect to perform sometime during your career.

Pilots continuously prepare for an emergency forced landing. We should know our emergency procedures perfectly. But how many of us know a few common sense rules for cold weather operations? We should. Such a list is published in TM 1-300, METEOROLOGY FOR ARMY AVIATION. It is basic, brief and nontechnical and

Pilot landed on snow and used unequal, reversible prop thrust

should be adhered to in every respect. *But do not stop with Army publications!* Many Army Aviators feel that only Army literature is dependable. This is incorrect. While the publishers of our literature consult other agencies and even other countries to assure that we get a well rounded opinion on any topic, we must not be parochial in our reading. A majority of the cold weather flying has been done by civilians and members of other services. Their experiences have been documented and should be read and evaluated.

I have compiled a cold weather flying list through correspondence with the Arctic Test Board, research of statistics at USABAAR, and reading pertinent aviation publications.

After reading the list, you might think it is not a safety list, but a book of instructions, another TO. As statistics prove, one excellent reason for so many rules is that cold weather indirectly and directly causes many aircraft crashes, maintenance breakdowns, loss of flight time, injuries to personnel, and a high cost of operation.

Before listing the cold weather operation rules, let us review some cold weather problems. My source of information is Maj John A. Love, an Army Aviator attached to the Arctic Test Board. Major Love considers the following the most important problems and suggests how to best counteract the condition before damage or injury results.

All remarks in parentheses are those of the author.

1. Aircraft covers, including engine covers, must be used during any overnight outdoor storage, or during periods of precipitation. The engine covers provide an excellent means of containing heat used during preheat. During precipitation the covers help prevent formation of ice and frost on the aircraft surfaces. (All frost and ice must be removed from aircraft surfaces and airfoils because they create drag and destroy lift. The rough surface created by ice and frost will also aid in the formation of more ice.)

Pilot thought that snow-covered ground would automatically support aircraft. Note water under wheel.

2. Preheating turbine engines does not appear to be necessary. Tests conducted at the Arctic Test Board show that the T-53-L3 engine can be started without preheating in 55 seconds at −61° F after being cold soaked for 81 hours. (Cold soaking assures that the aircraft is the same temperature at the very core that it is at the surfaces. It requires more time for the protected interior components to reach the same low temperature as those exposed to the elements.)

The T-53-L5 engine performs as well but has to be shut down if not preheated due to high transmission oil pressure. (The T-53-L3 engine is used on the OV-1 and the T-53-L5 engine on the UH-1. Preheating the transmission of the UH-1 is necessary only for good starting. This is needed because of the high viscosity of the lubricant.) However, 10 minutes of preheat at −50° F proved sufficient to start the UH-1. Teardown of the engines subjected to the cold starts indicated no internal wear or damage due to lack of or improper lubrication.

3. When cold-starting turbine engines, an adequate power source must be available, either a *fully charged battery* for the Mohawk or an *APU* for the UH-1. This precludes engine damage from a hot or hung start. When these conditions are encountered, the fuel must be shut off and cranking continued. The extra power source will be necessary for the continued cranking. During cold starts, "torching" is common but does no damage to the engines. Re-

vised starting procedures are being staffed at this time. Under the new procedure, the ignitors of the Mohawk are activated as soon as possible; don't wait for 10 percent (N_1). Hold the ignitors until acceleration is continuous and stabilized. Depending upon the temperature this might last until 38-40 percent (N_1). The same will be done with the UH-1 where the starting fuel and ignition switch must be used to achieve the same result.

4. With reciprocating engines, oil dilution is a must. The best procedure is to carefully follow the manual for each aircraft. This is time consuming, but a successful start is more important than the time spent. At −40° F the Caribou must be preheated 30 minutes, and have the engine run for 30 minutes to reach boiloff temperature and another 35 minutes for boiloff. This is a total of 1 hour 35 minutes of work before becoming airborne. (Dilution is the process of pumping raw fuel into the crankcase oil for a prescribed amount of time at a prescribed rpm and oil temperature. If allowed to remain in the oil at high rpm, this gasoline could cause severe damage to the internal, oil lubricated surfaces. Therefore, on restart of an engine that has been shut down after using the oil dilution system, the engine oil temperature must be raised through engine operation at a prescribed rpm until the boiling point of the gasoline is reached. At this temperature the gasoline will vaporize and flow overboard through the engine breather pipe. This naturally does not compensate for the sealed transmissions filled with hydraulic fluids. Here, draining the lubricant and keeping it warm overnight is the best policy.)

5. After an aircraft has been exposed overnight *during which the temperature was below 0° F,* reciprocating engines must be preheated before starting. (Does the temperature at your airfield get down to 0° F?) This is to aid a successful start as well as to preclude internal engine damage. How much preheat to use is the problem. An unsuccessful start, during which the engine fires once or twice, will prevent a successful start until the plugs are removed and cleared of frozen condensation.

A rule of thumb used by bush pilots is that the entire engine is heated enough when the frost has thawed from the propeller hub. The reasoning is that the engine has absorbed enough heat and is warm enough to transfer the heat through the propeller drive shaft to the hub. When the frost on the hub thaws, most of the engine components are at or above 32° F. A common practice at the Arctic Test Board is to monitor the cylinder head temperature gauge until it reaches 0° C, which is adequate heating.

This procedure can also be used with helicopters. Here, the problem of preheating the transmission arises. Many points of the transmission are lubricated by drips or splashes, and cold congealed lubricants will not suffice. A normal procedure is to heat the transmission until the engine is ready, but no method has been devised for determining the temperature within the transmission. Both methods of preheat can be aided by draining the oil before placing the covers on, keeping it warm overnight, and refilling the engine and transmission with the warm oil prior to the engine start. Preheat time can range from 30 minutes to 1 hour 30 minutes, depending on temperature and wind velocity. (The velocity of the wind will greatly lower the surface temperature of any object left exposed to the direct blast of the air. Check the windchill chart for an estimate of the outside air temperature in exposed areas. Many times this will be a determining factor on the use of covers and preheat. The temperature may be many degrees colder than in concealed and protected areas.)

6. Preflight procedures are normal, with one exception: they are duplicated once the engine has been started and all systems activated. Many times hydraulic or oil leaks will be found after liquids are warmed to their normal viscosity. Flex lines will develop cracks that are not apparent until heated fluid is applied under pressure. The majority of these leaks are of such magnitude that flight has to be terminated. Remember that fittings are joined or mated with dissimilar metals which have different coefficients of expansion. While the aircraft is cold no leaks will develop, but upon warming, the fitting will expand at different rates, producing a loose and leaking connection. It is better to tie the aircraft outside and leave it than hangar the aircraft part of the time and keep it outside part of the time. The best solution is to hangar the aircraft all the time, but this is not always possible in most situations. (If left outside, use brooms and burlap or some other field expedient to remove all snow, ice, and frost from the surface before flight is attempted. Melting the ice with preheat equipment could cause water to flow to some low portion of the fuselage and refreeze unnoticed. This could create a hazard to flight through weight, center of gravity limits, and control interference.)

7. Particular attention must be devoted to tire, air-oil strut, and float inflation since the pressure of contained air decreases as the temperature decreases. During prolonged periods of operation it is desirable to use tubes in all tires because the loss of the pressure from a tubeless tire may allow the tire to separate from the rim, and all of the air is then lost. (Tire and strut inflation could cause ground resonance in aircraft such as the CH-34. On some fixed wing aircraft improper inflation of tires and struts could allow structure or propeller damage on hard landings.)

8. Oil lines and coolers on all aircraft seem to have some points within the system where circulation or passage of oil is slowed or restricted. During cold operation, these tend to get more sluggish and oil congealing starts, blocking the system. The result is a ruptured oil line or cooler. A partial answer is to be certain that a thorough preheat has been performed, but this rupturing has also been encountered during flight when the entire system should have been at operating temperature. The majority of ruptures occurred after the aircraft had been parked with the engine shut down for an hour or so and then restarted. Although the engine was still warm enough for starting, the high oil pressure, due to high oil viscosity, would rupture the cooler. A common practice is to start and run the engine every half hour. Immediately after an engine shutdown, an attempt should be made to drain oil from the system. If the oil will not drain due to viscosity, every precaution should be taken to preclude a ruptured system. This problem is more prevalent with the CH-37, CH-34, and CH-21 aircraft.

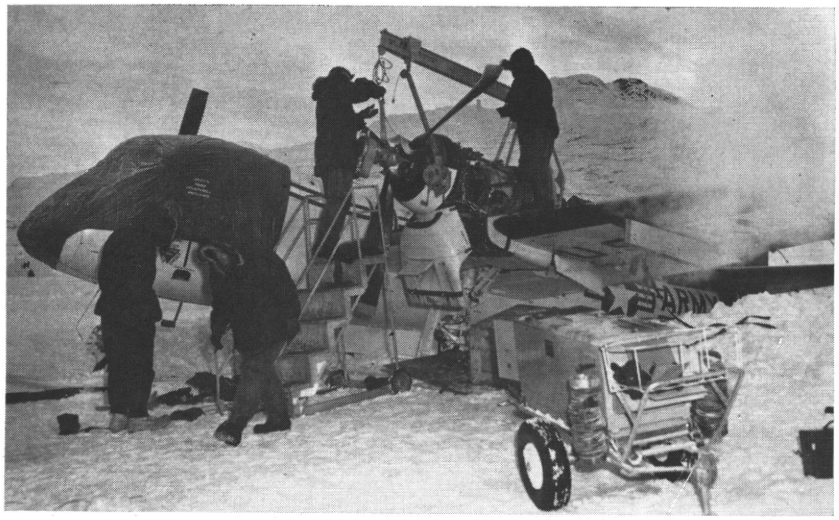
9. A thorough cockpit check cannot be overemphasized. All electrical systems should be activated before takeoff. During cold periods, when electrical systems are activated, wiring will expand and break insulations which have become brittle due to low temperature. The wire may break at a kink or tight connection. Also, the relative humidity is normally low and electrical sparks will bridge gaps that could not be jumped during warmer temperatures. This could result in fire. During the cockpit check, the loadmeter must be monitored and normally grounded circuits will be indicated.

10. The cockpit heater is an important item. Even though arctic clothing is warm, the absence or malfunction of a cockpit heater creates a serious condition. Personnel may not be aware of being physically cold until some cockpit operation requires manual dexterity. Then crew members find that fingers, arms and legs will not function with the adeptness necessary. (It is advisable to operate the cabin heater until the temperature in the cockpit has risen sufficiently to heat the engine and flight instruments. Without some cabin heat, the instruments are slow to react and may become inoperative in extremely low cockpit temperatures because of the increased viscosity of the instrument lubricant. Major Love states that the Arctic Test Board places all aircraft tested near the red X condition due to insufficient cockpit heat.)

11. When using skis not treated with nonfreezing substances or not bottom stripped with a nonfreezing material, freeze-down will be experienced at each stop. Most skis are treated, but if not, a good practice is to taxi onto a bed of pine boughs or onto wooden crosspieces. If this is not possible, taxi onto a rope. The rope can then be used to free the skis by seesawing the rope back and forth along the bottom.

12. During extremely cold weather the density altitude will be in the minus range many times. This gives good aircraft performance, but it drastically increases fuel consumption. Gen-

Pilot lost visibility during blinding snowstorm



Schedule maintenance cautiously in severe weather conditions. It takes too long; mechanics can only work 30 minutes at a time; parts supply is slower; etc.

erally this increase is 20-30 percent, but in one instance an OV-1 increased fuel consumption 50 percent at −6,000 feet density altitude.

13. Landing, taking off, and taxiing on skis must be accomplished with caution. Down to a temperature of −20° F snow is slick and will pack into a smooth sliding surface. Below −20° F, snow assumes the texture of coarse sand and gives additional friction and tends to ball up beneath the skis. This will not give the normal support and produces added drag. During extreme cold, all skis tend to plow through the snow rather than slide on or close to the surface. Although these conditions do not present an operational hazard, the knowledge of snow-ski traction is of prime importance.

14. Rotary wing aircraft must use modified landing and takeoff procedures over snow-covered ground. During any hovering, the helicopter will become engulfed by a snow blizzard and ground reference can be lost. Consequently, all takeoffs must be from the ground and must be between a normal and a maximum performance takeoff. Even this technique creates a period when the blowing snow produces an IFR condition.

The most successful landing technique has been shallow with a higher than normal approach speed, during which the aircraft is landed prior to building ground effect. Thus you land before the snow blizzard engulfs the aircraft. This type of landing is similar to a running landing but with no rollout; the aircraft is at a full stop at touchdown. The main precaution is to BEWARE OF HOVERING. If hovering cannot be avoided, a visual reference can be used directly under the aircraft. Normally the pilot can see straight down but not laterally. Use of these methods requires some practice to become proficient.

15. When using aircraft with reversible propellers, caution must be taken during the landing rollout. The Mohawk will be completely covered by a snow blizzard at 40-50 knots on the landing roll with propellers reversed. A technique developed by the Arctic Test Board is to use full reverse until the entire aircraft is engulfed by blowing snow with the exception of the cockpit, which is protected by the reverse blast of the propellers. Then reduce the reverse thrust and maintain a cockpit-blizzard relative position through judicious use of the reverse thrust. This is a successful procedure, but it increases the landing-roll by 20 percent. Reduction of the reverse thrust lessens the propeller wash to the exact reverse force that will keep the snow from covering the cockpit but still will not create the maximum blizzard.

16. Another flight hazard over snow-covered ground is whiteout, a condition where the sky and snow surface seem to blend and no visible horizon can be ascertained. After flying under this condition for some time, pilots are affected somewhat like having vertigo and become disoriented. One solution to this situation is to climb above any known obstacles and immediately go on instruments. Another solution is to find a non-white reference point for orientation. This is an extremely critical situation. Although not specifically determined as such, whiteout may have been the cause of some accidents in the Arctic during the past.

17. Ice fog creates another extremely critical situation. On a clear, cold, windless day, any agitation of a supercooled airmass will generate ice fog. The engine exhaust and rotor wash from a CH-37 helicopter taking off can lock a field in at 0-0 for several hours. On many occasions, aircraft have departed a field for a 1- or 2-hour flight and returned to find the field

socked in from ice fog created on their takeoff. During the past winter, two aircraft, a UH-1B and an OV-1A, had to execute precautionary landings due to heavy fuselage ice while flying under CAVU conditions. The only plausible explanation is that the engine exhaust and rotor or propeller wash created ice fog during flight that accumulated on the aircraft surfaces. Both aircraft were observed producing vapor trails of great magnitude at the time of the incident.

18. When blowing snow, either actual or created by rotor downwash, is encountered, sling-load hook-up and release is hazardous due to the tremendous buildup of static electricity within the aircraft. The results of a test at Fort Greely, Alaska, showed that the CH-37 will build up 200,000 volts. (This could have been more since the measuring device pegged at 200,000 volts.) This necessitates having the hook-up crew ground the sling before operation. This is generally done with an insulated wire or some field expedient.

19. During cold weather, servicing and maintaining the aircraft will require 2 to 3 times as long as in warm weather. Usually only graphite grease suffices where regular aircraft grease is used. Normal aircraft grease becomes hard, and brittle and useless at −40° F, and oil will not even pour until heated. You can also expect to be constantly changing types of lubricants as the temperature changes.

I have reviewed some of the more serious problems encountered under severe cold weather conditions, conditions that can and sometimes do exist at Army airfields in the northern section of the CONUS. I have not attempted to elaborate on the brittle metals, plexiglass, ice removal, windshield defrost, supply and POL storage and transport, and the countless other problems that will constantly be harassing you. Maintenance will be slow and the duty hard.

However, I think you will find your aviation duties under cold weather handicaps easier and safer if you apply the following abbreviated rules.

Common Sense Cold Weather Safety Rules

Don't fight the cold mentally. Accept it and do your best.

Be willing to accept new solutions to old problems.

Schedule maintenance cautiously. Work when you can, and under the best conditions. Establish and follow a sound plan for scheduling maintenance.

Expect slow replacement of supply items.

Leave the aircraft either outside or inside, be consistent. Perform maintenance inside.

Conduct a thorough preflight before and after engine warmup.

Remove all ice and frost from the air foils.

Don't place bare hands on bare metals.

Use caution when climbing or walking about the airframe. Don't jump from the airframe at any time.

Preheat engines and transmissions to O° C or 32° F.

Use an APU for all starts.

Check the cabin and cockpit heater. Beware of carbon monoxide poisoning.

Check the electrical system thoroughly for dangerous leaks.

Check the tire and strut pressure.

Ascertain that the aircraft is not frozen down before hover or taxi.

Activate all systems for serviceability before takeoff.

Perform a thorough cockpit check.

Taxi slowly on established taxi routes when snow covers the ground.

Don't hover helicopters over snow-covered ground unless it is absolutely necessary.

Consult and follow your TO for oil dilution procedures.

Drain the oil and keep it warm if oil dilution is not practical.

Start and warm up the engine every 30 minutes when neither draining nor diluting the oil is practical.

Check the viscosity of the oil immediately after engine shutdown.

Drain all condensation from the oil sump and fuel cells approximately five minutes after shutdown and after servicing.

Perform a constant crosscheck of engine instruments during flight.

Allow for excessive fuel consumption in flight and during warmup when planning a flight.

Use a copilot on extended flights across snow-covered ground.

During flight periodically exercise your body as vigorously as cockpit space allows.

Fly only over the most favorable snow-covered terrain. Remember the type of landing necessary even during forced landings.

Use minimum torque values when a minimum and maximum are stated.

Use insulated grounding cables during sling loading operations in blowing snow.

Tie down all aircraft at any prolonged stay. High winds are common and sudden. Park only on nonfreezing materials.

Use sunglasses or the antiglare filter of your helmet when flying over snow.

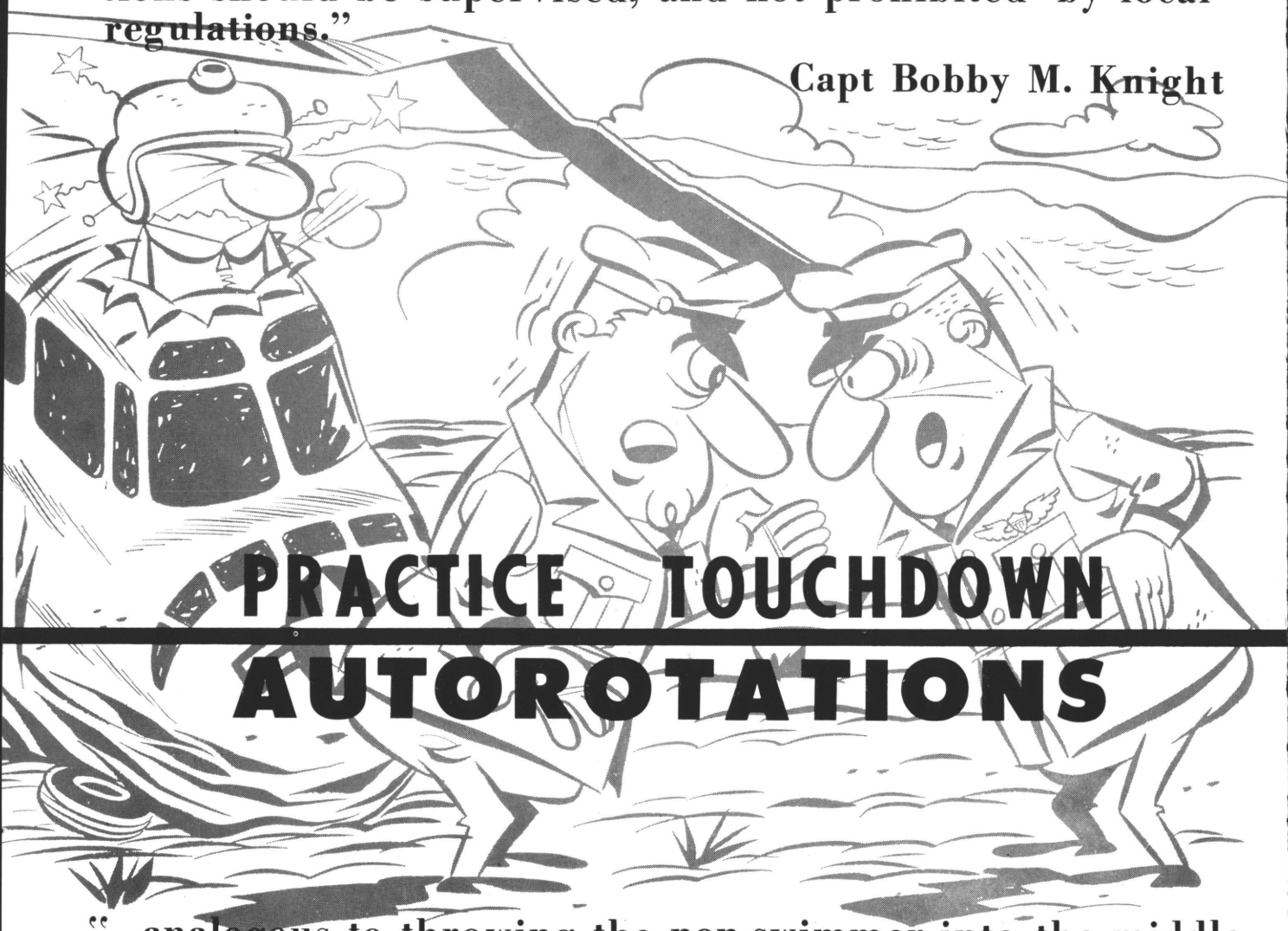
Use a windchill chart to determine whether to use covers and preheat equipment.

Be prepared for the unexpected at any time.

Caution ground crews to avoid prop and rotor wash. Frostbite can occur rapidly.

"...a proficient aviator is the aviator who has had the opportunity to train. This opportunity to practice autorotations should be supervised, and not prohibited by local regulations."

Capt Bobby M. Knight



PRACTICE TOUCHDOWN AUTOROTATIONS

"...analogous to throwing the non-swimmer into the middle of a lake on repeated occasions to overcome his fear of the water. It may work but there is also a very good possibility that he may drown. The expected gain from any given training procedure must be weighed against the risk involved."

Col Spurgeon Neel, MC
Senior Flight Surgeon

YES

Capt Bobby M. Knight, a graduate of the University of Southern California Safety Course, is assigned to Milwaukee Defense, USARADCOM.

RECENTLY AN AVIATOR in a Shawnee was on a service mission with twelve passengers and a crew of three. While flying through a mountain pass, the oil pressure suddenly dropped to zero, the cylinder head temperature started climbing, and within 5 seconds the engine was dead. Our aviator quickly scanned the terrain for a place to land. There wasn't much time: 35 seconds from engine failure to the ground. A small valley near a creek looked best, so he placed the spot on the windshield and got lined up. On the way in he had it made; but when he put the bird down, the right wheel dug into a soft spot. By now the rapidly dwindling rpm was ineffective and the cyclic went uselessly against the stops. The old bird went over onto her right side, seeking her own natural equilibrium.

Our aviator climbed out and counted the passengers—all hands safe. He nervously scanned the wreckage and began thinking back. What did I do wrong? He had planned the flight well. He was over what was considered to be the best route for this flight. He had performed a good preflight and the engine had checked out perfectly. What could have been performed differently on that autorotation?

He fumbled for a lighter, went through each pocket three times, finally found the package of cigarettes. He continued to mumble to himself. How should I have known the ground was soft, and what about that 10° slope that didn't show up during that turn? Sure took a long time to get that collective pitch down when the engine stopped. The rotor rpm was below the redline for a long time . . . guess I looked at the instruments a little too long before beginning my turn. Things had surely happened fast up there.

Yes, our aviator had been busy all right. Every one of those 35 seconds of deadstick time could be accounted for. This aviator had 1,200 hours of helicopter time, but this was his first engine failure. Surely wasn't like those autorotations where the instructor pilot sat there to assist if anything unusual happened. No, this time our aviator had had his normal thinking process interrupted by *fear*. He had only seconds to overcome this fear and regain complete emotional control. This fear is normal and we cannot eliminate it from our aviators. Further, we cannot calculate the proportional contribution of fear to the failure of our aviator in

NO

Major George C. Kuhl is Chief, Operations and Training Section, USABAAR. He is rotary and fixed wing qualified.

DURING FY 62, USABAAR recorded a total of 268 Active Army helicopter forced landings without damage. Seventy-nine (29 percent) of these forced landings were accomplished by autorotations to the ground. Seventy-four (28 percent) were landed with power, and the remaining 115 (43 percent) of the crash facts messages did not specify just how the forced landing was accomplished.

Also on file at USABAAR is a total of 147 accidents and incidents whereby helicopters were damaged due to touchdown autorotations.

Of this total, 38 (25 percent) of the touchdown autorotations were initiated by the pilot due to emergencies, and the remaining 109 (75 percent) were simulated practice touchdown autorotations. The dollar damage for the emergencies was roughly $1,600,000 while the amount required to practice the maneuver cost the taxpayer about $800,000. Therefore, it seems safe to assume that three out of every four of these events were caused by practicing the maneuver, but it only cost half as much as the real thing.

A breakdown of the 147 accidents and incidents is as follows:

Emergency Autorotations	
Major accidents	28
Minor accidents	0
Incidents	10
Total	38
Simulated Autorotations	
Major accidents	39
Minor accidents	7
Incidents	63
Total	109

Of the 38 emergencies that occurred, 36 took place during daylight hours and 2 at night. Eight of these 38 (including both night flights) were pilot induced by fuel starvation. Total accidents with injuries were three: one minor, one major,

YES

trouble to respond properly and effect a safe landing.

Fear can only be realized by the particular aviator involved at the specific time and place and cannot be calculated or appreciated by others. As a rule, we might then say that each autorotative forced landing is characteristic only to that specific time, place, density altitude, terrain, aircraft, aviator, and mission; and these circumstances can never be duplicated.

Should we expect an aviator to autorotate a helicopter and not damage the aircraft? This will depend on several things. First, consider his proficiency and confidence in himself and the machine. If he has a built-in confidence, then he has the ability to overcome the emotional fear that is forced upon him. The greater his proficiency, the sooner he will regain emotional stability and control of his flying senses.

Experience is another important factor affecting fear. This may add or detract from the situation. If the aviator has had similar experiences that were favorable, the prior experience will greatly enhance his ability to overcome the present situation. His experience is proportional to proficiency, and recovery from fear under this similar circumstance may be almost instantaneous.

If, on the other hand, his past experience has been unfavorable, he will recall this experience and it could have great detriment to his reaction and recovery time. Suppose his last engine failure resulted in a fatality. This thought may occupy his conscious or subconscious mind and slow his reaction time throughout the autorotation. Suppose he had a tough time from a commander or an accident board. He could be thinking about this fact during the autorotation and, at the critical moment, his actions could result in an exact reproduction of his last accident.

Training is another factor influencing fear. Training is confidence. A proficient aviator is the aviator who has had the opportunity to train. This opportunity to practice autorotations should be supervised, and not prohibited by local regulations. A prepared area should be provided for this training and the aviator should first be checked by the unit instructor pilot, and, when safe, cleared for practice solo autorotations. This solo practice is a must if the aviator is to have confidence and remain proficient. Too much practice with an instructor pilot can cause a reversal and instill a lack of confidence and build a dependence upon the instructor.

NO

and one critical. The following is a breakdown of the 28 major accidents resulting from emergencies:

Type Aircraft	*Number Accidents*	*IP Aboard A/C*
OH-13	10	0
OH-23	4	2
UH-19	5	4
CH-21	4	1
UH-1	5	0
Total	28	7

CAUSE FACTORS PRIOR TO TOUCHDOWN

Tail rotor/cone struck object during flare	5
Loss of rotor rpm, hard landing	11
Main rotor struck object during approach	5
Landed in rough or soft terrain	7
Total	28

Of the 109 simulated, practice autorotations undertaken, 107 were conducted during the day, one at night, and one is listed as unknown. Total accidents with injuries were five. Fortunately, all personnel involved received only minor injuries.

The following is a breakdown of the 39 major and seven minor accidents that resulted from practicing this maneuver:

			IP Aboard	
Type Aircraft	*Major*	*Minor*	*Major*	*Minor*
OH-13	13	1	9	1
OH-23	16	1	8	1
UH-19	2	0	2	0
CH-21	2	3	2	2
UH-1	5	2	5	2
CH-34	1	0	1	0
Total	39	7	27	6

CAUSE FACTORS PRIOR TO TOUCHDOWN

Tail rotor/cone struck object during flare	12
Loss of rotor rpm, hard landing	13
Landed in rough or soft terrain	2

YES

Fear is inherent in all humans. Any emergency will involve some undetermined degree of fear. The influence of emotional fear of a particular individual under stress cannot be judged. Even if we have knowledge of the emotional status of an individual, we cannot accurately predict his behavior. If we do not know the emotional status, our prediction is even more inaccurate. The degree of fear and the time required to overcome it may be greatly reduced through training. The accident board and commander who severely criticize an aviator involved in an accident are not contributing to the prevention of further accidents, but may be contributing toward causing these accidents. If the aviator and his passengers are safe, the aviator has accomplished the purpose of his autorotation.

Fear is an emotion experienced by everyone, and like all human emotions can be both good and bad. As Army Aviators, it is important that we learn to use fear by overcoming the tendency to panic and sharpening our sense of safety in operation.

NO

Insufficient pitch, hard landing	14
Abrupt cyclic during ground roll	4
Lost directional control on landing	1
Total	46

Without burying ourselves in too many statistics, let's take a realistic look at how we can prevent accidents of this type in the future.

We will set aside the 38 emergency occurrences, noting, however, that on eight occasions the pilots failed to heed the fuel warning light and/or the fuel gauge. The remaining pilots here suffered from an aircraft that refused to fly and did the best with what they had.

A look at the 109 practice autorotation occurrences indicate that the man, machine, and ground were not getting together at the correct time and place. In the total of 46 major and minor accidents, we find that on 33 occasions an instructor pilot was aboard. So, about seven out of ten times the pilot had someone along who should have been able to "take over" if need be. In the other three out of ten times, the pilot was on his own. Unfortunately, exposure rate figures (number of properly executed practice autorotations to a touchdown) are not recorded. If this figure vs the unsuccessful autorotation were correlated, we could arrive at an accident rate statistic. However, this would not eliminate the 46 accidents that occurred while practicing not to crash. This figure represents 20 percent of the total major and minor rotary wing accidents incurred during FY 62.

With the number of rotary wing aircraft in our inventory being increased, plus the addition of the Chinook and future LOH, the number of accidents of this nature is bound to increase unless steps are taken to prevent it.

Several possibilities exist; some of which are to

- conduct the maneuver only at the Army Aviation School;
- same as above, and use only the power recovery in the field;
- continue the present policy and accept the consequences.

Much talk centers about the command policy, local SOP, etc., designating specific practice areas for the touchdown autorotation and requiring an IP aboard as a solution. As we have already seen, 70 percent of the time you might as well have left the IP at home. Also, 36 of the 39 major practice autorotation accidents took place at an approved, designated touchdown area.

If the man, machine, and ground cannot get together under required conditions, maybe one should be eliminated. There's still a requirement for the pilot and hardware, so perhaps we could take the ground out of the maneuver.

Continued from page 1

be a new TM on this equipment which will do much to clarify questions and misunderstandings. I hope that the new TM is scheduled for early release, for it will be of considerable value for all aviators.

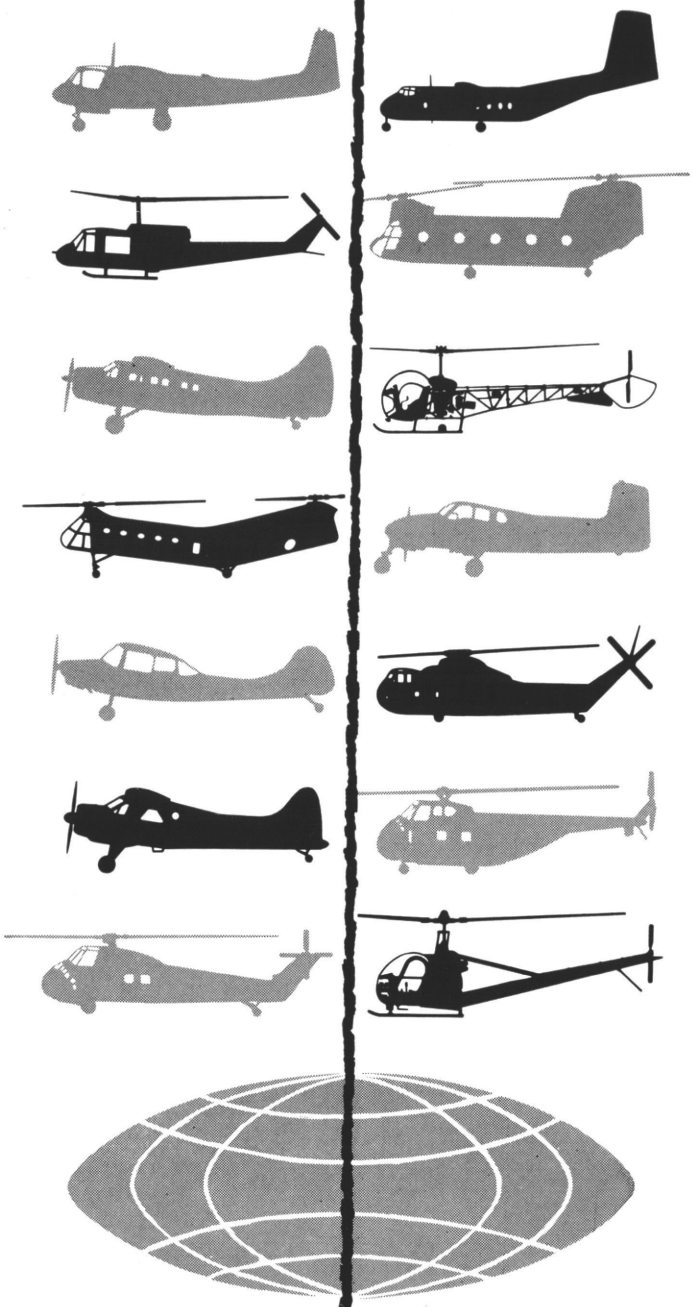
ROBERT E. BRIZEE
Major, SigC
Commanding Officer, AFOF

- *The ground set interrogates automatically except when it is in standby position, warming up, or off. Therefore, if the pilot turns his control set to EMERGENCY, his set is automatically being interrogated and replying as long as the ground set is not in standby position, warming up, or off.*

prepared by
THE U. S. ARMY
BOARD FOR
AVIATION
ACCIDENT RESEARCH

TWX EXCERPTS

From Oct. and November



CH-34C CRASHED AND BURNED in wooded area when engine failed shortly after night takeoff. Pilot and two passengers sustained fatal burn injuries. Cause of engine failure undetermined pending analysis.

UH-19D HYDRAULIC FLUID level was noted low in flight. Forced landing was initiated and control system stiffened during final approach. Aircraft completed forced landing with no damage. Caused by ruptured hydraulic accumulator bladder.

CH-34C ENGINE FAILED approximately three minutes after takeoff. During autorotative approach, main rotor blades struck building. Left main landing gear collapsed during touchdown. No injuries. Cause undetermined pending investigation.

CH-21C FUEL LEAK discovered in sump area. Caused by failure of submerged boost pump gasket.

U-6A ELEVATOR FAILED and aircraft crash-landed during takeoff from field strip. Aircraft destroyed. Extent of injuries to pilot and three passengers unknown. Cause of elevator control loss undetermined pending investigation.

U-6A TAXIED INTO reflectorized metal marker stake at night. Incident damage to propeller.

OH-23B EMITTED BURNING ODOR in cockpit during flight. Forced landing accomplished with no damage. Caused by burned out cooling fan drive.

OH-13E LANDED HARD during practice autorotation. Major damage to main rotor blade, tail rotor, and tail rotor gear box. Caused by late application of collective pitch.

O-1E EMITTED SMOKE, heat, and flash of light from instrument panel during climb. Forced landing accomplished with no damage. Caused by loose voltage regulator shorting against instrument panel.

CH-34C LOST POWER during takeoff. Forced landing accomplished with no damage. Caused by failure of No. 7 cylinder.

U-6A STRUCK TREE during power approach to field strip. Incident damage to right wing. Weather not a factor.

CH-34C SEAT BACK FELL forward on copilot's side and restricted cyclic movement in flight. Forced landing accomplished with no damage. Caused by improperly mounted seat back.

U-8F LOST POWER from left engine during level flight at 4,500 feet. Forced landing accomplished with no damage. Caused by crack in base of No. 5 cylinder.

CH-34C CARGO DOOR FELL into dense woods during climbout from heliport. Unable to locate door. Suspect inadvertent release of door due to improper engagement of release mechanism.

OV-1 LOST OIL PRESSURE in No. 2 engine shortly after takeoff. Aircraft completed forced landing with no damage. Cause undetermined pending analysis.

OH-13H CRASHED AND BURNED when right skid dug into ground while moving sideways during practice for demonstration. Pilot sustained singed hair and minor burns on hands and face.

O-1E ENGINE FAILED after power reduction in traffic pattern. Forced landing accomplished with no damage. Suspect carburetor ice.

O-1E ENGINE RAN ROUGH in flight. Forced landing accomplished with no damage. Investigation revealed four cylinders were below minimum compression limits.

UH-19D ENCOUNTERED DOWNDRAFT while climbing near mountain, lost rpm, turned downslope, and hit ground. Rpm was regained and aircraft continued flight to point of departure. Major damage to both nose gear, left main gear, and aft fuel tank.

UH-19D BACKFIRED in flight. Forced landing with partial power accomplished. No damage. Caused by left magneto jumping time.

UH-1D ENTERED UNCONTROLLABLE TURN to right in flight. Cross tubes and fuselage damaged on ground impact. Suspect tail rotor failure.

CH-34C LOST SERVO POWER in flight. Forced landing accomplished with no damage. Caused by failure of high-pressure hydraulic hose to primary servo.

CH-21C EMITTED LOUD NOISE in flight followed by partial loss of power. Chip detector warning light came on and oil pressure dropped. Forced landing accomplished with no damage. Cause undetermined pending analysis.

UH-19D LOST OIL PRESSURE during flight. Forced landing accomplished with no damage. Cause undetermined pending analysis.

U-1A VIBRATED SEVERELY during flight. Forced landing accomplished with no damage. Caused by fatigue break of counterweight shaft to No. 3 propeller blade.

OH-23D TAIL ROTOR SNAGGED unsecured tie-down string from main rotor blade during engine start. String fouled tail rotor shaft and tie-down block was pulled into tail rotor, causing incident damage to tail rotor assembly.

O-1A TAXIED onto soft sod and right landing gear sank. Minor damage to propeller and cowl. Sudden engine stoppage.

CV-2 LEFT ENGINE FAILED to unfeather during feathering checks of test flight. Forced landing accomplished with no damage. Cause undetermined pending analysis.

O-1A OVERTURNED during landing roll. Major damage to both wings, vertical stabilizer, rudder, and propeller. Aircraft landed during ferry mission due to deteriorating weather conditions. No injuries.

OH-13E LOST POWER during attempted takeoff at field elevation of 6,156 feet, settled to ground and overturned. Aircraft destroyed. Cause of power loss undetermined pending investigation. No injuries.

OH-13H LOST POWER and crashed during reconnaissance of landing site. Aircraft destroyed. Pilot sustained bruised shoulder and leg. Cause undetermined pending investigation.

CH-21C LOST PARTIAL POWER when aircraft started climb from 700-foot altitude. Aircraft struck tree during forced landing autorotative approach. Major damage. No injuries. Cause of power loss undetermined pending investigation.

UH-19D COPILOT WINDOW separated from aircraft during straight and level flight at 60 kt. No damage to aircraft. Cause undetermined pending analysis.

U-8D LANDING GEAR collapsed during takeoff at approximately 50 kt. Propellers and UHF antenna struck runway. Aircraft became airborne, but right gear could not be fully retracted or lowered. Landing was made on foamed runway and right gear collapsed at touchdown. Major damage to engines and propellers. No injuries. Suspect malfunction of landing gear switch (P/N AN3227-3).

OH-13H ENGINE RAN ROUGH in flight for approximately 10 seconds. Forced landing accomplished with no damage. Caused by cracked ceramic on spark plug of No. 2 cylinder.

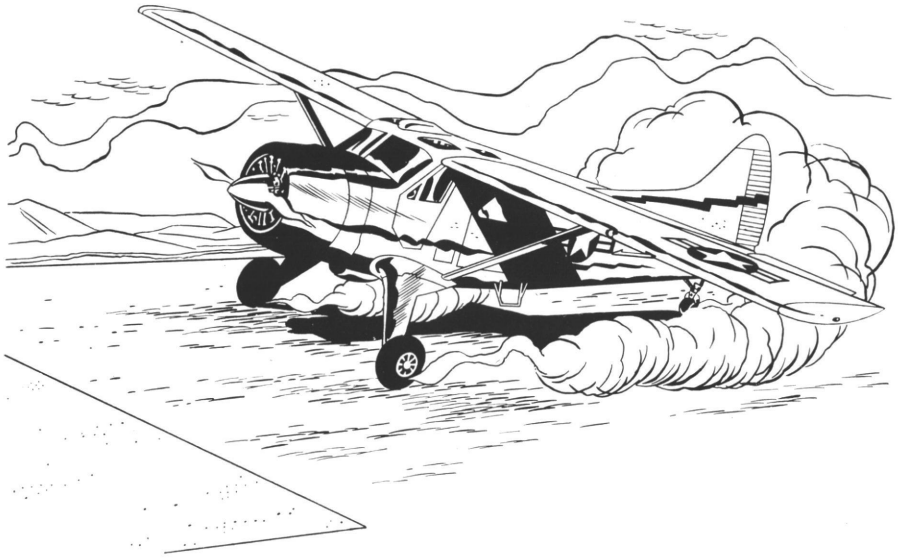
UH-1B SKID GEAR COLLAPSED during practice autorotation touchdown. Minor damage. No materiel failure or malfunction suspected.

OH-13H STRUCK WIRES during low-level training flight. Minor damage to bubble assembly, swash plate, and control rod assembly at swash plate. Pilot sustained abrasion on hand and leg.

O-1A STALLED AND CRASHED from 150-foot altitude during attempted go-around from tactical strip. Aircraft destroyed. Pilot and observer fatally injured. Cause undetermined pending investigation. Possible engine failure.

CH-21C STRUCK TREE during demonstration pinnacle takeoff. Major damage to aft rotor blades and right ski. No injuries. Weather not a factor.

FLAPS



THREE WELL spaced Beavers entered the traffic pattern and were cleared to land by the tower.

The first one overshot and landed long. Number two landed smack on the panel. Number three made a long, dragged-in approach, plopped down short of the runway, and sent a billowing cloud of dust into the air.

"Holycow! What flap judgment!" thundered the division commander, watching from the tower. "What would these men do in a short field tactical situation?"

The commander is not alone in his concern for the poor flap

Improper flap setting on takeoff from a tactical strip resulted in this destroyed Beaver. Four were injured.

Prepared by the United States Army Board for Aviation Accident Research.

technique used by his pilots. The trend is clearly shown in Army accident reports, where an increasing number of accidents can be traced to misuse of flaps.

In analysis, what did Beaver pilot No. 2 do that pilots Nos. 1 and 3 failed to do? The answer is: *He used good judgment in deciding the correct flap setting for a given situation.*

Notice in the italicized sentence that three factors are involved: the pilot, the aircraft, and the situation (i.e., wind direction, air density, altitude, distance, etc.).

It immediately becomes apparent that the aircraft is a silent pawn in a battle between the pilot and the elements. If a lax pilot is occupying the cockpit, inattentive to the situation around him, he can easily become a self-imposed victim of poor flap technique.

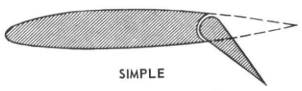
Most pilots will agree that practice makes perfect in the use of flaps, but a sound aerodynamic knowledge helps, too.

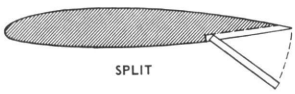
Baughman's *Aviation Dictionary* describes a flap as "a hinged or pivoted airfoil forming the rear portion of an airfoil used to vary the effective camber."

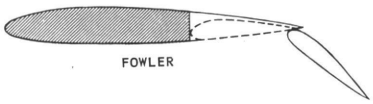
Stated simply, a flap is a small wing behind a large wing. When the flap is placed in the down position, it changes the lifting capacity of the wing by changing the shape or area (camber) of the wing surface. This also causes drag and, as a result, gives the pilot the advantage of slower landing and takeoff speeds. It allows steeper, safer descents and climbs for operation in confined areas.

It didn't take long after the Wright Brothers' successful flight for aviation pioneers to foresee the need for flaps. They knew that only one angle of attack for a given speed would maintain a constant altitude. They also found out that flying too slow resulted in excessive angle of attack and eventual stalling. The problem was to find a way of changing the coefficient of lift. They knew on paper that this could be done by changing the airfoil, or camber, while in flight. The Wrights had used "wing warping" for lateral control before ailerons existed, but to increase the upper camber of the entire wing had more structural objections than variation of area. The problem of varying the camber was solved when they decided on turning down the trailing edge of the wing.

Several variations of flaps have been developed. They include the simple, hinged type used by most Army aircraft, the split-flap, and the Fowler flap.



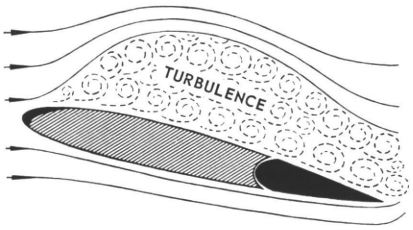




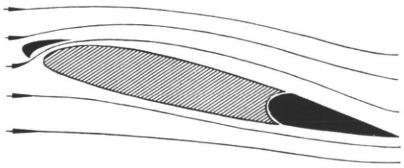
After World War I, safe aircraft competitions were held on an international basis to promote easier handling, safer aircraft. Methods were sought to improve landing characteristics. One means which was effective in postponing but not completely preventing the stall was the slotted wing.

It was the invention of Gustav Lachman and Frederick Handley-Page. Lachman, a German pilot in World War I, thought of the slot idea while in a military hospital. He was recovering from serious injuries sustained when his aircraft stalled. Handley-Page, an Englishman, happened to be developing the same idea across the channel. Later they worked together. Handley-Page also invented slotted trailing-edge flaps.

An improvement on the slotted wing is the leading edge wing slat. This is a high-lift device and is used on the OV-1 Mohawk. It is simply a winglet which is moved ahead automatically by the negative pressure at high angles of attack. This creates a slot which is kept closed by positive pressure in normal flight.



SLOT CLOSED



SLOT OPEN

The development of flaps and high-lift devices have kept pace with modern aircraft. They are the result of inventive genius and constant research. They perform their appointed tasks well only *if the pilot uses good judgment in deciding the correct flap setting for a given situation.*

How's *YOUR* flap technique?

Why Always the Pilot?

Captain Marvin E. Gordon

TOO FREQUENTLY an atmosphere of "hang the pilot" seems to affect flying evaluation boards investigating Army Aviation accidents.

A case in particular occurred some months ago when an aviator on a routine flight in the continental United States was making a normal approach in an Army helicopter at a civilian airfield. The entire flight was routine, including the approach for landing. There was no significant difference from any other approaches he had made in some 350 hours in this type of aircraft.

About 75 feet in the air on his final approach to land he heard a muffled noise from the engine. Quickly cross-checking his instruments, he determined they were all functioning as they should be and in the green. He continued his approach for landing. At about 30 feet another noise was heard, and this time the instruments were not reading as they should. Time lapse between checks was 3 seconds. Immediately the pilot made an emergency autorotation at the runway, with considerably more damage to the helicopter as a result of the hard landing. Initially, the aircraft was damaged by engine failure and secondly, by the pilot's hard landing. In the main the aircraft was intact; none of the passengers or crew was injured and today this same vehicle is flying.

In about ten working days the board had completed its report, and in one of the conclusions, "poor judgment" of the pilot was adjudged. They reasoned that because the pilot did not enter an immediate autorotation at the first muffled noise at approximately 75 feet, this resulted in the hard landing which caused extra damage to the helicopter. The board decided he had used "poor judgment," resulting in additional damage to the aircraft. The pilot's rebuttal, in which he mentions that he saw no reason to resort to emergency procedures as he checked the instruments the first time and all were reading normal, was upheld by USABAAR and he was cleared of the charge of poor judgment.

Of the four board members, only one was qualified in this particular type helicopter and he had received his checkout by the pilot involved in the accident. Further, he had less than 50 hours in the type of helicopter involved, was on ground duty, and the junior member of the board.

At this particular post were two graduates of the Army Aviation Safety Officer's Course at the University of Southern California. Neither of these graduates was used, either in an advisory capacity or as a member of the board.

I would like to stress these points:

The Pilot—He proved to the board by an actual flight that even with 75 feet, the most time he would have had for sooner action was 3 or 4 seconds.

The Board—It is difficult to believe that their thoughts were not the same as many other persons associated with aircraft accident investigation boards. The pilot will be blamed. The only variance will be the degree of guilt. Second, the two trained Safety Officers were available but were not called on for assistance or guidance.

In brief summary:

- Let's stem the tide of that prevalent built - in premise: "Lacking evidence we assume the cause of the accident is pilot error."
- Only too many times a pilot has had an emergency and saved himself, passengers and many thousands of dollars in aircraft through his skills and quick thinking only to receive rebuke. When an accident board reviews his accomplishment in combating damages there is no recognition of this fact.
- The selection of board personnel should be carefully screened and not selected because of their availability.
- Graduates of the Army Aviation Safety Officer's Course should be used as members of the board or in an advisory capacity.

Capt Gordon was a student at the University of Southern California Safety Course when this article was written.

If our supply system isn't perfect, it's because too many in the program won't go through the proper channels. Are you a

?SCROUNGER?

Captain Roger D. Byrd

IF SOMEONE called you a "scrounger," it would probably make you fighting mad. This is rightly so if you use the definition in its truest sense: "To look around for and take (something) without permission; pilfer." Yet, how many of us have resorted to scrounging in its more colloquial sense, that of "obtaining items through borrowing or begging without recourse to the normal and proper supply channels"?

My comments here are directed more to the small aviation sections, and the separate aviation companies, not because a larger aviation unit can't fall prey to the evils of scrounging, but because their larger supply organization will usually prevent this from happening.

Let me dramatize several examples to illustrate how easy it is for a unit to plunge into a "scrounge" supply system and to show the resulting effects.

The first scene is a small aviation section, foregoing the wonders and splendors of the "land of the big PX," struggling valiantly to accomplish their mission in some overseas area . . . and, as fate would have it, the third echelon support is some 50 air miles distant.

Crewchief: "The right magneto is out on my O-1."

Linechief: "Make out a parts request and get one from supply."

Crewchief: "I've already done that and supply doesn't have any."

Linechief: "O.K. Let me call my buddy down at the division aviation battalion. They keep a lot of parts on hand and have helped us out before."

Five minutes later: Linechief is talking to his buddy on the telephone.

Linechief: "Say, Harry. Wonder if you could help me out? We have on O-1 down for a magneto and our supply doesn't have one—What? Yeah, I know it's the third one this month. I don't know why our supply people don't get these parts on hand. They know we need them every so often, but you know how those supply guys are . . . You have one, huh? O.K., I'll send the crewchief down to pick it up. Thanks a lot. Goodbye."

Same scene: later in the day.

Crewchief: "I need some 2408-12s and 2408-13s."

Clerk: "Look in the box out there. Should be some in it."

Crewchief: "Nope. It's empty."

Clerk: "Well, that's all we had on hand and I had to borrow those from that helicopter company. They said that was all they could spare. I've called every outfit around here trying to get some, but they all say they have just enough to get by themselves. I've had 3,000 on order for 2 months now. Don't know why AG can't get these blank forms and supply us like they're supposed to. I remember last year when I ordered blank forms, it took them 4 months to come through."

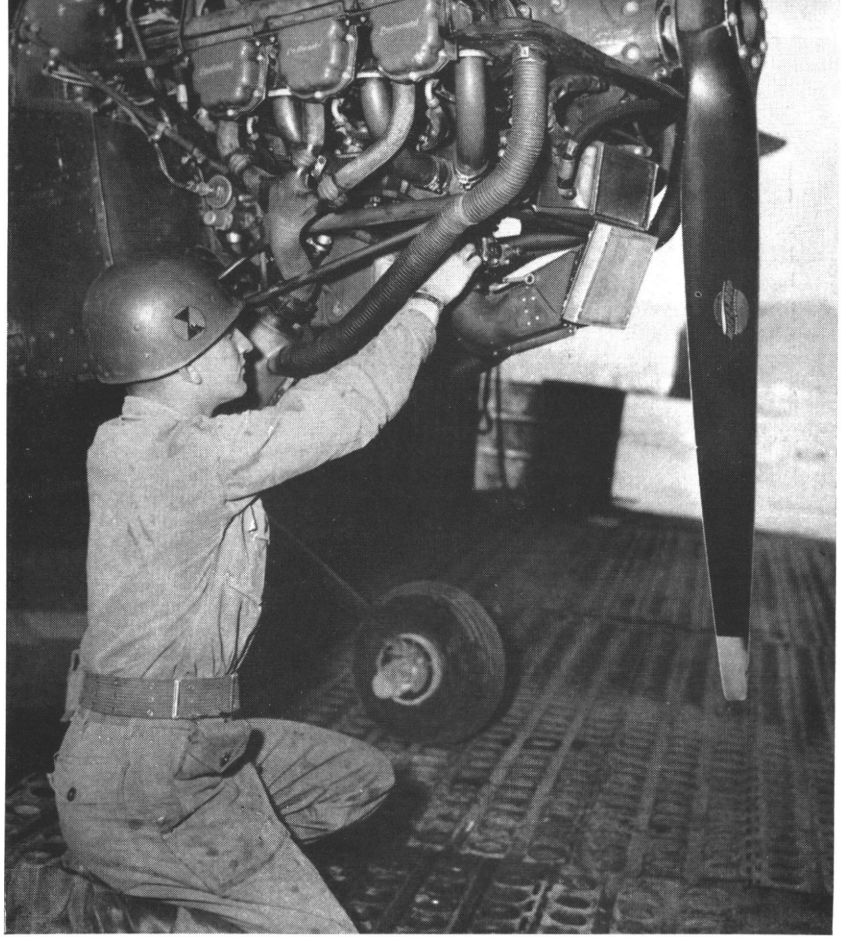
Crewchief: "3,000 on order? That sounds like a lot for our 12 airplanes."

Clerk: "Yeah. But I figure if I'm going to have this kind of problem every time I order them, I might as well get a lot. Anyway, my tour is up in 10 months and this many forms will take care of us until after I've gone and the next guy who has my job can worry about them."

Scene changes to a F/W aviation company which arrived in the theater 6 months previously.

MO: "We have six aircraft down on EDPs and transportation supply tells us it will be 20 to 30 days before the parts will be in. They say we and our sister outfit are the only two organizations that use these parts and that we are the only units in the theater with our type of aircraft."

Capt Byrd is a project officer in the Doctrine and Organization Division, Combat Developments Agency, Fort Rucker, Ala. He is a dual rated Senior Army Aviator with approximately 2,000 flight hours.



A little scrounging to fix this one

XO: "Don't we have any of these parts in that bunch we brought from the States with us?"

MO: "No, our supply has given out except for a few small items. I'm sure glad we brought them with us instead of turning them in stateside like we were supposed to. We would have been grounded a long time ago if we hadn't."

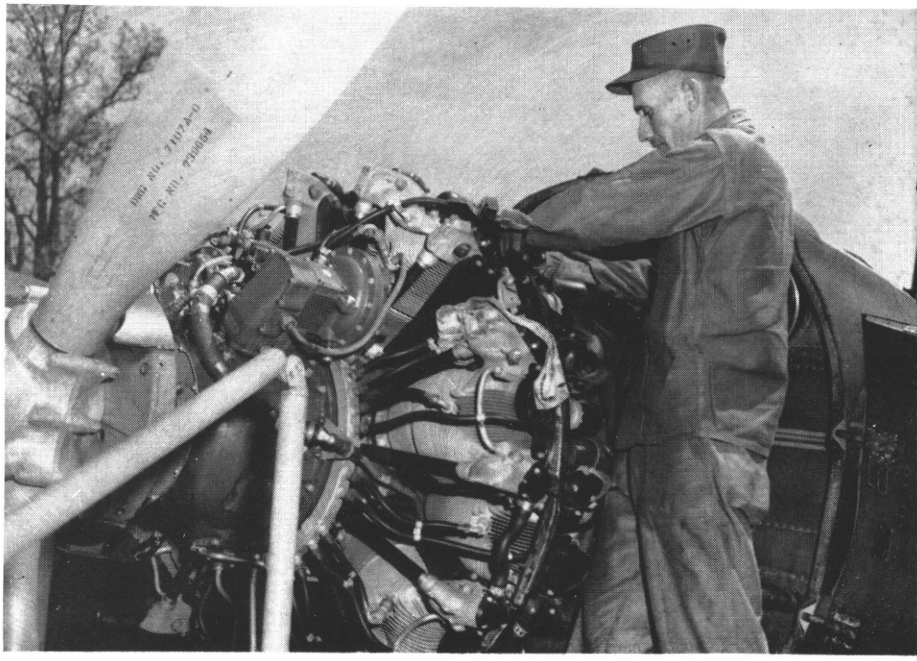
There you have it. One unit with aircraft out of action, unable to perform its sole mission; another unit that may soon be in the same state. Both swear against the supply system. The cause? Their own incorrect use of the supply system and probably some lack of education in correct procedures. Let's discuss these events one by one.

In the first example, the reason the unit supply did not have the parts on hand was due to scrounging the parts from other organizations. Their own supply never had a chance. If the parts had been requisitioned through their parts supply instead of getting them from another unit, a usage factor would develop. Without a usage factor, the supply personnel had no way of determining what parts should be kept on hand. To be sure, the O-1 may be down for only a short time. But what would happen if a magneto couldn't be "scrounged"? If this unit had been requisitioning parts correctly previously, a usage factor would have evolved and the part would be available now in its own supply. The result would be one O-1 ready to fly in a few hours instead of a few days.

Sometimes depot supply does not have parts on hand. AR 711-16 specifies the number of demands a depot must have to stock a part. This varies according to the technical service involved. For example, Transportation Corps requires three demands in one year. A demand is a requisition for a part. One requisition for three spark plugs is one demand. Three requisitions for one spark plug each are three demands. Thus, the requirements of one unit could generate enough demands on a depot to stock a specific part.

If the recently arrived com-

. . . a little scrounging to fix this other one



pany had turned in its parts as directed before departing the U. S., the depot would already be stocking recurring items. Because of this, they may have already caused their sister unit to have aircraft out of action, because the three demands, for some parts, probably could only be generated by two such units. Needless to say, they are in a difficult position now. No usage factors are available for the theater. No demands are placed upon supporting depots. And if they don't get on the ball, they will create serious doubts in their commanders' minds as to Army Aviation's ability to perform required missions.

Finally, let's discuss the shortage of forms. Blank forms are to be requisitioned each 30 days with a 30-day supply kept on hand. AG Publications stock supplies are based on the previous 60 day's requisitions. If the aviation section had begun to order what they needed each month, AG would know and requisition the correct amount for the command. For an overseas area, it takes approximately 2 months to fill an unexpected publications request. It would take about 4 to 6 weeks for this section in the example to get into the system and have it function properly for them. Also, by ordering each month, much less storage space for blank forms would be required, forms would always be on hand, the whole system would function smoothly, and the unit would have the latest forms when changes are incorporated or new type forms issued.

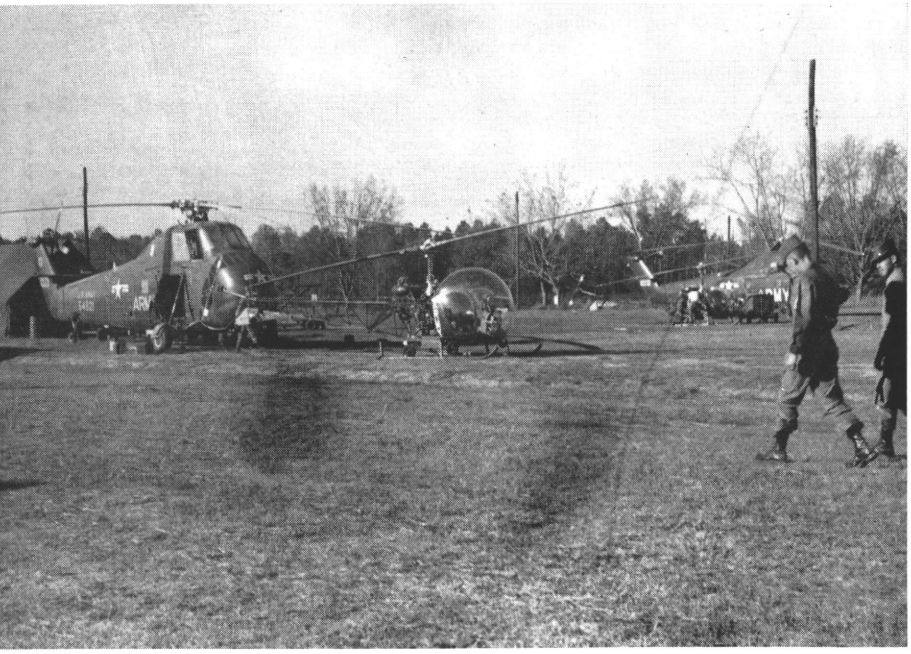
In the past, you have used DA Form 12-5 for automatic issue of certain TM-1 and TB AVN series publications. This has been replaced with the DA Form 12-31. Further, your local AG publications center should no longer be supplying you with these manuals. DA Circular 310-52, dated 12 July 1961, established new procedures. In short, each unit with organic aviation establishes an account directly with the AG Publications Center in St. Louis, Mo., which in turn will fill all requisitions for the TM-1 and TB AVN publications and will automatically send you all changes and initial issues of these publications as indicated on the DA Form 12-31 you have filed with them. Remember, keep them informed of your needs by use of the 12-31. See the March 1962 issue of the official *Army Information Digest* which more adequately describes "The Army Publications System."

So, what are the benefits of "scrounging"? Answer: None (unless you consider headaches and ulcers a benefit). The supply system we have is not perfect, but if everyone would learn how to use it and then use it correctly, it would be more nearly perfect. These points may help you:

- Requisition all required parts through normal supply channels.
- If you locate the part in another unit, have it transferred to you through supply channels. This will keep everyone's usage factors correct and still place a demand on the depot.
- Requisition blank forms and publications regularly each month.
- Determine and maintain correct usage factors.
- Turn in parts when you no longer have a usage factor for them. Someone else may need these parts.
- Train all personnel from the mechanic's helper up through the aviators in your unit in all aspects of parts requisitioning and handling.
- Ensure that your supply SOP is compatible with the technical services supporting you and that it contains sufficient information to ensure that a changeover in personnel will not affect the system.
- Make unannounced spot checks to determine if personnel are following your supply SOP.

Following these few simple points will be your best insurance that you will be there—above the best.

. . . means no usage factor has been established to fix any.



The Army Aviation Story Continues With

PART VII, THE WAR YEARS

Europe—Pacific—Korea

Richard K. Tierney

After Italy fell, World War II raged on in Europe and the Pacific. As Allied might grew, so did the Army's confidence in its liaison pilots. Demobilization slowed the growth of Army Aviation after World War II, but in 1950 the Korean War resulted in a new expansion of the program. This part of "The Army Aviation Story" will review these developments.

REPORT FROM EUROPE

During the invasion of France in June 1944, most of the Army's liaison planes were dismantled and loaded on trucks which were carried across the English Channel to Normandy on LSTs. However, quite a few aircraft were flown across the English Channel. The story of how the 4th Infantry Division flew its aircraft across the channel reflects problems typical to those encountered by other divisions.

Prior to the invasion Capt James Gregorie (now Lt Col), the 4th Infantry Division artillery aviation officer, preselected an area in France near St. Martin de Varreville to set up the division airstrip. It was planned

Above, shell holes leave the de Varreville area unusable for a landing strip. Below, Lt Dave Condon after landing in France on D + 1.

that he would proceed with the ground forces to the preselected area on D-day (6 June) and if it was usable as an airstrip he would notify his assistant, 1st Lt Dave Condon (now deceased), by radio to bring the aircraft from England.

Captain Gregorie arrived at Utah Beach in Normandy on D-day. At about 1500 hours he located the area, but found that artillery fire had left it in an unusable condition. He searched until the next morning before finding an area suitable for an airstrip. At about 0700 on the 7th (D + 1) he wired Lieutenant Condon to come ahead.

The L-5s had enough range to fly across the channel and back to England if necessary. This was not normally true for the L-4s, which had to carry additional fuel. The 4th Infantry Division L-4s had 8-gallon oxygen tanks filled with fuel and temporarily attached to the back seats. A fuel line ran from the extra tank to the main tank, which gave the L-4s 20 gallons of gas and enabled them to easily make the flight across the channel.

After receiving Captain Gregorie's message, Lieutenant Condon flew the division L-5 in lead of the L-4s. Since Lieutenant Condon was not fully briefed about the location of the new strip, Captain Gregorie monitored the radio at the divarty command post. About 1300 Lieutenant Condon checked into the divarty net. Smoke grenades were placed on the strip and Captain Gregorie talked him in on the radio.

By the time Lieutenant Condon arrived with the planes, all of the division's artillery had been brought ashore. However, the batteries had not been registered because hedgerows limited visibility. Since the principal concern was to get the guns registered, Captain Gregorie and Lieutenant Condon immediately took off in the L-5 without refueling and registered the first artillery fire on Utah Beach.

Meanwhile Maj J. Elmore Swenson (now Col) and his "29th Air Force," as he called his 29th Infantry Division artillery aviation section, had arrived at Omaha Beach under similar circumstances. Major Swenson called in one of the first fire missions on Omaha Beach. Also, the 1st Infantry Division air section set up on Omaha Beach on D-day and flew its first mission on the morning of D + 1. Lieutenant R. S. Harper (killed in action about a month later) and Sgt F. E. Donley received heavy ground fire on the first mission and had to force land their L-4.

The Cub demonstrated what has been called its greatest efficiency on the Normandy battlefront. The Air OPs maintained excellent observation over

the entire front except during the worst weather. Brigadier General George Shea stated: "Without the Cub plane practically all our fires would have been unobserved. With the Cub, weather permitting, we could observe most of our fire. Any artilleryman knows what that means."

A veteran fighter pilot from the 9th Tactical Air Force in Europe had nothing but admiration for the Grasshopper pilots. In an article appearing in *Wing Talk* in 1944, Capt Harold H. Strickland wrote: "I watched one of the Grasshoppers — 'Li'l Sourpuss'—hovering over a tiny pasture near Isigny (in Normandy). Within the pasture there were slit trenches, foxholes and cows. Completely surrounding it were trees and concrete telephone poles. A 20-mile-an-hour wind was blowing across it, a gusty wind, too. It was raining. It was dark. And the field was small even for a Grasshopper.

"The pilot dragged it methodically, then straightened out for a cross-wind landing, gliding and crabbing into the wind with such a high drift angle that the ship appeared to be flying sidewise. He did a neat turn around a beech tree at an airspeed close to the stall. He maintained the large angle of yaw and a sideslip until just before it touched down, then straightened out in the direction of flight with downwind rudder and aileron into the wind. He dropped it in about 12 inches.

"It was a good landing, under full control, squarely in the middle of the pasture at a place where apple trees served as a windbreak. Yet, from our position in the hedgerow, we were wondering. He was rolling fast, and straight ahead of him were the cows. As usual, they wouldn't budge. Having survived barrages, naval shelling and blockbusters, these Normandy cows cared little about the intricacy of a cross-wind landing. Grasshopper crews, though, have learned to evaluate one risk against another, and sometimes considerable juggling of values is required.

"Li'l Sourpuss headed into the cows, then decelerated at a remarkable rate. It was deceleration seldom witnessed in peacetime and was achieved because the pilot dropped it in, utilized the braking effect of tall grass and applied brakes heavily—far back toward the tail his plane carried a spare propeller.

"With these extraordinary assurances of deceleration, he rolled close up to the nearest cow, executed a neat, controlled groundloop into the wind, then asked if there were any unexploded shells around.

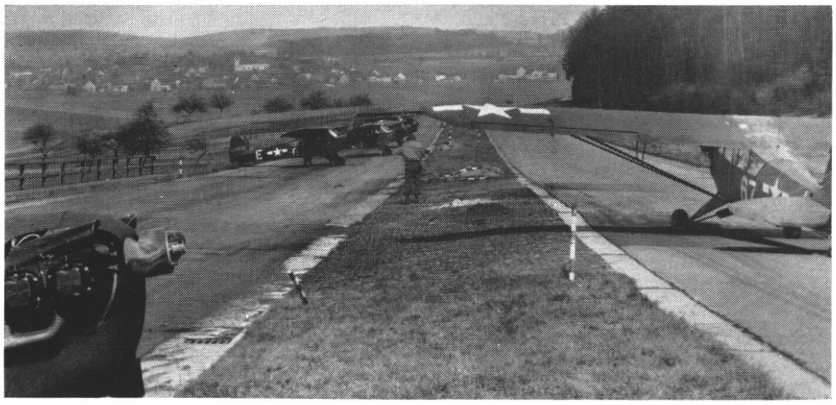
"It wasn't all luck. It was good airmanship and good headwork of the kind that is required every day from the wartime Grasshoppers."

After Allied armored columns began penetrating the Brittany Peninsula, it was necessary for the liaison pilots to fly as much as 40 miles from their base fields to expeditiously relay information to Corps. The Air OPs often were the only source of contact with the rapidly advancing armored columns. During the rapid advance the liaison pilots also were on the job in front of Allied troops. From the Air OPs they kept track of enemy positions and flew road and bridge reconnaissance missions. Some units were reluctant to move unless a Cub was above them to give information.

A little more than a year after Rome fell, the Allies were on the verge of liberating Paris. As had been the case at Rome, the liaison pilots were "invading" the capital before the Germans had pulled out.

Lieutenant Ross Hazeltine and an unidentified liaison pilot were among the first to fly into Paris. However, their first trip turned out to be a little premature. On 23 August 1944 they decided to land at the Longchamp Race Track, on the west side of the city, between the Seine and the Bois de Boulogne. They skimmed the rooftops over peaceful Versailles, passed near the Eiffel Tower, and slipped under a bridge. They came sailing out over the race track and "straight toward the biggest antiaircraft gun either of us had ever seen," writes Lieutenant Hazeltine.

Autobahn serves as an airstrip for Army L-4s in March 1945



Ski-fitted L-4 lands in France in January 1945

"We saw a few Germans run into the gunpit and the rest headed for machineguns," he continues. "We ducked for the river. They missed us, but I'll never know how because we were flying at the fantastic speed of 60 mph!"

During the Battle of the Bulge the infantry was continually calling for the Cubs, but they were having trouble taking off in the deep snow. Lieutenant Tony Epsaro (now Lt Col) solved this problem for the 87th Infantry Division. He told the division aviation officer, Capt Ted Shirmacher (now Lt Col), that he would get skis for their Cubs. No one believed Lieutenant Epsaro could swing it, but in about 4 days an Army Air Force truck arrived at the airstrip with ten sets of skis. It seems Lieutenant Epsaro had once met and impressed an Army Air Force colonel who made good a promise to help out Lieutenant Epsaro and his fellow Grasshopper pilots if he ever could. The skis were put to good use, and the 87th contends that its Cubs were the first to use skis in combat.

Lieutenant Samuel Fein, a liaison pilot with the 2d Armored Division, also was involved in a "first" during the Battle of the Bulge. While flying his Cub on a routine mission, he was startled by several German "buzz bombs" which whizzed past his plane. Circling, he located a portable ramp and saw another buzz bomb launched.

Lieutenant Fein called in artillery fire from American and British batteries, and in a few moments the launching platform was destroyed. Later it was learned that this was the first time the Germans had launched the buzz bombs from right behind their own lines. Thanks to the sharp eyes of an artillery pilot, a German "first" backfired.

During the rapid advance on the Rhine, the Air OPs proved invaluable in controlling unit movements when ground communications could not be used. On one mission Lt Horace E. Watson, of the 8th Armored Division, spotted a recon outfit held up by a blown bridge. He circled the area and found another bridge the troops could use. Lieutenant Watson made a low pass over the troops and with engine idling yelled, "Follow me." They did, and in a short while another town was liberated.

The Air OPs were a part of a novel plan devised to help support General George Patton's assault on the Rhine River. It was devised by Brig Gen Edward T. (Molly) Williams, General Patton's artillery chief. The Air OPs were to transport reinforcements to the beachhead, after it was established across the Rhine. Tests indicated that 90 L-4s could airlift an infantry battalion across the Rhine in about 3 hours. The Cubs were assembled but the entire assault across the Rhine was such a spectacular success that they were not needed.

General Patton had at least one narrow escape while flying in a Cub. While on a flight near Munich, his Cub was suddenly attacked by a fighter. Patton's pilot dived for the ground. The attacker followed, making two

L-4s are dug in for protection from artillery fire

more passes. On the third, the fighter pilot pulled out too low and crashed. General Patton was unharmed. Later it was learned that the attack was made by a Polish RAF pilot who had mistaken General Patton's plane for a Storch (German Cub).

Recalling the incident, Patton laughingly admitted he had been frightened. "After the first pass I decided I might as well take some pictures of my impending demise," he related. "There wasn't anything I could do, so I thought I might as well use the camera. But after it was all over, I found I had been so nervous I had forgotten to take the cover off the lens and all I got were blanks."

German Air OP planes were used on a limited scale and few reports of them were turned in by Allied commanders. One German Air OP plane did appear on 3 January 1945 over Allied lines in Belgium.

After spotting the German observation plane, an American liaison pilot grabbed a tommy gun and took off in his Cub to do battle. It looked for a moment like the troops on the ground were going to be treated to a dogfight—1917 style. But when the German saw the Cub he fled, leaving a disappointed, heckling audience.

During the rapid advance across Europe, the Air OP sections frequently had to move their airstrips. Usually a liaison pilot would fly ahead and pick out a suitable area. He'd radio the information back to operations, and the operations officer would drive out and give the site a ground check. Lieutenant William R. Kenney, operations officer of Major Swenson's "29th Air Force," frequently had to check ground sites during the advance and soon became perturbed about the language barrier. He decided to do something about it and memorized this sentence in French, "Avez vous grande champ por petite avion?" (Have you a large field for a small airplane?).

Lieutenant Kenney, anxious to try out his question, was a little deflated when he got his chance. "Avez vous grande champ por petite avion?" he asked a Frenchman one day.

The Frenchman thought for a moment and then, with a twinkle in his eye, replied in perfect English, "Yes, Lieutenant, I think I can help you."

Cubs were instrumental in winning the supply battle in the drive across Europe. They helped direct supply trains by reconnoitering the most effective routes to the front. Frequently the liaison pilot would land near a convoy and inform the convoy commander where the forward units were located.

The Air OPs also would fly food, ammunition, and medical supplies to patrols and isolated or trapped units. Near Luxemburg City, Germany, the 76th Infantry Division aviation section, headed by Maj Carl I. Sodergren (now Lt Col, Ret) was called upon to supply an isolated infantry battalion for about 3 days. Later the battalion commander credited the aviation section with supplying the necessities needed to resist capture or destruction. Pilots who flew these missions included Major Sodergren, Lt Clifford S. Athey (now Maj) and Lts Joseph Roseberry (who was later killed), Ford and Phores.

Near Engelsdorf, Germany, Cub pilots supplied medical supplies and blood plasma as two surrounded Ninth Army infantry companies held off superior German forces. Supplies flown in by the Cubs, plus devastating Allied artillery barrages, enabled the besieged troops to hold out until they were rescued. Cub pilots who flew the missions were Lts William R. Kenney, David P. McNamara, Leonard R. Mitchell, and Raymond W. Stockbridge.

On the Metz front liaison planes supplied trapped units of the 95th Infantry Division with medical aid, food, ammunition and dry clothing. In one instance Maj Elmer Blaha flew Maj Eugene Cleaber (an Army surgeon) into an area under heavy attack; then he shuttled supplies in and wounded out from a pasture pockmarked with shell holes and battle debris.

On numerous occasions liaison pilots landed in fields and rescued downed fighter or bomber pilots. The classic story in this respect goes something like this:

The Cub pilot saw the Allied fighter pilot run for nearby woods after crash landing his plane in the clearing. It looked as if it would be a routine rescue mission as the liaison pilot set his Cub down in the field and began bumping along to the spot where the fighter pilot had disappeared into the woods.

Nearing the trees, the liaison pilot saw a man running out of the woods and waving at him. The pilot maneuvered the Cub into position for a quick pickup. Then he noticed that the man rapidly approaching the Cub was a German soldier waving a pistol. The liaison pilot began taxiing for a takeoff, but the German caught up and shoved the pistol into the pilot's face.

Click! It didn't go off. What followed was a wild scene. The aircraft bounced along over the field with the German running alongside. Part of the time the German was hitting the American with the pistol, and part of the time the American had the pistol and was hitting the Ger-

man. The German finally pulled the liaison pilot from the airplane and they both wound up rolling and fighting on the ground before the decision went to the American.

As the liaison pilot stood wiping his brow and looking down at the unconscious German, the Allied fighter pilot walked up.

"Say, that was quite a fight," he said. The bruised liaison pilot, still trying to catch his breath, looked at the fighter pilot in disbelief. "You mean . . . puff, puff . . . you saw all this . . . puff, puff . . . and didn't come to help me?"

"Oh, you were doing a fine job," was the answer.

German artillery usually ceased fire when the Air OPs appeared. Only when the Germans had something they particularly wished to keep hidden, would they risk return artillery fire and shoot at the Cubs. On such occasions the Nazis would direct all available firepower at the Cubs.

As in Italy, allied ground commanders took advantage of the German reluctance to shoot when Cubs were in the air (even on days of low ceiling and visibility). Brigadier General Henry C. Evans, 75th Infantry Division artillery commander, used the Cubs in this manner one morning in mid-March 1945. At about 0630 General Evans routed Lt Clifford S. Athey out of the sack. With a 300-foot ceiling and visibility about 1 mile, the general gestured toward the sky and asked if any planes were up.

After receiving a negative reply, General Evans said, "Let's get one up if we can fly. The infantry is catching it."

Within minutes, Lieutenant Athey was airborne and flew up and down the Moselle River (near Wittlich). After about ten minutes he was informed by radio that incoming artillery had stopped shortly after he took off. Although Athey couldn't see across the river, the Germans could hear the Cub's engine and quit firing.

Other reports from commanders in Europe read as follows:

. . . There has been considerable flying in bright moonlight nights . . . it is felt that air pilots still in training should practice moonlight observation.

. . . The Cub planes have been the answer to the artilleryman's prayer . . . they have performed about 40 percent of our observed missions and more than 60 percent of our precision registrations.

. . . In the hedgerow country (Normandy) where ground OPs were nonexistent, the Cub was the only thing that was effective against Jerry SP guns.

. . . When the king of Norway fled the Germans, a Norwegian Air Force officer used a Cub on skis to maintain contact between the king, hiding in the mountains, and officials near Oslo . . . Often German pilots flew over without noticing the Cub, and at other times the pilot would land and hide when he saw enemy planes.

. . . Later, Lt Jackson K. Pennington, pilot, and Lt Leonard J. Mann, observer, dropped a round of bazooka ammo on a suspicious looking building. Out rushed a platoon of Jerries, and Lieutenant Mann called in a few rounds of artillery fire smack in the center of the bunch.

. . . It was like luring a fly into a spider's parlor. Major John H. Focke, Jr., and T/5 Edward F. Hubback suddenly found their Cub under attack by an FW-109. They let him come and by the time Jerry made his third pass he had been lured into the ack-ack of Lt Col B. M. Warfield's 552d AAA AW Battalion. They got the Jerry.

. . . A liaison pilot of the 87th Infantry Division has been credited with sinking three ships and two barges on the Rhine. . . .

A "baffle plate" on an L-4 cowling helps keep the engine warm in cold weather

Another pilot reported seeing a periscope moving down the Rhine. At any day we expect a Grasshopper pilot to report, "Sighted sub, sank same."

... You wanted to know about your planes in action—well, they are honeys! When we see those little crates fly over, we give a silent cheer. We call them our "air support"—and they're just that. Once they are up in the air Jerry keeps his head down and his artillery stays pretty quiet. Ack-ack and ground fire doesn't seem to bother them. I've seen them hightailing away from MEs and FEs and shake them too! They are doing an excellent job and the boys who pilot those planes deserve plenty of credit.

... Junction with the Russians was most happily effected, first by personnel of the [10th Infantry] Division artillery in its Cub liaison planes, next by ground patrols, and then in an exchange of visits by staff officers and commanders.

... Lieutenant Ford, of the 76th Infantry Division, spotted a squad of friendly troops headed toward a hidden machinegun nest. He flew low, throttled back, and shouted a warning. Adding throttle, he looked back to see if he had accomplished the warning and flew right into the side of a hill. The L-4J was a total loss, but Lieutenant Ford survived and fought with the infantry a few days before returning to his section.

... Approximately 10 March 1945, we accomplished a "human ASR approach" in the 76th Infantry Division. One of our boys was held up "registering" [until] late in the afternoon and started back just at dark. He couldn't find the pasture and radioed his plight. We moved our radio vehicle to the edge of the strip and, with three or four people spread out around the strip for "ears," made an "aural DF steer" until he was over the strip. Then we used one jeep with lights to mark it for a successful landing.

... By late March, the Germans had almost ceased using tracers when firing at liaison airplanes. Nevertheless through practice we had become fairly accurate in locating these installations.

... At the close of hostilities, Brig Gen Henry C. Evans, 76th Infantry Division artillery commander (now Maj Gen, Ret), stated that over 70 percent of the artillery missions fired, and tactical information received, came from his airplanes.

... In a few instances the liaison planes have been used as an expedient to guide bombers over the target.

... It was SOP in the 3d Armored Division for at least one artillery observer to be in the air during all daylight hours observing enemy movements. They flew over enemy lines and were seldom fired upon as the enemy did not wish to give away his position.

In Europe, ground commanders had full confidence in the ability of the liaison pilots. Frequently they asked them to accomplish seemingly impossible missions.

For example, during the fighting in Austria a bridge over the Inn River was proving particularly bothersome to General Patton. The XII Corps was making good headway along one bank of the Danube River, but the XX Corps was having trouble on the other side, primarily because the Germans were rushing in troops and supplies over the Inn River bridge and into the XX Corps sector. (The Inn River flowed into the Danube near the bridge and behind German lines on the XX Corps' side of the Danube.)

General Patton ordered the bridge destroyed. He gave the job to the 11th Armored Division and indicated that with the help of the Cubs one battery of 155mm guns could move up along the XII Corps' side of the Danube and destroy the bridge with 27 rounds per gun. This was all the ammunition General Patton allotted for the mission.

Bets were made within the 11th Armored on whether or not the mission could be accomplished. In many other instances it had taken hundreds of rounds per gun to knock out a bridge, and it was still a difficult task.

Captain Gregorie, XII Corps aviation officer, and Lieutenant James (first name unknown) flew to the area of the bridge and were immediately driven off by three German FW 109s. A few hours later the pair returned and got down to business.

The first round landed well over the bridge, and the second was short and about 200 yards to the right. The third splashed under the bridge.

Captain Gregorie called back that the third round landed "50 short." He was informed that No. 4 was on the way. It seemed that the round was taking forever to get there, but suddenly there was an orange flash in the center of the mined bridge. A huge, billowing cloud of black smoke began engulfing the bridge, and then the ends slid down into the smoke and river.

Staring in silence at the spectacle, Captain Gregorie and Lieutenant James finally became aware that the battery was trying to contact them on the radio. "My only regret," Colonel Gregorie recalls, "is that I couldn't think of an appropriate statement to fit the occasion. I just said 'mission accomplished' and we went back."

An L-4 Cub is dwarfed by an LST in New Guinea

"Mission accomplished!" Captain Gregorie's seemingly common statement was becoming uncommonly significant. Liaison pilots were echoing it hundreds of times daily in all theaters of war as they performed missions considered impossible a few years previously.

REPORT FROM THE PACIFIC

"I can remember," the liaison pilot wrote, "back in the States how Air Corps pilots would laugh when we said we flew Cubs.

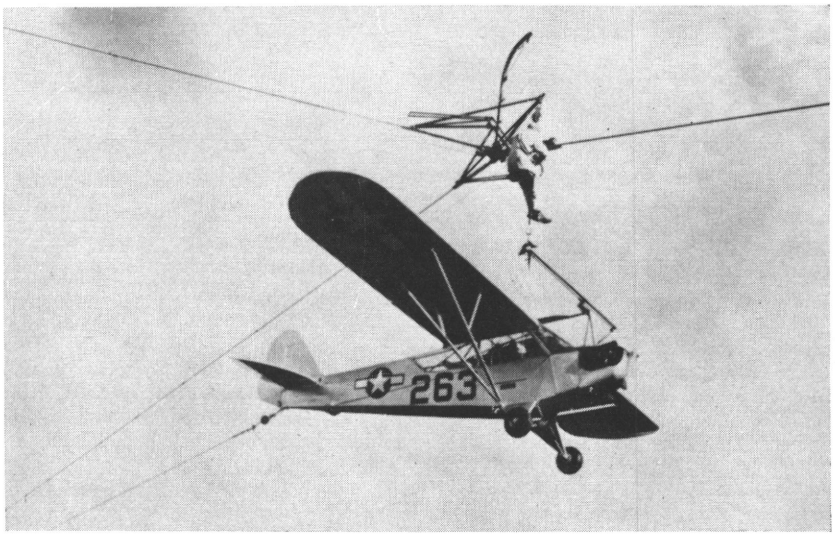
"Down here [in the South Pacific] I believe that we are deeply appreciated by all, especially when the enemy starts shelling our areas. It's getting so that whenever the Cubs are spotted in the air by the Japs, they cease firing."

As in Europe, the role of the Cubs in support of the ground battle became increasingly important to the ground commander. Artillery observation was the primary mission of the Air OPs in the Pacific, but here also the Cubs were soon accomplishing numerous other duties. Ingenuity and initiative on the part of the liaison pilots also were evident in this theater of war and resulted in rapid growth of the Army Aviation concept.

Getting the aircraft ashore during the invasions of the islands was one of the main problems encountered by liaison pilots in the Pacific. Many units devised systems similar to that used by the 37th Infantry Division during the landing at Lingayen Gulf, 9 January 1945. The wings were removed from the division's five L-4s and each was loaded with its wings aboard a DUKW. The DUKWs were transported from Bougainville aboard LSMs and launched at sea off Lingayen Gulf. The L-4s' SCR 610 radios were used to maintain contact as the group proceeded to a predesignated dirt road on the beach. There the Cubs were reassembled and took to the air to become the first Army aircraft active in the Luzon Campaign.

During the invasion of Okinawa a rig known as the "Brodie Device" was effectively used. The Brodie Device, named for its developer, Lt James Brodie, consisted of four masts which supported a strong horizontal steel cable that provided a straight, smooth, clear runway for landing and taking off. A trolley with an attached sling underneath caught a hook mounted above the center of gravity of the aircraft. The trolley ran along the cable and allowed landing and takeoff runs. The airplane could be raised or lowered to the ground by tightening or slackening the runway cable.

Brodie Device used on LSTs to land and launch aircraft



Originally the Brodie Device was envisioned as something to help combat the submarine menace in the early months of World War II, but later modifications allowed its use on either ships or land. It was first tested at New Orleans Moissant Airport and on the ship "City of Dalhart" in the Gulf of Mexico.

Later General Leslie McNair, chief of staff at GHQ, witnessed a demonstration of the Brodie Device at Fort Belvoir, Va., and immediately recognized its potential for use with artillery planes. On 31 October 1944, General McNair directed that training in the use of the Brodie Device be instigated at the Department of Air Training at Fort Sill, Okla.

In the Pacific, the Brodie Device was mounted on LST No. 776, which also became known as the *USS Brodie,* and was the only LST in service to have an official name.

During the invasion of Okinawa an urgent requirement developed to set up artillery units in the Kerama Retto Islands to shell the defenses on nearby Okinawa. Photography and aerial observation were needed by the batteries on the Keramas, but the group of islands offered no place to set up a landing strip. The *USS Brodie* came to the rescue, and during the invasion of Okinawa, Cubs used the Brodie Device on the LST to fly numerous sorties. Not a pilot or plane was lost.

General Joseph W. (Vinegar Joe) Stilwell, Commander of the Tenth Army, used the Cubs extensively during operations in the Pacific. He enjoyed riding in the Air OPs with both windows open. On one occasion he was being flown by S/Sgt Lyle W. White on a mission off Okinawa. A gust of wind blew through the Cub's cockpit and the general's battered campaign hat, that he had worn for over 20 years, blew out the window.

L-4 lands at Morotai Island after observing Japanese positions

General Stilwell sadly watched his hat float down and plop into the sea. He remarked, "I'd sure like to go down there and rescue my old friend." Upon landing, Stilwell offered $25 to anyone who recovered the hat; much to his delight, it was returned to him 4 hours later.

Often the Cubs provided invaluable assistance to the infantry in the Pacific. They would lead patrols to designated spots in the jungle, relay positions of friendly and enemy units in the thick underbrush, and provide transportation between command posts when heavy rainfall brought ground transportation to a standstill.

Artillery pilots in North Africa and Europe were not the only liaison pilots who captured prisoners. One such incident in the Pacific involved a 38th Infantry Division liaison pilot who spotted several Japanese on rafts trying to escape from Corregidor to Bataan.

The liaison pilot landed, picked up a tommy gun and a supply of hand grenades, and headed back to the fleeing Japanese. Intelligence felt the Japanese possessed information of value, so a boat put out to chase the enemy. When the Cub arrived over the rafts the Japanese immediately began offering resistance. A little automatic fire and a few grenades killed several of the enemy and convinced the surviving two that it was time to surrender.

"Bombing" the enemy with hand grenades wasn't as easy as it sounds. Lieutenant Edwin S. Marman wrote from New Guinea that a pilot from his outfit spotted a Japanese soldier paddling across a lake in a native canoe and threw his last hand grenade at him. "He'll never live it down that he missed the canoe by 50 yards," Lieutenant Marman wrote.

Liaison pilots in the Pacific made it a habit to carry small arms, hand grenades, and tools on flights. They never knew what they would spot from the

air, or when they might be down in the jungle. Colonel David Larr, a member of General Douglas MacArthur's staff, found himself in just such situations 2 days in a row.

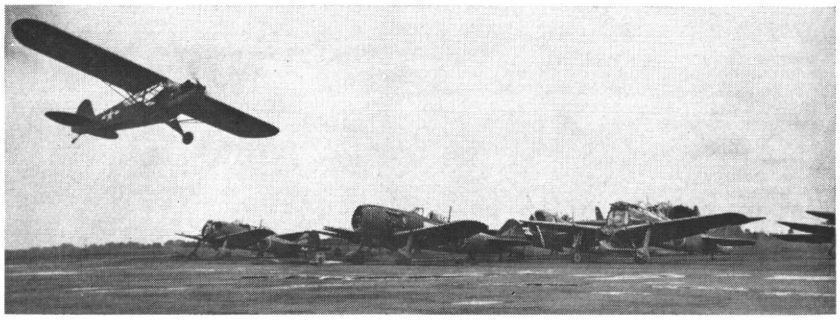
Colonel Larr and his pilot were forced down behind Japanese lines late one afternoon in New Guinea. They had been seen by the enemy but had the necessary tools to repair the Cub that night. They took off the next morning just ahead of probing Japanese troops.

The next day Colonel Larr spotted a column of Japanese troops from the air. His pilot dived on the enemy and Colonel Larr sprayed them with machinegun fire.

"Horsefly" type missions also were used in the Pacific. In one instance this system was instrumental in saving a company of the 14th Infantry Regiment which was surrounded in North Luzon during fighting in 1945. First, the liaison pilot directed transport planes in dropping food and ammunition to the surrounded troops, and then he guided tactical air strikes which enabled the company to break out and escape.

As in Europe, reports of Army Aviation's accomplishments were numerous:

Above, a mechanic changes a motor on an L-4 on Okinawa in 1945. Below, wrecked Japanese Zeros lined a strip used by L-4s in Tokyo after the war.



An L-4 takes off at Cebu, P. I., in April 1945

. . . (From Bougainville) Division artillery retained control of the liaison planes at all times. The air observer proved to be invaluable in helping to prevent enemy mortar fire. At first a Cub was only sent when enemy mortar fire was received, but later one was kept on patrol at all times.

. . . (From New Guinea by Lt Edwin S. Marman) The strip was the worst possible. It was located between two hills, uphill, and all landings had to be made from the ocean, downwind.

. . . The day airfields were cap-

tured, Cubs landed on them. The infantrymen swarmed about the planes, and their first questions were "How is the war going?" and "Give us a ride."

. . . We did little artillery observation but made up for it in our passenger and supply work. For a while we were the only means of communication and carried messages, morning reports and couriers.

. . . Some of the pilots flew as much as 5 to 6 hours a day. Generally, when not in combat, the division keeps it down to 2 hours per day.

. . . (From the Southwest Pacific) Oil seals out here just aren't. We found that the oil seal out of a transfer case of a ¾-ton truck is just right, except that the outside diameter is ¼ inch too small. We took the shell case base of a 75mm and hunted up ordnance and they made us a brass bushing for the seal.

. . . We fly behind the lines and all over them. We observe fire from over the target or behind it. Every ship has been hit by machinegun and rifle fire.

. . . (From Leyte by Maj J. C. Kriegsman) Following a report of enemy activity in the area, Lieutenant Hartwig and Lieutenant Laroussini circled the end of our strip almost a half an hour under a 100-foot ceiling. Hartwig glanced over his shoulder and saw something move near a funny looking pile of debris in a coconut grove. They found that stack to be a group of Japs huddling in an effort to keep out of sight. They called in artillery and the second round landed squarely on the target. They fired for effect. Actual count showed 82 dead.

. . . Our mechanics and helpers are positively the best. Engine failures seem to be almost a thing of the past.

. . . (From the Southwest Pacific) All commanders wanted Cubs equipped with more durable floats. On two occasions the medical supplies dropped saved lives. One large patrol was supplied and wounded were evacuated for a period of 3 weeks.

Troops inspect an L-5 damaged in surprise raid by Japanese

. . . On one occasion a native village occupied by the enemy was effectively attacked by two liaison planes with hand grenades and submachineguns. The enemy concentration had been located by a small ground patrol and would probably have moved on before an attack by high performance aircraft could be arranged.

. . . (From Saipan) Eighty percent of the medium and 20 percent of the light artillery targets were fired by air observation. The liaison pilots observed from over enemy territory at all times. Several casualties were suffered.

. . . (From Leyte) The Japs threw everything but the kitchen sink at the Cubs and as a result several were lost.

. . . Drop loads consisted of "K" rations, ammunition, medical supplies, blankets, and socks. Breakable loads were padded with blankets and straw. The individual in the observer's seat carried the load in his lap and pitched it into the trees to reduce the force of the drop. The majority of the loads were recovered and losses from breakage were light. On one occasion about 150 such sorties were flown to support two companies.

AXIS VIEW OF THE AIR OP

"Germany can't win," the Nazi prisoner was telling Lt Col John W. Mayo.

Asked why, the German pointed to a Cub circling overhead. "Because of those things. That's the most dangerous weapon you have. We can't get out of our foxholes without being spotted by one, and when our artillery shoots they always spot him and bring down counterbattery."

When Colonel Mayo asked why the Germans didn't shoot our Cubs down, the prisoner replied, "Our officers have told us that the planes are very heavily armored and couldn't be shot down." Colonel Mayo relates that the real reason they didn't shoot at our Cubs was that they feared the inevitable counterbattery fire that would follow.

The effectiveness of the light airplane in combat is reflected in the following extracts of a report submitted by a Panzer Grenadier battalion commander: "As a rule an attack is preceded

by a strong artillery preparation in which the Americans employ all calibers, including their heaviest. Planes are used for fire direction, and excellent results have been obtained. . . .

"Artillery directed by observation planes places fire on each of our movements. . . . Whenever possible, attack preparations should be avoided during the day. U. S. air observation detects every movement, and directs sudden and heavy fire concentrations on the deployment area."

German respect for the liaison planes also was shown in a captured paper which established a point system for awarding German fighter pilots a medal similar to our air medal. Three points were given for knocking down an escorted four-engine bomber, two for a two-engine escorted bomber, one for a fighter plane, and two for a liaison plane.

One prisoner, marveling at the effectiveness of the Army's Air OP planes, said that every time he saw an observation plane his blood would boil. "It's an insult to have that little defenseless box bobbing around in the air and not be able to do anything about it," he said.

Still another German prisoner stated, "When the Cub flies over, all firing ceases. All we move is our eyeballs."

A Japanese prisoner said that more fear was generated by the sight of a Cub above them than by any of our other planes. The reason was that invariably when they saw Cubs, artillery was brought down on them, and more of their men were killed by this fire than by bombs.

REPORT FROM KOREA

While World War II proved the value of Army Aviation in support of ground forces, the Korean War proved that its uses and potential in combat are unlimited. In Korea, Army Aviation techniques were invented and improved as helicopters and new airplanes were introduced to the combat scene.

In the early stages of the war L-4s, L-5s, and L-16s were used by Army Aviation. However, these World War II vintage aircraft were soon replaced by the L-17, L-19, L-20, and L-23.*

The L-17 did a creditable job in courier work, even though it was not designed for use in combat. The L-17 was replaced in late 1952 by the L-23 for transportation of commanders and staff officers. The L-20 was used for transportation of equipment, supplies, and troops. As discussed in Part III of "The Army Aviation Story," the L-19 became the favored ship for reconnaissance.

At first Army Aviators were able to fly in Korea at altitudes of 100 to 5,000 feet, but increased ground fire soon forced them to 7,000 feet or better. Usually light antiaircraft and small arms rounds spent themselves before reaching this altitude. Heavier weapons were not accurate at this low an altitude.

The helicopter received its combat baptism in the Korean War. In 1950-51 ground commanders were becoming increasingly aware of the many and diversified jobs the helicopter could accomplish in the combat zone. Rotary wing aircraft arriving in Korea quickly provided added mobility and excelled in the field of medical evacuation. (Army Aviation's use of the helicopter for medical evacuation will be discussed in a later chapter.)

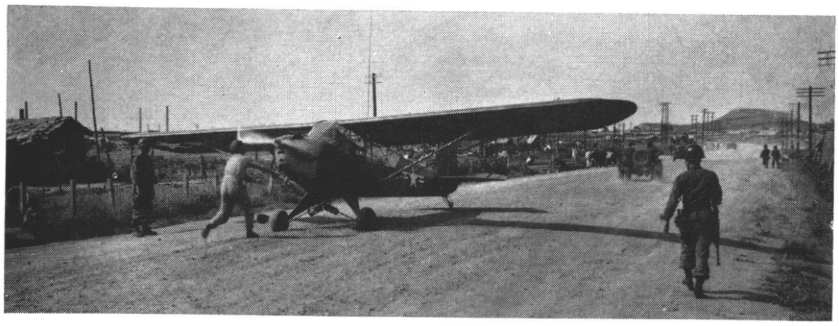
Cargo helicopters provided outstanding support in Korea. The 6th Transportation Company (Helicopter) was the first Army helicopter transportation company to support units in combat. The 6th had been engaged in an intensive training program at Fort Bragg, N. C., when in November 1952 it was ordered to Korea. An advance party left the U. S. by air on 7 December and reported near Chunchon, Korea, on 14 December—the same day the main body of the 6th sailed for Japan from San Francisco. Personnel of the 6th arrived at Chunchon on 6 January, but the company's 20 H-19s remained in Japan. They were flown to Korea in groups of five between 11 February and 24 March.

The 6th Transportation Company's first combat mission occurred on 20 March when it supplied forward elements of the 3d Infantry Division, which had been isolated by a flood.

The 13th Transportation Company (Helicopter) arrived at Inchon, Korea, on 1 May 1953.

An Army L-16 taxis on a Korean road in August 1950

*While new Army aircraft designations were changed by AR 700-26, "The Army Aviation Story" will continue to use the old designations to remain in context.



L-4 shared roads with jeeps and troops in the Korean War

The 13th was the only other Army transportation helicopter company to operate in Korea during the war.

Reports on Army Aviation from Korea read like these:

...The most dreaded of enemy antiaircraft guns were the 85mm radar-controlled weapons. They [the enemy] were uncannily accurate with their antiaircraft fire. If you flew at 8,215 feet, that's where the first bursts were. Thank God they usually misjudged our speed! Never head for a cloud or your own lines... they expect this and will have other weapons registered on possible entry into a cloud, and/or will lead their rounds toward your lines.

...Considering the amount of adverse weather, it is remarkable how few flying days are lost. However, many flights are made in weather well below minimums for VFR.

...During the last campaign, Gen Maxwell D. Taylor, Eighth Army commander, stated that he could not have maintained the right flank of the front of the MLR in its position without the assistance of cargo helicopters. Some units had been forced back behind the main supply route and supply would have been untenable without the helicopters.

...The Division Air Section flew blood plasma, ammunition, rations, and radio batteries to the Korean Marines surrounded at Tongyang. Landings were made on a 1,000-foot strip with poor approaches. Wounded were evacuated on return trips.

...The 3d Infantry Division aviation section, in conjunction with the X Corps aviation section and the Air Force, made many flights to the Chosin Reservoir area to resupply and evacuate surrounded Marines fighting their way to the sea.

...In addition to obtaining many aerial photos, numerous successful wire-laying flights were conducted.

...The first attempts to span the river with cable carried in H-19s failed due to the heavy pull of the river current. However, nine spans were successfully installed during the next two days.

...Seventy-one round trips were required to remove and replace 420 troops in H-19s. Supplies weighing 4,200 pounds were moved in seven flights, and the entire mission took 8 hours, 10 minutes flying time.

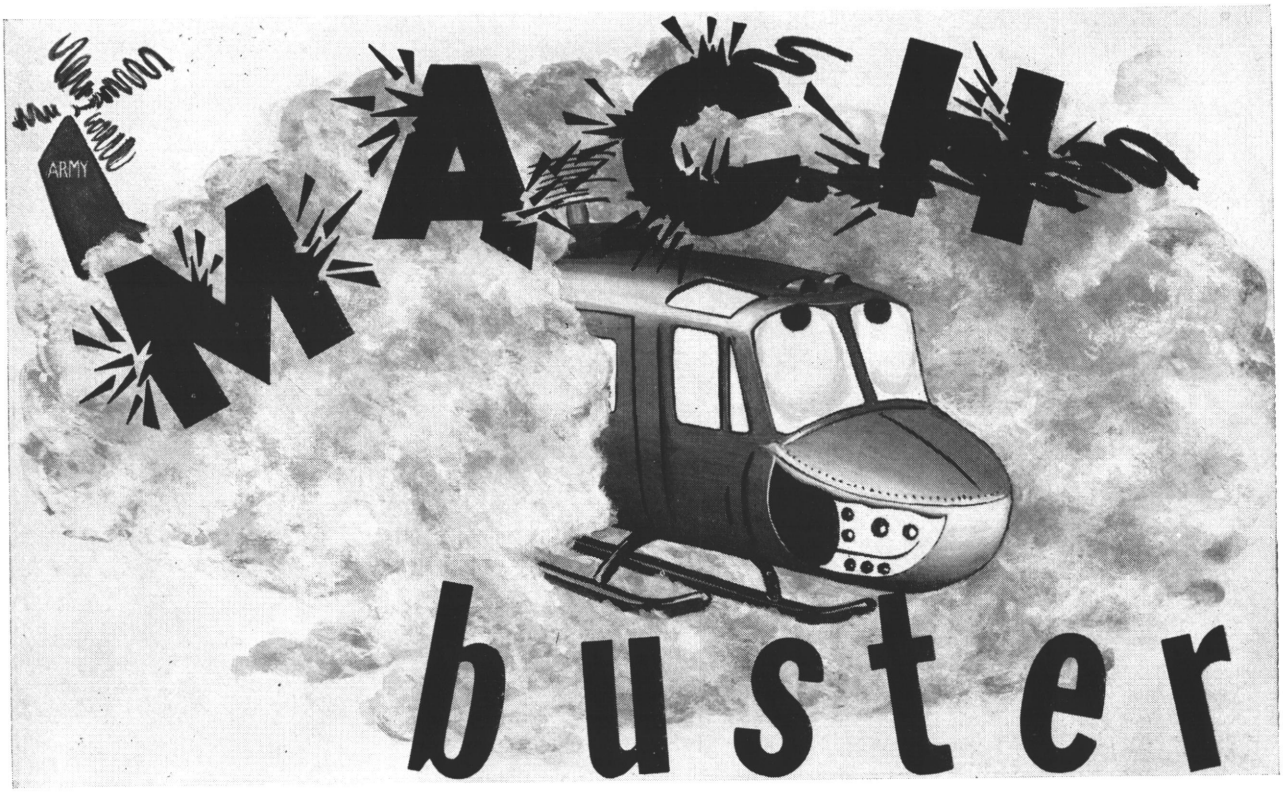
...Lt Gen Ruben E. Jenkins, IX Corps commander, observed the battle from his helicopter. Despite incoming artillery and mortar rounds, he remained in the area in his helicopter until satisfied the 9th ROK Division would hold the outpost.

...Observation and reconnaissance became one of the primary missions of helicopters because they afforded overall views of the disposition of friendly units.

...It fell to the 3d Division helicopters to rescue 200 of the troops stranded by the rapidly rising Imjin River.

Army Aviation has traveled a long, embattled road, from the landings in North Africa, to the conference table at Panmunjom, and today to the jungles of South Vietnam. The journey is far from over, but one conclusion is definite: the concept of Army Aviation, aviation in support of the ground battle, is sound.

Left, Gen J. Lawton Collins straps himself in an L-5 in Korea. Right, Lt Gen Edward M. Almond sits in the rear seat of an L-19 in Korea.



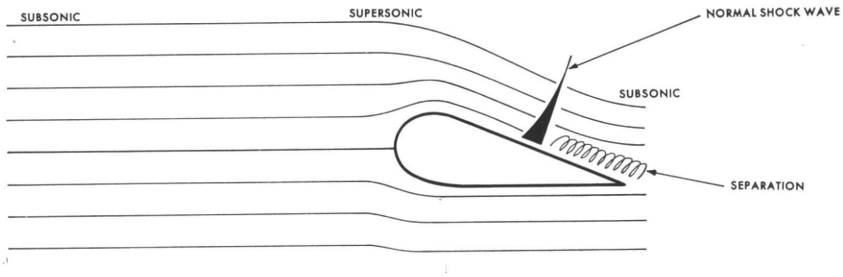
Captain Herbert M. Webber

EXCEED THE SPEED of sound in a helicopter? Impossible you say? The fact is that some pilots may have done it and not realized what occurred.

Most helicopter pilots have been fairly well versed on retreating blade stalls, but let's investigate what happens on the advancing blade. On the UH-1A, as an example, at a rotor rpm of 314, the rotor tip velocity is 719 ft/sec or 426 knots. This velocity coupled with a forward velocity of 105 knots gives a resultant tip airspeed of 531 knots.

No sweat, you say; 531 knots is still not the speed of sound (662 knots at sea level, standard day). The illustration shows a typical helicopter blade section in transonic flow. As it flows over the airfoil subsonic air is accelerated to such an extent that it becomes supersonic in velocity. When the airflow slows to subsonic again, a normal shock wave is formed. This always occurs when a supersonic airstream slows to subsonic without a direction change.

Critical Mach number (Mach number is the ratio of the true airspeed to the speed of sound) is the measure of the velocity at which the above effect starts to take place. In other words, it is the freestream velocity above which the flow over the airfoil can be accelerated to supersonic velocity. The critical Mach number may or may not be given in the flight handbook; however, for most typical helicopter blades it is between 0.70 and 0.80. For



Capt Webber is stationed at the Sacramento Signal Depot, Sacramento, Calif. He is fixed and rotary wing rated with approximately 2,400 hours.

the CH-34 the critical Mach number is arbitrarily given as 0.8. In our earlier example of the UH-1A at standard sea level conditions the blade is operating at 0.802 Mach.

Okay, so the speed of sound can be exceeded in the helicopter. So what? Listed below are the major effects of operation in the transonic range.

- It takes large amounts of power to move the blade because:

A great amount of energy is consumed in the normal shock wave, which is lost as heat, and is of no value in creating lift. This loss of energy is known as wave drag.

Some additional drag is created by increased skin friction due to temperature rise and the compressing of the air before and over the blade.

- As the section passes from the subsonic range through the transonic range, the aerodynamic center moves aft from its subsonic position at about 25 percent of the chord length to about 50 percent of the chord length. This causes:

A twisting of the blade, as the whole blade is not in transonic flow, so the aerodynamic center is not on an even axis throughout the blade length.

As the blade passes in and out of transonic flow (as the blade goes around toward the front), the shifting aerodynamic center will cause vibration.

- Just prior to the critical Mach number there is a slight increase in lift due to compression of the air, which increases the air density. This increase in lift will manifest itself as a slight nose pitch-up of the helicopter (due to gyroscopic precession).

- Another result of the shock wave is shock induced separation which will cause a burble behind the wave with resultant rotor roughness.

The symptoms the pilot encounters when operating in the transonic range are:

High power required.

A slight pitch-up tendency.

A vibration or rotor roughness.

Let's next consider the variables of operation that may have some effect on transonic operation. These may be broken down into three general areas:

1) *The freestream velocity of the air.* This is controlled by:

The rotor rpm; high rpm leads to increased probability of encountering transonic effects.

The forward velocity of the helicopter; high velocity would lead toward conditions of transonic flow.

2) *The acceleration of the air over the airfoil.* This is a function of the angle of attack of the blade. The higher the angle of attack for a given freestream velocity, the higher the acceleration of flow over the airfoil. The angle of attack may be varied under the following circumstances among others:

Gross weight of the helicopter. The heavier the weight, the more angle of attack is needed to fly.

Flight maneuvers. Climbs and turns put a higher loading on the rotor thus requiring a higher angle of attack.

Density altitude. The higher the density altitude, the more angle of attack is required to maintain the same performance available at lower density altitude.

Turbulent flight conditions, in that gust loads may cause momentary increases in the angle of attack.

3) *The speed of sound* which is dependent only on the temperature. The colder the air the slower the speed of sound (see table). Thus operation in cold weather can lead to sonic flow at lower airspeeds.

Generally speaking the effects of compressibility, or exceeding the speed of sound, on the blades are undesirable in helicopter flight, so the corrective action to take should be of interest to those involved. These techniques are rather self-evident.

Decrease airspeed slowly (a sudden flare would increase blade angle of attack and aggravate the situation).

Lower collective pitch.

Decrease severity of maneuver.

Decrease rotor rpm.

The similarity of symptoms and corrections between retreating blade stall and compressibility effects should be noted. The main difference in the corrective action is rotor rpm control.

Air Temperature °C	Air Temperature °F	Speed of Sound Knots	Air Temperature °C	Air Temperature °F	Speed of Sound Knots
−25	−13	614	10	50	656
−20	− 4	620	15*	59	661.7
−15	5	626	20	68	666
−10	14	633	25	77	672
− 5	23	638	30	86	678
0	32	644	35	95	684
5	41	650	40	104	689

*Standard Sea Level

CRASH SENSE

PREPARED BY THE UNITED STATES ARMY BOARD FOR AVIATION ACCIDENT RESEARCH

SHOPPING FOR A PRESENT to fit all CRASH SENSE readers is on a par with trying to buy a bride an unmentionable from the lingerie counter without knowing her size. An inch off either way and you're in hot water. We wanted something different, we wanted the best of its kind, and we wanted it to fit. Thanks to the Civil Aeronautics Board, we were able to fill the bill on all three counts.

Despite many millions of words from highly educated experts and advances in the fields of aviation technology and equipment, the best aircraft accident prevention tool remains experience—*preferably someone else's experience.* And that's our Christmas present for you. Through the efforts of the CAB, we're bringing you some 1962 accidents and cause factors from general aviation in the United States. This is something different, it's the best of its kind, and it fits Army Aviation.

JET BLAST

When a DC-3 pilot could not take off because of mechanical trouble, he returned to the

parking area and parked behind a Boeing 707. The tail of the DC-3 was toward the tail of the 707, with a separation distance of less than 200 feet. As the 707 was started and began to move forward, the jet blast buffeted the controls of the DC-3, causing substantial damage.

ICE

While an aircraft was being refueled during an en route stop of a cross-country flight, the pilot noticed that the wings, fuselage, and empennage were coated with ice. Despite this condition, the flight was continued. About 10 minutes after takeoff, the pilot radioed that he was encountering freezing rain, a condition indicated by current forecasts and weather advisories.

The aircraft crashed about 24 miles from the refueling point, shortly after the last radio transmission. Evidence showed that the crash occurred during an attempted landing. The landing gear and flaps were extended and the propeller was in low pitch. The aircraft crashed in a right-wing-down, nose-down attitude. It was still coated with ice an hour after the accident. Probable causes were loss of control due to structural icing during an attempted emergency landing and the poor judgment of the pilot in continuing the flight into known icing conditions.

WIRE STRIKE

A pilot on a local flight saw a group of coyote hunters on the ground. A short time later he sighted two coyotes and descended to call out the information to the hunters. While his attention was diverted, the aircraft hit a powerline and crashed.

WEATHER

A private pilot, intending a VFR cross-country flight, was advised of the likelihood of low ceilings and visibilities from a cold front. These were expected to approach marginal conditions for visual flight. Moderate to severe turbulence, strong winds, and possible squall-line conditions were indicated in the frontal area.

During a radio contact after an en route refueling stop, the pilot asked for and was given destination weather. He was also warned of thunderstorms, moderate turbulence below 9,000 feet, and rain along his intended route. Sometime later, the pilot made another radio contact and advised that he was lost. During efforts to assist the pilot, radio communications terminated.

The wreckage of the aircraft was found the next day. Evidence revealed it had crashed against rising terrain while flying in adverse weather associated with the frontal zone.

GROUND HANDLING

A duster pilot taxied his aircraft to the loading area and, following normal procedure, left it with the engine running. The loading truck was unable to get close enough to the aircraft to reload because of mud. As several farm hands and two pilots proceeded to push the aircraft into position, one of the farm hands started to walk around in front of the aircraft. The pilot warned him of the prop. The loader did not hear or understand and walked into the idling propeller.

HIGH TERRAIN — LOW CEILING

A non-instrument-rated private pilot departed for a cross-country flight. No flight plan was filed, but he departed under provisions of a controlled VFR departure clearance due to a 500-foot ceiling. Four minutes after takeoff the pilot reported out of the control area 5 miles

from his point of departure. No further contact was made with the flight. Approximately 6 minutes after takeoff, the aircraft struck trees on a ridge of a mountain at a terrain elevation of 1,100 feet msl. The crash site was 10 miles northwest of the point of departure. Investigation revealed that the pilot had been adequately briefed on existing and forecast en route weather. He had also been advised that conditions were extremely marginal for visual flight. The pilot had stated he would proceed through the weather to the clear area in about 2 hours flying time and that he had 4 hours of fuel on board.

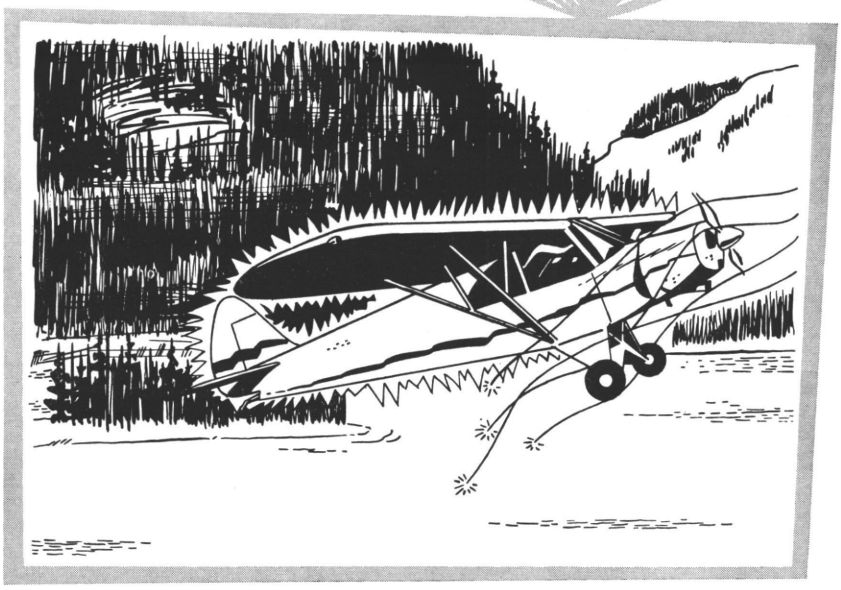
THUNDERSTORM

Prior to an intended VFR flight, a non-instrument-rated private pilot obtained weather information twice. Each time he was advised of frontal activity over his intended route. He was told that thunderstorms and associated turbulence, low ceilings, and low visibilities made the flight inadvisable. Despite this information the flight was initiated.

Forty-one minutes after takeoff, the pilot radioed that he was lost and in instrument weather conditions at 9,000 feet. Radio communication ceased shortly after this. About 9 minutes later two witnesses saw the aircraft tumble out of the clouds and crash. The observers saw that one wing had separated from the aircraft. The missing wing fell about 3/4 of a mile from the main wreckage. Examination of the aircraft wreckage showed that the right wing failed because of loads exceeding its design strength.

WIRE STRIKE

During a cross-country flight on a clear day, the aircraft was seen flying down a river, about 25 feet above the water. As it approached a bridge, a pullup was made, but the aircraft struck



a powerline 20 feet above the bridge and crashed out of control.

BELOW MINIMUMS

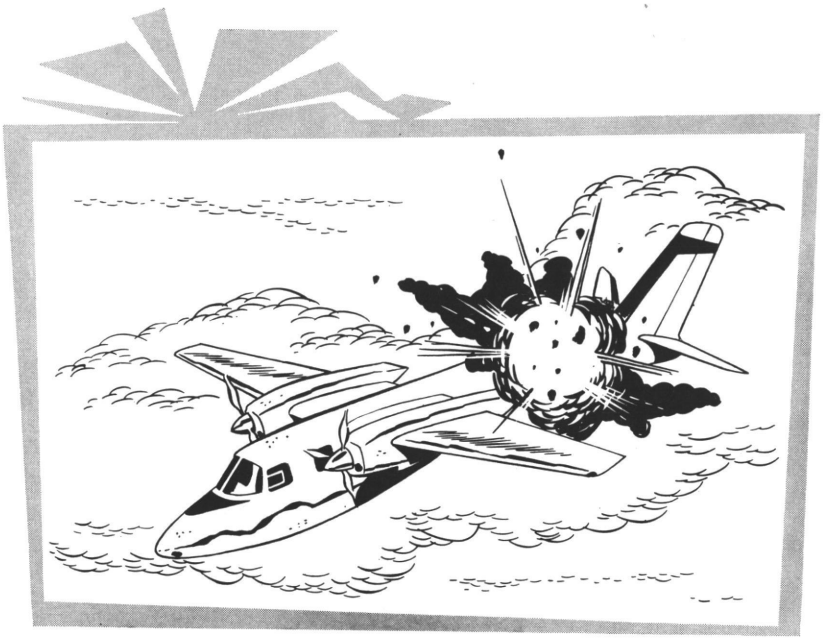
After a night IFR flight, an ATR pilot requested an instrument approach to land at his destination. Landing minimums for the airport were 500 feet and 1 mile. The pilot was cleared for the approach and advised that the latest weather was: "Indefinite 500-foot ceiling; obscured visibility is 3/4 of a mile, light snow and fog."

The first approach was discontinued, and the pilot was unable to see the runway lights because of snow cover at the airport. During the second approach the aircraft touched down 1,000-1,500 feet down the runway. Unable to stop the aircraft, the pilot initiated a second go-around and the aircraft struck trees beyond the runway. Despite substantial damage, the aircraft was able to continue and land at another airport.

TURBULENCE

A private pilot with a total of 84 hours was advised that en route weather conditions were marginal or below VFR minimums with icing, heavy turbulence, and thunderstorms. The pilot and his three passengers decided to go to the coffee shop. They returned 30 minutes later and were given the same weather outlook. The pilot filed a VFR flight plan, stating that he intended to fly out some distance to look for a hole through which to climb to his filed 10,000-foot altitude. If unable to find one, he intended to return to the point of departure.

The pilot took off and headed west toward a hole in the overcast. Weather was 800 feet scattered, 2,000 feet overcast, visibility 2 miles in rain and fog. One hour and 15 minutes after takeoff the aircraft crashed, killing all aboard. Investigation disclosed that the aircraft had sustained inflight structural failure of the left wing. The wing panel fell to the ground 1 1/4 miles from the main wreckage. Failure of the wing was the result of positive loads exceeding the design strength of the aircraft.



SLIPSHOD MAINTENANCE

Ground witnesses heard an explosive sound from an aircraft flying overhead. Looking up, they saw the empennage separate from the fuselage and the aircraft plunge to the ground. Investigation and laboratory analysis disclosed that a low-order explosion of a gasoline air mixture type had occurred aft of the baggage compartment, in the area of the center wing fuel sump drain line where several electrical units are located. The explosion and air loads caused structural breakup.

Aircraft records disclosed that in 1960 the center wing fuel sump drain line had split. It was repaired by putting fuel resistant tubing over the line and clamping it with worm-type clamps. This was a temporary repair, but there is no record that it was ever converted to a permanent airworthy repair. The general condition of the aircraft prior to the crash was poor.

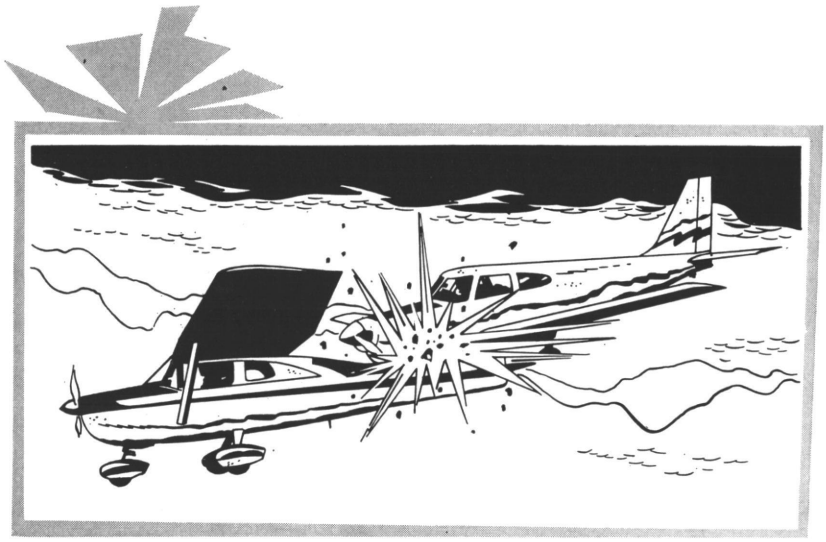
LOW-LEVEL AEROBATICS

A commercial pilot with more than 1,000 flight hours was seen to execute a series of descending rolls or a spin to low level. Recovery was made and the aircraft climbed to about 1,500 feet, where it entered a second spin or rolling descent. Recovery was started but not completed, and the aircraft struck the ground in a steep descent. Investigation disclosed a ceiling of 1,600 feet above the surface with limited visibility below the

clouds at the time of the accident.

TAIL ROTOR

A helicopter, with one male and one female passenger aboard, was landed on a hotel heliport. The male passenger got out on the right side, and the woman passenger got out on the left. The woman walked to the rear of the aircraft and ducked under the tail boom. She was struck and killed by the spinning tail rotor. Investigation disclosed that the tail rotor will spin up to 15 minutes after the engine has been stopped.



ICE

A commercial pilot, instrument rated with more than 12,000 flying hours, filed an IFR flight plan, advising the flight service specialist that he had obtained a weather briefing. Weather information showed a cold front over the intended route. Forecasts called for multilayered clouds from 6,500 to 24,000 feet msl. They also called for moderate to briefly heavy icing with precipitation up to 23,000 feet. Moderate to severe turbulence was expected at all levels. An advisory to light aircraft was issued concerning the icing and turbulence.

The flight departed at 1450, and at 1558 the pilot made a report stating he was considering turning back if he experienced any heavier icing. At 1626, while flying at 15,000 feet, the pilot asked permission to climb to 17,000 feet in an attempt to get over the icing. A minute later the pilot said he could not climb, and 8 minutes later he radioed that he could not control the aircraft.

The aircraft crashed out of control, killing the pilot and his passenger. Investigation disclosed that the aircraft was not equipped with deicing equipment.

OUT OF GAS

A commercial pilot experienced power failure while entering the traffic pattern for landing. The aircraft slowed, entered a spin, and crashed. Investigation revealed the fuel selector was positioned to the left main fuel tank which was found to be empty. The left fuel reserve and right tanks were full.

COLLISION ON FINAL

A dual instruction aircraft, making touch and go landings, was on final approach. Another aircraft, entering traffic after a cross-country flight, overshot the turn to final approach. While correcting back to runway alignment, the cross-country aircraft overtook and crashed into the dual aircraft. Impact occurred approximately 200 feet above the ground and 1/4 mile from the end of the runway. Both aircraft were destroyed, and all three occupants sustained fatal injuries.

UNAUTHORIZED, UNQUALIFIED

A student pilot with a total of 18 flying hours took off to practice instrument flying in fog at night with a passenger aboard. The aircraft crashed in a wooded area near the airport shortly after takeoff, killing the pilot and causing serious injuries to the passenger. Investigation revealed the aircraft had been taken for the flight without knowledge or permission of its owner.

ROCKS IN CLOUDS

A non-instrument-rated private pilot filed a VFR flight plan while in flight and asked for en route weather. He was advised that it was 3,500 feet overcast and 1/2 mile visibility. The pilot was asked if he had been briefed on en route weather and he answered that he had. The flight route lay across mountainous terrain in which forecasts called for moderate to severe turbulence with mountain passes obscured. About 3 1/2 hours after takeoff, the pilot identified the aircraft and

radioed, "Mayday, Mayday." There were no further transmissions and the pilot could not be contacted. The wreckage of the aircraft was found the next day at a terrain elevation of 6,000 feet. Investigation showed it had crashed in a nose-down, wing-level attitude. There was no evidence of malfunction or failure of the aircraft.

MOUNTAIN WAVE

Prior to an intended IFR flight a commercial, instrument rated pilot was advised of moderate to severe turbulence over and near the mountains, with downdrafts in the vicinity of the eastern slopes. The weather bureau issued a light aircraft advisory concerning the turbulence and downdrafts.

After takeoff at 1238, the pilot climbed to 14,000 feet and then to 17,000 feet. At 1626, the pilot radioed that he was unable to maintain 17,000 feet and was revising course because of severe turbulence and downdrafts. He advised he was flying at 15,000 feet. After this, the aircraft was identified on radar and the pilot reported he was west bound at 13,000 feet to get clear of the turbulence. The pilot was told that the terrain was 10,671 feet on his heading. This was the last communication of significance. The wreckage of the aircraft was located where it had crashed against the steep side of a mountain pass at an elevation of 11,500 feet. The aircraft was apparently under control at impact, but descending at 2,000 feet per minute, as shown by the impact stopped vertical speed indicator.

BUZZING

A 39-year-old commercial pilot struck a powerline and crashed into an embankment while flying low in the vicinity of a friend's house. Witnesses stated they had seen the aircraft for a period of 15-20 minutes as it was flown at low altitude in the vicinity of the crash.

C.G.

A commercial helicopter pilot was engaged in placing large sections of pipe in position. While hovering with a section of pipe, the aircraft began to roll to the left. Corrective action was ineffective and the pilot released the pipe. The helicopter rolled farther and crashed on its side. Investigation revealed the aircraft was equipped with an unapproved sling, and the load was improperly attached relative to the center of gravity considerations of the aircraft. Surface wind at the time of the accident was quartering at 18 mph.

Finally, for those of you who think you've heard everything:

FOWL NIGHT

A private pilot with a total of 74 flying hours was flying at night at an altitude of 1,600 feet. The aircraft struck geese and one or more of the fowl penetrated the windshield and hit the pilot. The aircraft went out of control and recovery was not possible until it descended to about 100 feet and the pilot was able to react to the emergency. The aircraft would not climb because of damage affecting its aerodynamic characteristics, and the pilot made an emergency landing during which the aircraft struck a powerline. The pilot, though injured, survived.

Investigation revealed the geese were not displaying position lights as required by CAR 60.23 for operation between sunset and sunrise.

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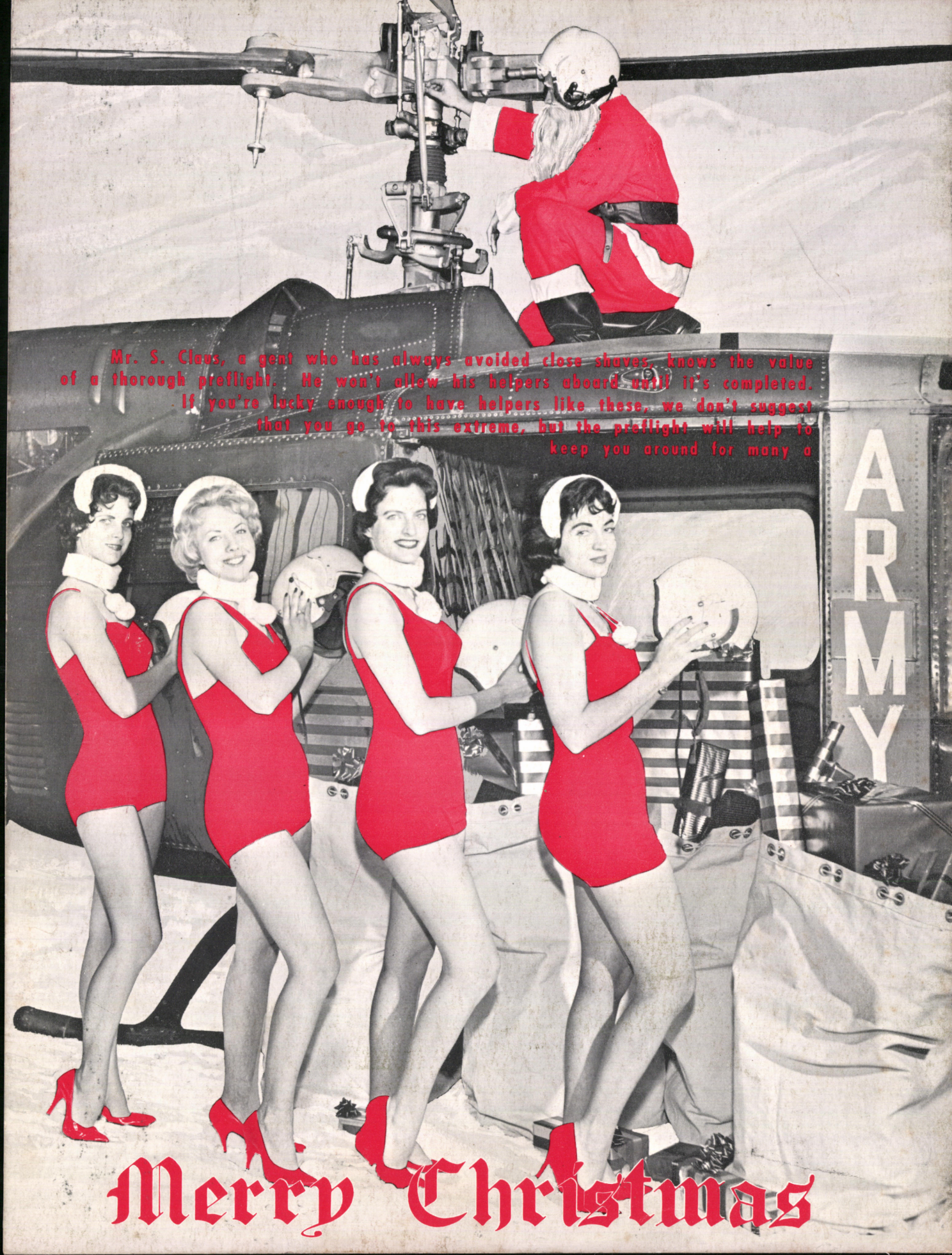
Mr. S. Claus, a gent who has always avoided close shaves, knows the value of a thorough preflight. He won't allow his helpers aboard until it's completed. If you're lucky enough to have helpers like these, we don't suggest that you go to this extreme, but the preflight will help to keep you around for many a
ARMY
Merry Christmas