FLYING SAFETY

INSPECTOR GENERAL · U. S. AIR FORCE

SAFETY IN THE NEST—page 2

"MILITARY AVIATOR"—page 26

By Brig. Gen. Frank P. Lahm

The Nation's First Military Pilot

DECEMBER 1951

UNCLASSIFIED

Last month, we inaugurated and very carefully explained a security classification code for articles appearing in FLYING SAFETY. This month, we're kicking the system out the window. It's no longer needed, because we have obtained permission completely to declassify the entire magazine. The "restricted" tag will be absent henceforth. This makes all articles available for reprinting and distribution without the security problems formerly present. Non-Air Force organizations should still query the Editor before reprinting, indicating how the material will be used.

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THIS MONTH

The article entitled "Safety In The Nest" which begins on page 2, should allay any qualms or doubts that veteran pilots may have regarding the "brash youngsters" fresh from flying schools. Cadets get flight safety thrown at them even before they crawl into an airplane, and safety is a part of the curriculum until they sprout their silver wings. When they graduate, they're safe.

The second article, "GCA Saves Lives," is more or less a sequel to the GCA story which appeared in November. The November article was primarily about the equipment; this one is . . . well, read it.

"Jet Jockeys Are Human, Too," on page 20, is a condensation of a study which was prepared by the Medical Safety Division of the Directorate of Flight Safety Research. The study should have been distributed by the time you read this. However, the distribution is limited and does not reach pilots direct. We thought it sufficiently worth while to digest it for you. Title of the study: "Human Factors in Major Accidents of Jet Fighter Aircraft."

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NEXT MONTH

For January, we have a story on recovery from unusual positions in jet fighters while under the influence of weather. Probably there are a few jet wingmen who have full confidence that they would be able to recover properly and immediately if they should lose their leaders in the soup at a time when the gages are all way off center. There are probably many others who aren't so confident. This article, prepared by the instructors of the jet branch of the Air Force Instrument Pilot School, tells how to make recoveries.

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GIVE US THE WORD

We're hoping to be deluged by a flood of mail someday soon. More of you have been writing to us recently, however, and we're happy to get your ideas and comments on Flying Safety. We'd be four times as happy if we got four times as much correspondence. Give us the word and we'll try to give you what you want—if it's good for you, that is. The address for postcards is the Editor, FLYING SAFETY magazine, Deputy Inspector General, USAF, Norton AFB, San Bernardino, California. For letters, it's the same. P.S. If any of your letters should contain stories suitable for publication in "your magazine," so much the better.

Flying SAFETY

DEPARTMENT OF THE AIR FORCE
THE INSPECTOR GENERAL, USAF

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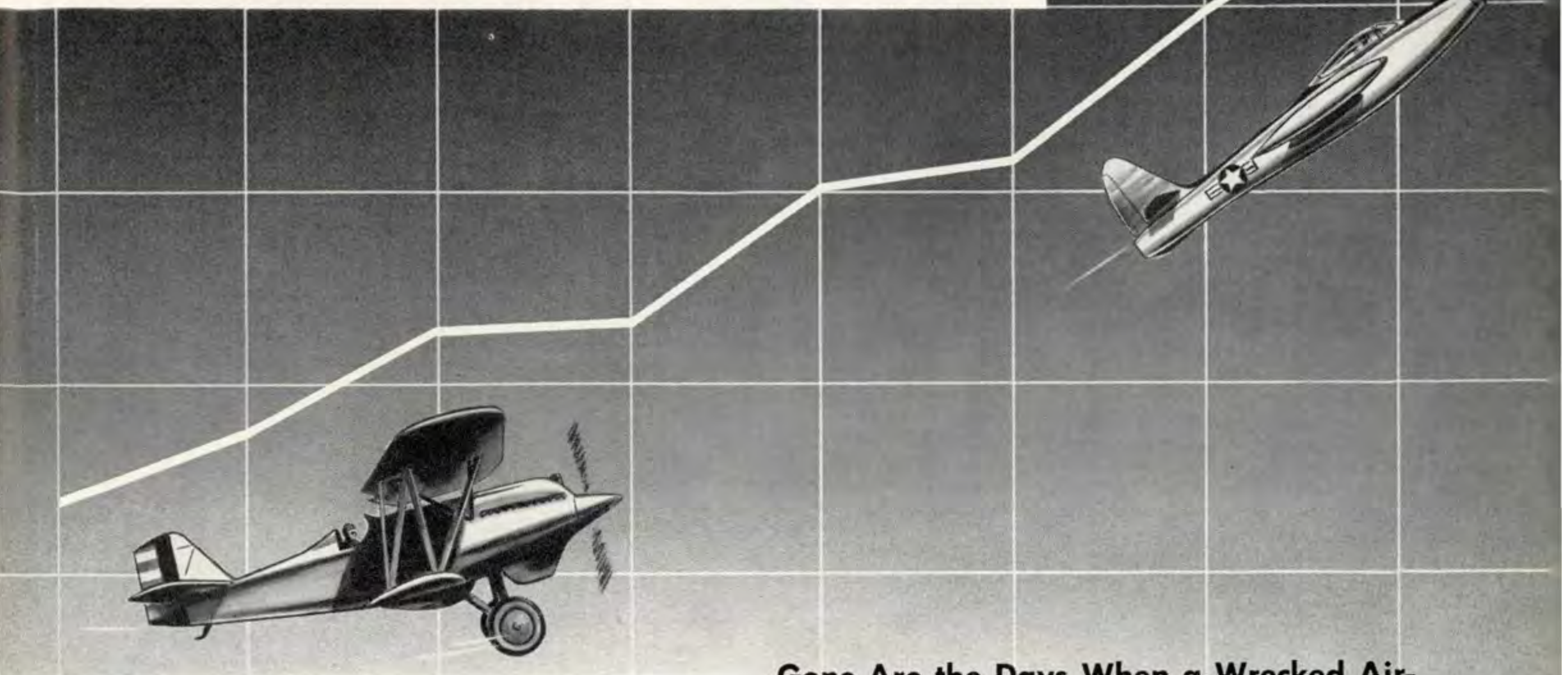
THE RI$ING CO$T OF AIRPLANE$



Gone Are the Days When a Wrecked Airplane Meant Just a Few Dollars Down the Drain. Today's Planes Represent Big Money

The little fighter plane droned steadily through cloud-flecked skies above Puget Sound. In the cockpit a test pilot stared intently—not ahead but to the starboard, out along the wing. At length, frowning, he picked up a pencil and scribbled words on a note pad strapped to his leg.

"Strut vibrates: beef it up," he wrote. And moments later he added another notation: "Not enuf rudder control: make it bigger."

Of such stuff was a flight-test report made in 1923, on an experimental model of the PW-9. There was other developmental work, of a more exacting variety, to be sure. No scale model of the PW-9 was wind-tunnel tested, but it benefited from tunnel tests on similar planes. These were checked out in the wind tunnel at the University of Washington, where wind blew through a four-by-four test section at 50 mph. Structural tests were conducted by heaping sandbags on the plane until something popped.

Three experimental models of the PW-9 were built, test-flown and delivered to the United States Army. The cost was $40,734.22, a statistic considerably more precise than some of the scientific figures accumulated in research.

Initial costs like this are relatively easy to catalogue. It's more difficult to put a price tag on all the research that goes into any successful airplane, for its development is a continuing thing as long as it remains in Uncle Sam's arsenal of weapons.

For example, the cost of the first Flying Fortress, built in 1935, was half a million dollars—an exceedingly low down payment on a large part of the victory in World War II. But research continued through ten years of the Fort's service life, bringing with it the refinements that went into nine successive models of the plane.

Some quarter-century after the PW-9, the XB-47 was designed. Two experimental planes of this model were built, test-flown and delivered to the Air Force. Their cost was several million dollars.

Thus, like eggs, airplane development today costs a lot more than in any of the yesterdays. Unlike eggs, however, today's airplanes are vastly improved over their predecessors. They are that way because, most of all, aeronautical research has been improved; this, as much as the new-type planes themselves, is what the dollars buy. And, in today's world, it is a necessary part of the price of survival.

Just 138,000 engineering man-hours, for example, were included in the cost of the first experimental Flying Fort. Today's B-47B involves 3,464,000 engineering hours. In wind-tunnel operation alone, the time has mounted from 248 hours for the entire Flying Fortress series to 4800 on the B-47 up to the end of last June.

Today's research is many things. It is many engineers at drawing boards, at electric switches, at menometer panels and at the controls of mechanical brains. It is numerous branches of science, pooling their efforts. It is research facilities, staggering in their size and number, fantastic in their complexity—and a little bit of both in their cost.

Much of the effort and expense goes toward making our planes operationally superior to all others. But much of it also goes toward building safety into the planes; safety to protect the investment in the equipment, to protect the lives of crewmembers, and to insure that accidents will not prevent the successful performance of the mission.

Human error can cause accidents which will nullify the effort and expense invested in Air Force airplanes. It is up to the pilots and crews who fly and maintain the planes to make certain that this does not happen.

IN TODAY'S AIR FORCE there is one aspect of pilot training developed to a degree never before experienced in the history of aviation.

The one aspect is safety. Safety in the nest—the cradle where men learn to drive the world's fastest planes through the sky.

Student pilots today are as safe while learning to fly as veteran pilots who were flying airplanes before present day cadets started shaving. This was by no means always true. At the end of World War II the rate of major aircraft accidents among cadets was more than twice that of rated Air Force pilots. But since 1947 this student accident rate has fallen until now it is lower than that of the veteran pilots.

In the years between 1947 and 1950 the student flying accident rate dropped almost 42 per cent. For the first few months of 1951, it decreased even further and reached the lowest point ever. Depicted on a graph, it would show such a startlingly slanted line that it could make a man want to learn to fly just to keep from getting hurt.

The cadet training program accident rate is now something that the rest of the Air Force could well use as a goal. Putting it on an individual basis, a man would have to fly night and day without landing for nearly six months before having an accident in order to match the student rate. If the Air Force were to match the cadet rate, each pilot would be "permitted" to have one accident during his entire flying career. Realizing that the cadet's flying hours are filled with landings, takeoffs, acrobatics, practice forced landings, etc., makes their low-accident rate even more imposing.

To what exactly does the Air Force attribute this low rate of student accidents? It cannot be pinned down to one single factor. It is due to improved methods of training, a higher quality of instructors, and new training and safety devices—plus a flying safety consciousness such as the Air Force has never before experienced.

Better equipment spells more safety for the student. For example, the use of dual-control fighter airplanes in advanced single engine training permits the cadet to get his first taste of "the real thing" with the feeling of security which only a good instructor in the back seat can give. Previously, fighter checkouts were given only to the sharper students or were not given at all until the wings and bars which automatically made the cadet

afety IN THE NEST

Safety is as Much a Part of Cadet Training as a Loop

The training period of young "Bald" Eaglets is attentively supervised by their parents. The young advance, through their long term of infancy, from strength to strength, until, prepared by their persistent exercises and their play, with instincts sharpened and habits formed, they are ready for independent flight. Ardent exercise is required before they gain sufficient courage and proper coordination of muscles and nerves to leave the eyrie under their own power. After solo, several months are spent with their parents, who still continue to bring them food, and who conduct them on XC flights to the hunting grounds.

a "full-fledged pilot" were awarded. Whether the fighter checkout was given before or after graduation from flying school, it was much like teaching a man to swim by first explaining how and then pushing him off the dock. The T-33 has changed this.

In current jet training SOP's, modern equipment is augmented by standardization in training and more consideration has been given to the selection of instructors, who must graduate from an Air Force pilot-instructor school. This school covers an eight-weeks course for basic instructors and six additional weeks for advanced instructors.

Learning under the new techniques has proved to be far better than the methods used in the "good old days." The standardization simply means that every instructor teaches the same thing exactly the same way. Cadet Joe Doakes, who graduated from Goodfellow AFB, and Cadet J. Smoe, who was trained at James Conally AFB, could well have learned to fly with the same instructor. They were taught virtually the same thing.

As an example of a typical training base set-up for today's cadet, the 3525th Pilot Training Wing (advanced single engine), at Williams AFB, Chandler. Arizona, is a major training command base with the primary mission of turning out jet fighter pilots.

For the Williams cadet, this turns into a two-fold job of (1) learning to fly the F-80, and (2) accepting the

Holt

responsibilities of a commission in the Air Force. Starting out at this base the cadet taking the advanced jet course will check out in the T-28, the T-33, and the F-80.

From the academic standpoint, the jet cadet receives a definite course of instruction in flight planning—a new teaching technique designed to give the student, as nearly as possible, actual experience in cross-country flights before he leaves the classroom.

Another advanced training aid used at Williams is the Captivair Trainer. An F-80, the Captivair is anchored in concrete and used to give the cadet various emergency procedures before his T-33 solo hop. In the Captivair, he is checked on his preflight, taxi, takeoff, climb and cruise. Then he makes his landing approach, lands, taxis and stops.

The Captivair arrangement includes a glassed-in "classroom" near the plane where an instructor sits before a panel of F-80 instruments with which simulated emergencies can be set up to include a flame-out, fuel pump failure, fire warning, hydraulic failure, low oil pressure, and electrical failure among other emergencies.

The Link and Dehmel jet trainers, more than ever before, are affording better and more realistic training on instruments. The ground-bound Link has been given a jet overhaul. In addition to getting jet plane instruments, the new trainer has a check-pilot station behind the cockpit for the instructor to set up emergency procedures. The old Link "crab" is displaced by recording equipment which provides a tracing of both ground track and altitude profile of the flight.

Other training aids for safety include the altitude chamber where the cadets "check out" and learn something about the effects and dangers of the lack of oxygen encountered in high altitude work.

The ejection seat tower is still another new and modern safety training aid to indoctrinate jet pilots on just how it feels to be "ejected" from a jet plane.

Except for the T-6, the old mnemonic check list is strictly outmoded and so for his T-6 time only, the cadet learns CIGFTPRSS which is, of course: C-controls, I-instruments, G-gas, F-flaps, T-trim, P-prop, R-runup, S-shutters (oil and carburetor heat), and S-shoulder straps.

The primary trainer has been eliminated; replaced by the T-6. According to the Training Command, this is in line with the advances made in aviation during and since the war, and the natural trend has been to place the students in faster and heavier aircraft earlier in their training period.

Ten years ago it would have been considered madness to send a cadet solo in a 600-mile-an-hour plane; now it is a routine part of the jet training program.

Lt. Colonel Charles Sawyer, Flying Safety Officer for Williams AFB, listed formation flying in jets and oxygen discipline as two of the hardest phases of flying training for the jet student. Otherwise, the cadet in the jet was readily learning advanced flying.

Oxygen discipline as outlined in a training group memo emphasizes for safety no less than 400 psi in the system. Besides requiring the pilot to make a positive check of the oxygen system for proper hook-up and operation, safety SOP's call for NORMAL position of the oxygen pressure dial below altitudes of 30,000 feet; SAFETY position between 30,000 and 40,000 feet, and above 40,000 feet set pressure dial to altimeter.

To help the student safely over the hump in formation flying, training is conducted in elements of two aircraft in flights of four. After the students are checked out to fly solo wing positions, there is a minimum number of changes in their respective positions. Cadets make individual takeoffs until proficient for formation takeoffs.

Some 13,000 to 14,000 flying hours a month are racked up by the cadets and instructors at Williams, Colonel Sawyer said, and three to four landings an hour are averaged.

In completing the advanced jet course, the cadet flies a combined total of 135 hours in the T-28 and the F-80. This time is broken down into transition, formation, navigation, instruments, acrobatics, and fighter tactics. Seventy hours of this flying time are flown in the T-28 and 65 hours in the F-80.

"Fifty per cent of the students check out in the T-33 after about four hours dual," said Colonel Sawyer. "Another twenty-five per cent will check out in five to seven hours, while eight hours will be required for ten per cent of the cadets," he added.

With the largest percentage of training accidents happening on landings and takeoffs, Colonel Sawyer pointed to the mobile control as used at Williams. Manned by control officers, this unit monitors student landings and go-arounds. At the head of the active runway on the inside of the traffic pattern, the mobile control is occupied by the flight commander and his assistant until a student average of 20 hours is reached.

Besides grading impartially all traffic patterns, the senior mobile controller clears aircraft, stands ready to advise in an emergency, checks landing aircraft and acts otherwise as a modern safety aid to accident prevention.

An example of how the improved training program with increased emphasis on safety is paying off could be this emergency landing made by a student of a recent class:

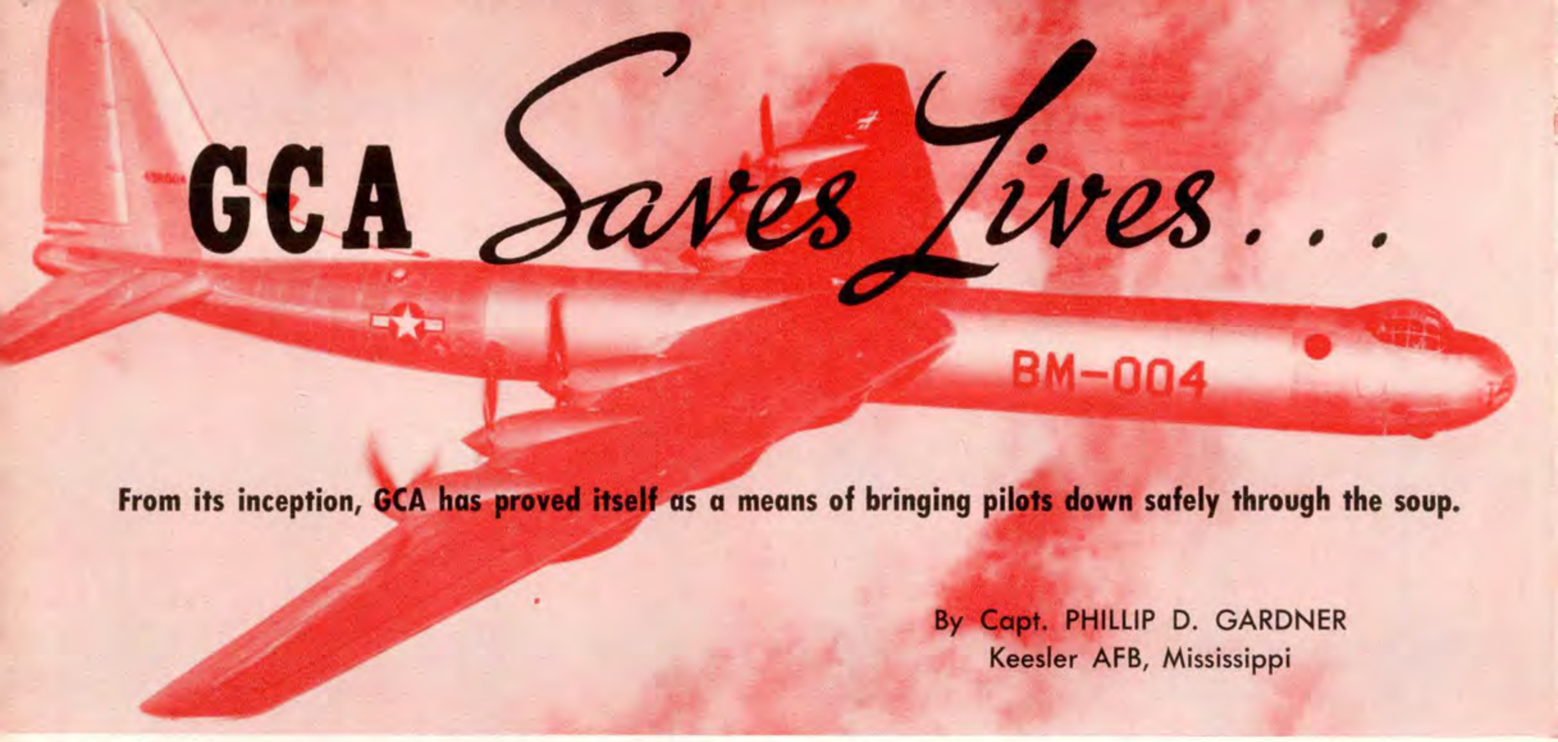
Flying an F-80 in a flight of four on a week-end cross-country and at an altitude of 25,000 feet, the cadet pilot noticed a sudden vibration. Throttling back from 96 per cent, he dropped to 20,000 feet and then, with the boost out, the vibration increased. Shutting off the throttle and all accessories except his radio for contact with the flight, the student began his letdown for a nearby field.

With the aileron boost turned off at 10,000 feet altitude, the student lowered the gear by the emergency system and hand crank, established a pattern and made a dead stick landing safely. This cadet knew his F-80.

Unlike flying the conventional plane, the high speed and high fuel consumption of a jet calls for more precise flight planning and quicker decisions in the air. Better training is required on emergency procedures and flight problems.

According to instructors at the advanced school, these problems are accentuated for instrument flight. The jet's high speed through turbulence, for instance, makes rugged instrument work. Continuous bouncing may cause the gyros to drift, and a small change on the indicator can lead to a large change in the flight path. Or a couple of thousand feet can be lost in a slight turn in a matter of seconds if the pilot relies on the artificial horizon only.

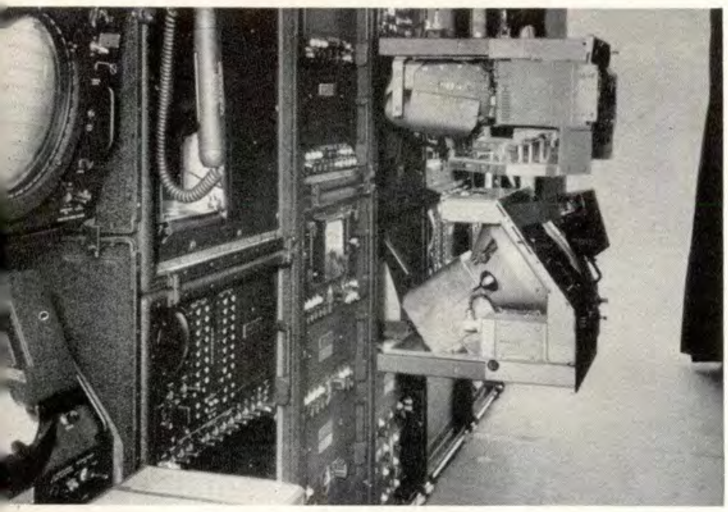
And so because of this fast and high performance of the jet airplane, the pilot training program has become more flexible—and important. Add to this the different nature of the jet engine and the problems of high speed flight and the advanced program justifies the increased attention to flying safety and the use of new training aids. Through these contributions "safety in the nest" keeps pace with the present and the future.



GCA Saves Lives . . .

From its inception, GCA has proved itself as a means of bringing pilots down safely through the soup.

By Capt. PHILLIP D. GARDNER
Keesler AFB, Mississippi



CPN-4 interior showing scopes pulled out from racks for maintenance. Accessibility is stressed throughout the new GCA units. Below, an operator checks air traffic on the GCA scope located in the control tower at the Los Angeles airport.

THE GCA-ILS CONTROVERSY is a closed issue. Yet in spite of the overwhelming evidence that Ground Controlled Approach is superior to all instrument landing systems, there are still a few fine pilots who, with a raised eyebrow, exclaim: "Well, GCA may be all right, but—." And occasionally the old-timer (the pilot from the old school, the individual whose total flying time is approaching infinity) often declares with firm conviction: "Gimme ILS. I was brought up on it. It can't be beat."

Why such opinions?

Let's take a look at the record, the official record. Time: 1945. Place: CAA Experimental Station, Indianapolis, Indiana. Mission: To settle once and for all the GCA-ILS controversy.

It happened like this: Ninety-one pilots were selected. CAA, Air Force, the major airlines—all were represented. Using a C-54 aircraft, the pilots made a series of simulated instrument approaches, first on GCA, then on ILS. Glidepath and azimuth deviations were recorded on Easterline-Angus graphs. The tabulated results were more than convincing—they were staggering! Here's one example:

A group of Air Force fighter pilots whose average flying time was only 805 hours were selected to make GCA approaches, while a number of CAA and airline airmen (with an average of 3,640 hours of flying time) were selected to make an equal number of ILS approaches. The Air Force pilots had never made a GCA approach before. Each of the civil pilots had made several ILS landings, the average of the group being 110. But, in spite of this, the fighter pilots were 350 per cent more accurate in their approach alignment.

This, naturally, demonstrated the superiority of equipment, not pilot technique. The Air Force pilots were mere fledglings in comparison to the civil airmen in this case. It did, however, establish beyond all doubt the simplicity and superiority of the GCA system.

And here is some more from the official record:

Dr. Luis Alvarez, the genius behind GCA, was awarded the Collier Trophy in 1946 by President Truman "For his conspicuous and outstanding initiation, and effective demonstration and use of the Ground Controlled Approach System for safe landing of aircraft under all weather and traffic condition." After voting unanimously for Dr. Alvarez, the Collier Award Committee referred to Ground Controlled Approach as "The greatest achievement in aviation in America, the value of which has been demonstrated by actual use during the preceding year of 1945."

And that isn't all. What about the unofficial record? What about the testimony of many pilots, who finding themselves in the soup with no apparent means of assistance, suddenly realized that they were being guided to the runway by GCA?

Files are filled with letters from pilots and GCA operators alike, expressing gratitude, appreciation and pride for the way in which GCA has come through to save lives and airplanes when the chips were down. Here are a few samples of such letters, all written early in 1945 while GCA was still a brand new thing.

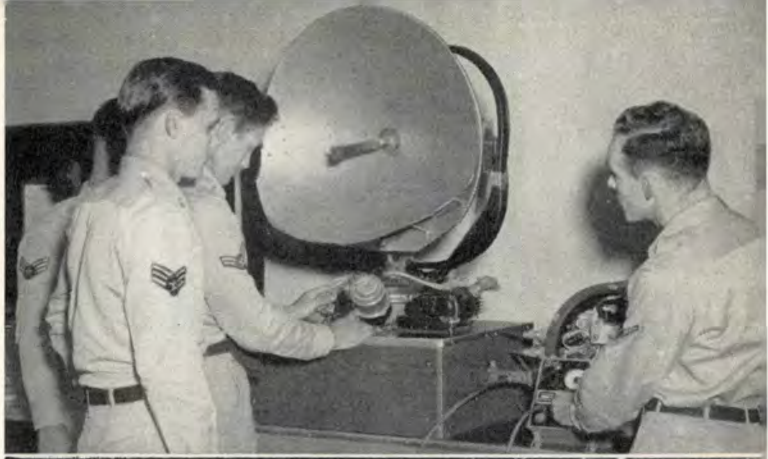
The first is from a GCA technician who accompanied one of the first sets to England during World War II:

"On February 12th, the tower asked us to bring in a C-47 over the base, which we did. Sergeant Cope did the controlling and I was on the PPI. Conditions were 150 feet ceiling and one-half mile visibility. The pilot said that all he had to do to land was make a three-degree correction. He insisted that we also bring in another C-47 which was flying down supplies to him that afternoon. We did this although the ceiling was 800 feet. HF transmission and reception on Darkie 6440 was good out to 15 miles, even though there are several code stations and some enemy jamming on this frequency."

"One afternoon a transient B-26 very low on gas called in. He was lost. Conditions weren't very bad—800-foot ceiling but it's quite hilly around there. He was picked up by GCA, brought down on the shortest path possible so that when he broke out he was in a position to land, which he did. He had 30 gallons of gas left when he landed. As soon as he got out of the plane he drove over to the trailer, rushed inside, threw his wallet, cigarettes, and change on the ledge and said, 'Take them; they're yours. Next time I come by here, I'm bringing a case of scotch if I can beg, buy, or scrounge it.' "

"In my letter of March 10, I mentioned bringing the transient B-26 down through 100-foot ceiling and one-fourth mile visibility. I forgot to mention that when I gave him his first instruction, he answered in a doubtful voice, as if he thought he was being tricked. The tower operator, an ardent GCA fan, immediately called over the R/T: 'Hello, Freeman Green Leader, you are about to be landed by RADAR!' Whereupon Freeman Green Leader replied: 'Radar? Dammit, it's great stuff!' From then on he did everything he was told and seemed completely confident that he'd make it down OK. He did."

The second letter, which follows, was also written from England by another GCA specialist:



In the photos above, trainees learn the principles of radar at the GCA school at Keesler AFB. At the school the trainees are thoroughly checked out on a GCA trainer which closely simulates an actual letdown of aircraft.

"At 0800 the ceiling was 300 feet and the executive officer, Lt. Col. Podwosky, was trying to get down after returning from a mission. He had never flown the system before. He was having some trouble with the aircraft and could not correct fast enough so the first pass was off in azimuth (right over the trailer). The controller told him he was too far to the left and to pull up and go around. The second pass was perfect and the aircraft landed in the middle of the runway. The tower didn't see the plane until he was over the end of the runway, visibility was approximately one-quarter mile (the pilot was happy!).

From Iwo Jima, in early 1945, came this letter, written by a Wing GCA officer for AACS in the Pacific:

"I wish you could have been here recently for what might be called our initial triumph. For intense drama it has never been equaled. We've had probables, but there were no ifs, buts, or maybes, about this one. Today, a B-29 still flies because of us, and 11 men feel that we saved their lives.

"Imagine a 100-foot ceiling, less than a mile visibility, a strong crosswind, severe turbulence, a hazardous obstacle about a mile away just off course, a new type of aircraft—the odds were certainly against us, and it took four tries, but we made it just before we ran out of gas."

So, that—in a nutshell—is the story of Ground Controlled Approach. It's a fine system. It's here to stay, make no mistake about that. Accepting it as such, then, how are you, as a pilot, going to reap the maximum benefits from the use of this equipment?

The following tips on technique are from a variety of sources: operators in the field, the results of accident investigations, the GCA operator school at Keesler AFB, Mississippi, and just plain horse sense.

KNOW YOUR MINIMUMS—Ground Controlled Approach is not a blind landing system. There is no such thing— yet. True, a few pilots have actually landed blind on GCA, but those cases are rare. There is no substitute for human sight during those last critical seconds of the landing process. Check the Radio Facility Chart for the established minimums. It might save your neck.

WATCH THAT AIRSPEED — Every pilot who has flown GCA is familiar with the operator's query: "What will be your speed on base leg and final?" Why? On the downwind the operator has to place you in the pattern and establish a reasonable base leg. And then the final! The only way the operator can hope to keep you on the glide-path is by knowing your airspeed in advance. And it must be constant. If you say one forty, keep it reasonably close to that figure. Five miles per hour either way doesn't make much difference, but any more than that can cause trouble. It doesn't take a great deal of meditation to realize that you fly above the glide-path with an increase in airspeed, and below the glide-path with a decrease in airspeed.

LISTEN TO THE OPERATOR—It is always a great temptation to ignore the voice of the controller when you break through the soup. The sight of the runway lights, or the runway itself, is a mighty welcome sight—if it is actually what it appears to be. But, you might be wrong. It's very embarrassing to end up on a taxi-way, or a runway situated a few degrees off the one GCA is using. Besides that, it's an ignominious way to die.

POSITION REPORTING—When you are being picked up by GCA from a range station or other fixes, report your position when you are over the fix, not two minutes before or three minutes after. This was especially troublesome during the Berlin airlift. During congested traffic periods, an error of only a few minutes in your position can easily result in misidentification, which is not only confusing but contains within it the seeds of disaster.

ACKNOWLEDGMENT—The GCA approach is the result of organized teamwork. There can be no organized teamwork without the application of precise procedures, of which "acknowledgment," in this case, is an excellent example. Somewhere in the pattern you hear the operator make this request: "Repeat back all headings and altitudes as given, and acknowledge all other transmissions." Again, why? If you failed to acknowledge, how could the operator possibly know that you received his instructions? But why repeat the headings and altitudes, you ask? When the operator says to maintain nine thousand, you are so sure he said five thousand that you feel a repeat-back is a waste of time—that is until you suddenly realize that you have switched copilots with the C-45 you just flew through.

It is, of course, impossible to acknowledge transmission while on final. Once you hit the slot, just listen and follow instructions. Every pilot knows that, of course. But—.

THE PPI ASSIST—Did you ever hear the operator say: "Our precision system is out, but we can give you a PPI assist." Unless you are a radar man or an ex-operator, or one who has bothered to investigate GCA at ground level, or just plain psychic, you were no doubt pretty much in the dark. Perhaps a word along that line might be appreciated.

In the first place, a PPI (Planned Position Indicator) is just a search scope. If the word "search" in this case is without meaning to you, just simply think of GCA without the glide-path and precise azimuth information. Now, when the precision system goes out, you are not completely deserted. The GCA operator can still "see" you. Legally, he can bring you down to the normal range minimum established for his field, and during an emergency (unable to proceed to alternate because of fuel shortage, etc.), he can do better than that. If conditions are not too severe, he can assist you through the soup to a point from which you can make a safe visual landing.

DON'T ASSIST THE CONTROLLER—Many pilots are guilty of this during practice approaches. It's mighty tempting to give yourself and the operator a break by making a visual line-up on the approach. But remember this: that man you are cheating out of an honest practice run may be the fellow at the scopes the next time it's a case of your hide versus the elements.

THE GREAT JET DIGESTION CONTEST

By RID DOWDING

(Reprinted from AVRO Canada NEWS)

It was a hot, dusty day in early fall, just the sort of day that had become associated with the great annual digestion championship, organized by Jet Engines International, Inc. of New York and Detroit, and the great concrete arena was thronged with people from all over the world.

To initiate those not familiar with the great sport of jet digestion, the general idea is to feed all types of junk, garbage, ice, small dogs, ground engineers, and so on, into the air intake of jet engines while operating at maximum conditions.

No type of jet is barred, but various classes are organized to give the small manufacturers a chance; class winners can then compete for the open championship, and fame and fortune, or ulcers!

The year of which I write, saw Peruvian Jet Motors, Ltd. a class winner, their two-stage centrifugal compressor having swallowed without damage, 100 pounds of two-inch ice cubes, three bags of assorted nuts and bolts, ten baseballs and a hub cap from a passing truck. This last effort won special praise from the judges, although their nearest opponents lodged a protest, rather pointlessly, seeing that they had lost their complete compressor trying to digest such a trifling item as a newsman's "speedgraphic."

The Ukrainian entry had topped its class too, but was disqualified on grounds of intimidation of opponents, by use of massed bands who had been instructed to hurl their entire brass sections into any motor not withdrawing from the contest. (The effect of a tuba passing through an axial compressor is no laughing matter!)

Eventually the championship lay between a real hush-hush entry from the mid-west, sponsored by Snodgrass and Cracknell, the great meat packers, and the Canadian entry sponsored by its manufacturer, Joe Row's Whizz Bang Motor Company of Toronto.

The Snodgrass job was a beautiful thing, a two-stage centrifugal compressor driven by a two-stage turbine, believed made by an old GM man especially for digestion contests; tastefully finished in royal blue and chrome plate, the tail cone was inscribed with the legend "Snodgrass and Cracknell's pork products, all hog from the word go."

Joe Row's entry was a sleek, low consumption high output axial engine, just loaded with appeal, and by its remarkable digestion performance, quite a comer. Already in the class elimination rounds, the Joe Row "Big Chief Hot Shot" had surpassed the digestion records set the year previously.

Starting with the usual ice cubes and riveting guns, compulsory in the big motor classes, the "Hot Shot" had worked its way up to the finals through an unprecedented collection of old phonograph motors, electric clocks, tray loads of canteen cutlery, and old files.

The Snodgrass challenger was no slouch, either; it digested a set of old Ford pistons, 30 empty anti-freeze cans, an old Remington typewriter, and, of all things, a Trilite lamp.

But, compared with the finals, all the foregoing was chicken feed.

An expectant hush fell on the crowd, as the rising whine of the run-ups filled the air, and the white-coveralled "feeders" took their positions, tightly strapped into their screened steel chairs, looking like umpires at a tennis game. The system in the finals took the form of challenge and counter challenge, and Joe Row, having made highest points in the elimination, ran up a wonderful opening challenge on the big electrical signal board: "150 feet of bailing wire" (the maximum allowed), and the fight was on. The end of the contest would only come when either a motor blew up or a challenge was not accepted.

To cut a long story short, Joe Row won! The totes paid a high price, having had few backers on an axial in the finals, but as night was falling and the great batteries of light came on, Snodgrass made a challenge he thought sure would finish the Row entry—but good. "300 pounds of paper" flashed across the signal board, and if there's one thing that will really stall an axial engine, it's too much paper. Joe Row raised a protest, but the judges allowed the challenge, and the feeders let go with 60 bundles of obsolete blue prints. The "Big Chief" dropped a few hundred rpm, surged violently, and almost stalled, but after a show of sparks, all was well.

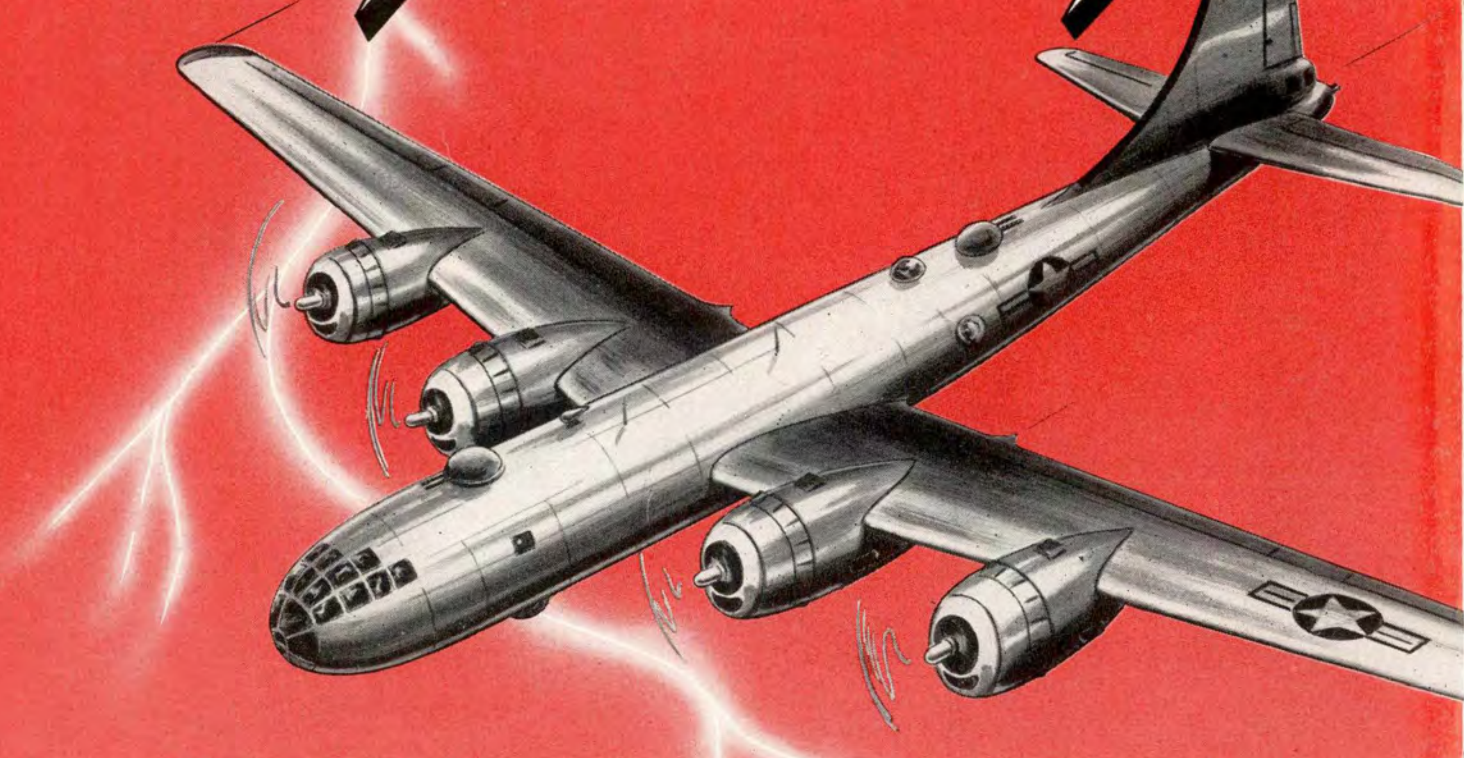
Stunned at first, the crowd roared approval and then it was the Snodgrass special's turn to try its own challenge. After the 30th bundle of paper, Mr. Cracknell's pride and joy was really losing steam and on the 55th bundle, it stalled—dead!

Nothing spectacular! No flying turbine blades—but an axial had won the championship!

Well, you might think that that was that, and it was—until an ad appeared in "Consumer's Report." I quote: "The Acme Meat Slicer and Garbage Disposal Unit Mfg. Co. announces their great new rotary slicer and crusher, as used recently in the winning entry of the Jet Digestion Contest."

The case proceeds.

Lightning



All metal airplanes and all-weather flight have made lightning a hazard which the pilot must consider.

ONE MAN'S THEORY for the cause of lightning is that the God of Thunder has not yet become sufficiently advanced to equip his chariot with rubber tires. When old Thor goes dashing across the sky, the iron rimmed wheels of his chariot crashing against the rocky roads of the cumulonimbus throw off monstrous sparks which we, mere men, have tagged lightning. The sparks thus cast off usually appear to earthbound creatures as exciting displays of Thor's temper. They often cause fires, destruction of man-built objects and occasionally death to some luckless one who happened to be standing in the wrong place at the wrong time.

But lightning means other things to other people. To those who fly the skies in airplanes while the God of Thunder is on one of his chases, lightning becomes something awesome in its vicious appearance, fearsome in its ability to wreak havoc with the plans and planes of pilots. Mostly, lightning is content to be just a threat to flyers. Occasionally, it will vent its fury on one who has the temerity to enter the same sky with a thunderstorm, just as a warning to airmen not to grow disrespectful of lightning's potential as a hazard to airmen.

A C-47 enroute from Westover AFB to an overseas base, droned monotonously along at altitude. Everything was normal and the crew relaxed in a smooth ride through the cold air. Then the plane entered a cloud and with paralyzing suddeness a bolt of lightning smashed a dent into the left side of the nose of the C-47, splintered the side window by the pilot, shattered the windshield and continued through the fuselage to erupt at the tail of the plane, ripping away a square foot of the fabric covering the elevator.

There were no injuries to the crewmembers. The plane, which was northeast of Seven Islands, Labrador, when it was struck by lightning, was brought in for an emergency landing at Goose Bay, where the necessary repairs were made.

The pilot reported that the flight had been routine until the plane entered a cloud, when the cockpit was suddenly filled with flames and the lightning had done its damage and disappeared.

In another case, near the end of a "routine training flight," a B-29 with the usual crew was struck by lightning while flying on instruments with normal power settings at 12,000 feet.

The pilot stated that there was no previous warning or display of electrical phenomena, such as St. Elmo's Fire. The lightning first formed in front of the aircraft and assumed the shape of an ellipse with projections horizontally on either end. The aircraft passed through the center of the circle causing the extreme tips of the wings to strike the ring of lightning which clung to the wing momentarily, then disappeared.

Two holes were burned in the trailing edge of the left wingtip. One hole was approximately one-half inch long and the other approximately three inches long.

These are only two examples. Flight Safety's files contain many more. In a recent period of less than four months, nine airplanes of MATS alone received sufficient damage from lightning strikes to be classified as aircraft accidents. Definitely, the danger is there.

Usually, though not always, lightning strikes do not cause sufficient damage to knock airplanes out of the sky. Ailerons, elevators and wingtips may be extensively damaged; fuselage skin and formers may be burned, buckled and fused; communications and ADF equipment may be knocked out; and magnetic compasses may be put out of operation or rendered unreliable. Such damage is seldom fatal, but it's easy to see how the results of the damage may have serious consequences.

Look what happened to a MATS R-4D which was being flown by a Navy crew:

"The flight was proceeding at 9,000 feet through a cold front. The weather encountered was typical—moderate turbulence, frequent lightning, sleet and snow. A sudden flash of lightning more vivid than those preceding was noticed. Immediately thereafter, the pilot noted a burning odor, which was traced to the propeller de-icer pump located aft of the pilot's seat. The de-icer pump was turned off. The flight mechanic detached a CO_2 fire bottle and stood by until the motor had cooled off.

"As he turned to station himself in the radioman's seat, he discovered flames flickering up through the floor boards directly under the radioman's seat. Immediate, efficient and cool-headed action on the part of the flight mechanic averted a serious incident. He seized the fire axe, chopped a hole in the flooring under the radioman's seat large enough for the nozzle of the CO_2 fire bottle, and expended the entire contents which extinguished the fire.

"Examination after landing revealed the following damage:

- The wire lead-in from the ADF was melted at the insulator.
- The de-icer pump motor was fused.
- Two holes were made in the alcohol supply line, permitting the fluid to flow out. This was then ignited and resulted in burning the spun glass insulation covering the hot air duct leading to the heater supply distributing manifold which had become saturated with alcohol."

Lightning accidents have in the past been rather unceremoniously tossed into the category known to Forms 14 experts as "Acts of God." It was realized that so long as men will make like birds and defy the elements in so doing, such accidents are bound to happen. And the attitude has been, "If they're bound to happen, why try to prevent them?"

We won't say that all such accidents can be avoided. We will say that there are some things which can be done to reduce the probability or possibility that your plane will be struck by lightning. Further, there are things you can do to reduce the severity of the consequences of a lightning strike. These procedures have been developed over the years, and they are all based on experience.

First, what can the pilot or pilots do to increase the chances of a lightning-free weather flight? Most preventive measures consist of avoiding flight in certain areas. First, avoid flying through large or towering cumulus and cumulonimbus clouds. If you must fly through such clouds, try to pick a level where the temperature falls outside of the 25 to 35° Fahrenheit range. It is in the temperature range near freezing that lightning is most likely to sock your plane. The same goes for rain, snow, sleet, hail and ice crystals, especially when such precipitation is from cumuliform clouds. Avoid flying through if possible; if not possible, try to choose a level where the temperature is not in the range given above.

A rule which holds for VFR as well as IFR (yes, airplanes can be lightning-struck even though they're not flying in clouds), is to avoid flight within 2500 feet of cumulonimbus clouds, especially if they have given manifestations of thunderstorm activity. Stay out of range, in other words.

If, during a weather flight, you should encounter moderate to severe precipitation static and/or corona discharge (St. Elmo's fire), also if it is evident from the temperature, cloud and precipitation conditions that you are in a zone of strong potential gradient, there are two things you should do. First, reduce your speed consistent with the Tech Order prescribed thunderstorm penetration speed for the plane you are flying. Second, descend to a lower level, if it is possible to do so, where the temperature is above 35°F. (above 40°F. is preferable). An even better solution, of course, would be to get out of the given cloud and precipitation conditions.

The measures just given are designed to avoid lightning strikes. Obviously, it will not always be possible to avoid areas where lightning is likely, so you must run the risk of being the subject of an electrical experiment in the heavens. There are things you can do to lessen the seriousness of your situation. Best known to pilots is the old warning, keep your cockpit lights turned on bright and keep your eyes on the instrument panel. The purpose, of course, is to prevent being blinded by the sudden flash of light. Sun glasses or a long visor to protect the eyes from an external flash might prove helpful, also.

Another measure is to have your auto-pilot set up and ready, so that you can engage it and depend upon it to keep you straight and safe for a few minutes till you can see again if you should be momentarily blinded. Other steps are to reel in any trailing antennas and to keep your headset on loosely to prevent acoustic shock.

Thunderstorm activity is not necessary for lightning strikes. They have occurred during flight in clouds where no thunderstorm indication existed. But these are the exceptions. Also, lightning strikes of aircraft may occur at any time of the year. But most do occur in the spring and autumn seasons, between noon and 1800 local standard time. Probably the reason that most strikes occur in these two seasons is the prevalence of frontal type thunderstorms which are more difficult to avoid because of their extensive lines. Summer thunderstorms are usually scattered, being caused by local heat, and can more easily be circumnavigated. When lightning does hit a plane flying in a thunderstorm, it most often happens when precipitation is falling in the frozen state (snow or sleet) and when the temperature is within a few degrees either side of freezing.

Probably you won't agree with the theory that lightning is really just a spark from Thor's iron rimmed chariot. Confidentially, we don't agree, either. Regardless, there is still much to be learned about the phenomenon of lightning as it affects airplanes. The Air Force has executed a contract with a civilian research institute to study the problem, and before too long it is hoped that a solution will be found and lightning struck aircraft will be things of the past.

Meanwhile, there are things that pilots can do, both to reduce their chances of being struck, and to minimize the danger if their planes should be struck by lightning. We have tried to present them in this article.

As a parting word on the subject, don't pay any attention to the old rag that lightning never srikes twice in the same place. If the potential is there, if the conditions are conducive to lightning, this "king's X" doesn't go. You'd best be on guard.

WHAT'S WRONG with this picture ?

Except that the inspection flap is turned back, the parachute in the picture on this page is just as it was turned in to a base parachute shop to be repacked. It's unfortunate that the name of the person who last used the chute could not be determined—records which would have given this information were destroyed as soon as the parachute was turned in and the discrepancy was not discovered immediately. But whoever the man was, he would probably be very interested in knowing the condition of the piece of equipment he was depending upon to save his life, if he'd had to bail out. He might have been a little bit unhappy, too.

You've probably discovered what is wrong with the parachute in the picture. The ripcord pin on the right is not only bent, but it is also installed in reverse. And, being made of stainless steel, it would take a mighty tug on the ripcord to break it so that the chute could open. If the lucky man who last wore this parachute had found it necessary to use it, he quite likely wouldn't have been able to carry it back and trade it in for a new one. Yes, he was lucky . . . but only because he didn't have to bail out.

Before anyone jumps to conclusions as to who was responsible for the discrepancy, we hasten to add that it is extremely unlikely that a parachute rigger could have made such an error. It is much more probable that someone else committed the crime after the chute left the shop. Who would have done it? Who knows?

What all this points up, of course, is that it is entirely up to you to inspect your chute before each flight. You can't depend upon the man who last used it to make this inspection for you. It's your life and it's up to you to look out for it.

Making a routine inspection of your parachute before each flight should be a habit with you. Here's what to check:

- Harness and parachute pack for condition, oil or grease stains, acid stains, dampness.
- Ripcord handle and cable for freedom and proper threading of the cable through the conduit.
- Open the flap which houses the pins and the packer's seal. Make sure the pins are not bent; that they are properly installed, and that the packer's seal is not broken.
- Check that the elastic bands which pull the chute open are in good condition.
- Check the date of the last inspection and repack. Chutes should be repacked every 60 days and inspected every 10 days.

Remember that if anything about the parachute is not as it should be, it's not only your privilege, but it's also your responsibility to turn in the chute and demand another. And you should also use some of that initiative flying people are supposed to possess in abundance to see if you can find out what caused the trouble and correct it if possible.

Parachutes were developed originally to fill a crying need for some sort of device which would lower an airman safely to the ground when his flying machine became no longer tenable. Take care of those chutes—they fill the need all right when they are properly cared for and used. If they aren't properly treated, however, the crying may still be with us.

LOOK and LIVE

Dear Mr. Finletter:

In our unceasing effort to prevent mid-air collisions, the Civil Aeronautics Administration is presently conducting a campaign to encourage pilots to be constantly on the alert for other air traffic while in flight.

As a part of this campaign, I have authorized the distribution of copies of the enclosed letter to all active civil pilots. In addition, we are publicizing on the back page of the *Airman's Guide* our motto: "LOOK AND LIVE," and certain other information which is considered to be of utmost importance to flight safety. It is further proposed to bring this vitally important message to the attention of all pilots through the media of newspapers, aviation publications and nationally prominent aviation enthusiasts.

It is known that a knowledge of the factors which cause accidents is the strongest tool in accident prevention. In this respect, the record indicates that the majority of mid-air collisions have occurred during good weather. Consequently, it is apparent that one of the basic causes of such accidents is the lack of vigilance by the pilots in maintaining a constant watch for other aircraft in flight. We can rightfully assume, therefore, that it is possible to prevent many of these accidents by adherence to the fundamental message conveyed in our motto: "LOOK AND LIVE."

We must, of course, have the aid and cooperation of the military services in order to carry out this campaign successfully. Accordingly, similar letters are being forwarded to the Secretary of the Navy, Secretary of the Army, and the Commandant, United States Coast Guard.

It would, therefore be sincerely appreciated if concurrent action, as you may consider appropriate, could be initiated within the Air Force to bring this vitally important message to the attention of all pilots.

Sincerely,

C. F. Horne,
Administrator of Civil Aeronautics.

Dear Mr. Hor

I have read
your letter of
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rely yours,
mas K. Finletter.

Dear Fellow Pilot:

The records show certain hard cold facts regarding mid-air collisions which I want to bring to your attention. In recent years in the United States, there have been eleven collision accidents involving scheduled air carrier aircraft and other aircraft, either military or civil. One hundred thirty people lost their lives in these accidents. From the beginning of the year 1947, to date, there have been 110 mid-air collisions in the United States involving other civil aircraft with a resulting loss of 127 lives. This loss of life demands our attention.

An analysis of mid-air collisions on record has revealed that the majority of these occurred during VFR weather conditions. It is realized that there are many factors, in addition to weather, which may contribute to this type of accident, such as cockpit visibility and the necessity for attention to instruments and controls within the cockpit. Nevertheless, it is believed that many of these accidents could have been prevented had the pilots of the aircraft involved been diligent in maintaining a constant and vigilant watch for other aircraft in flight.

It is always important to remember these memorable words: "Aviation in itself is not inherently dangerous, but like the sea, it is terribly unforgiving of any carelessness, incapacity or neglect."

I firmly believe that you, as an active pilot, can exert the strongest force in the prevention of near-miss incidents and mid-air collisions. You have the opportunity to save your own life and the lives of other people by *always* paying careful attention to other air traffic and by being on the lookout at *all* times in flight. I am sure you will agree that, with the advent of faster aircraft and the continuing growth of civilian and military aviation, this is an absolute necessity.

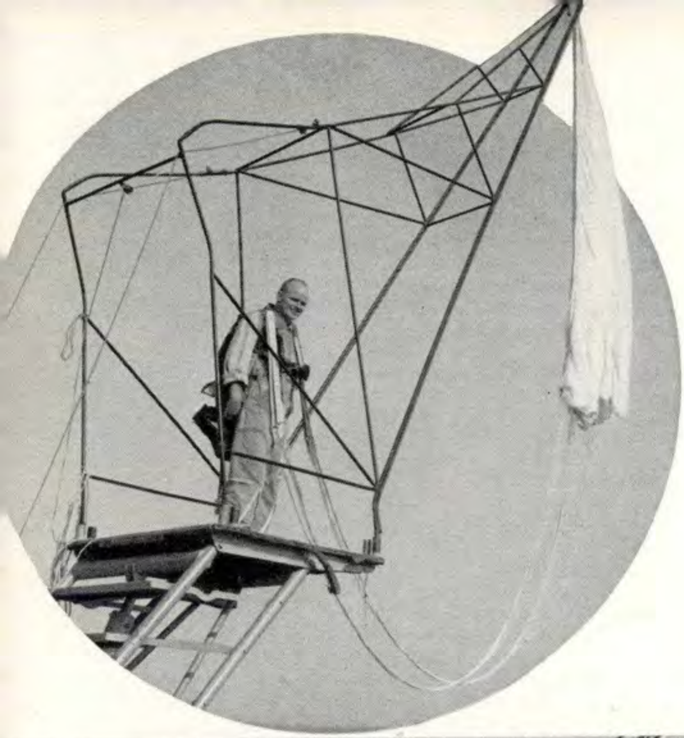
I know you are as vitally interested as we are in preventing mid-air collisions. We can go a long way towards accomplishing our objective if we make the motto "LOOK AND LIVE" really mean what it says.

Sincerely yours,
C. F. Horne,
Administrator of Civil Aeronautics.

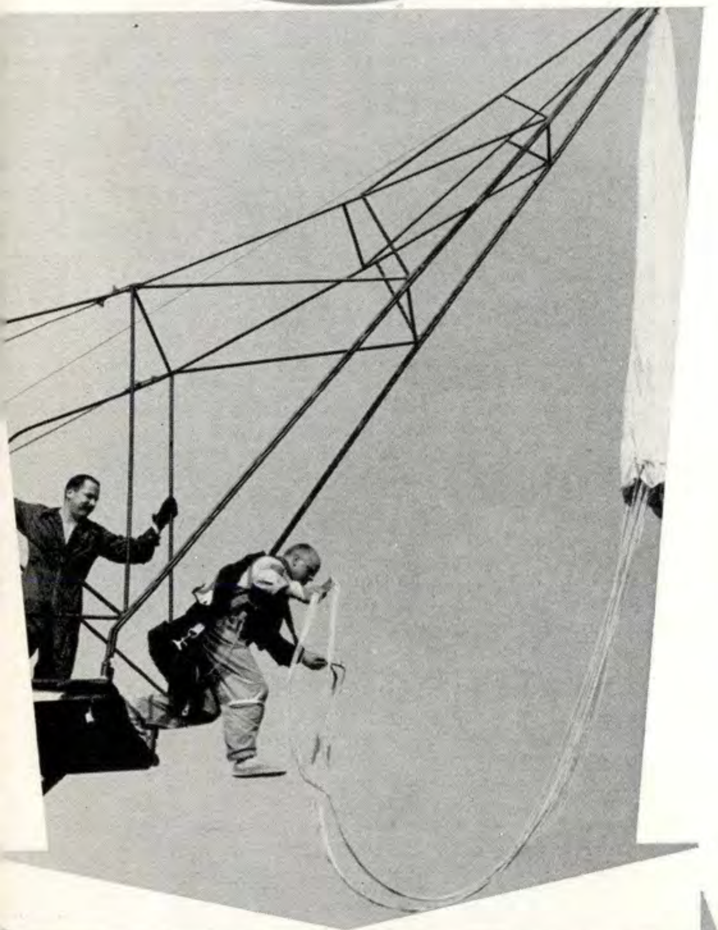
An IFR flight plan will not guarantee separation from uncontrolled traffic when the weather is VFR. Be alert at all times for other traffic.

Keep to the right, particularly in congested areas and when climbing or descending unless otherwise directed by Air Traffic Control.

When VFR, fly at prescribed quadrantal altitudes. Remember that climbing or descending VFR traffic may fly through your altitude.



Operation



FLYING CREWS of the 47th Bombardment Group, Langley Air Force Base, Virginia, were very busy this past summer with their combat crew training program. One phase of the program which kept them hopping was that known locally as "Operation Dunk." This was actually a water survival course, or at least the early stages of such a course. It carried crewmembers through entering the water via parachute, getting free of the chute, inflating the "Mae West" and readying and entering the dinghy.

It seems that the B-45 has been found to be something less than the perfect plane for ditching purposes. It's fine in the air and can do the job it was intended for and do it well. But when it comes to ditching, the horse changes color. Since the 47th Bomb Group is equipped with the Tornado, and since the Group does a considerable amount of over-water flying, crewmembers are preparing themselves to use their parachutes as a possible alternative to ditching the planes.

The training program which has resulted insures that an airman who bails out over water will get off to the best start possible. It has been made very realistic.

A "Rube Goldberg" type contraption, a cross between a tower and a crane, was assembled and installed on the boat dock at Langley. From the upper end of this tower a parachute was suspended, and a scaffold was built about 20 feet above the water level. The trainee, strapped into the chute harness, jumps from the scaffold into the water; another man releases the suspended parachute on top of the jumper; when the man hits the water, things get as realistic as they can. First of all, he has to scramble to get untangled from the shroud lines of the chute and get free of the harness. His next step is to

DUNK

inflate his "Mae West." Then he removes the dinghy from the packet and inflates it.

But even if all goes smoothly to this point, the trainee still isn't out of the wilderness—or out of the water! He must still enter the dinghy and paddle back to the dock. Have you tried crawling into a floating life raft lately? It isn't exactly as easy as falling out of bed. But it's something these men of the 47th Bomb Group must learn to do. Actually, the procedure can be quite simple once the tricks are learned. And after the tricks are learned, these crewmembers are a good bet to flop into their dinghies when it counts.

The pictures on these pages show a typical wet run of the training apparatus and procedure. The subject is Lt. Col. Hubert Blair. The only equipment required for this training program is a makeshift tower, an opened parachute, a dinghy pack and a "Mae West." Some old clothes make it easier on the pocketbook.

There is nothing haphazard about insuring that all crewmembers receive the training. It is a compulsory part of the combat crew training program operated by the group and every flyer is scheduled for attendance.

One thing discovered during the course of "Operation Dunk" was that there were a number of crewmembers who did not know how to swim. This called for the establishment of a swimming school at the base pool and soon the flyers will be swimmers all. It cannot be denied that the ability to swim lends a certain amount of confidence which makes it much easier to go through with the dunking and subsequent survival maneuvers.

"Operation Dunk" may some day prove itself by saving lives. It is certainly a worthwhile program.

This

by Colonel Don S. Wenger
Chief of Surgery
Chanute AFB, Illinois

The Jet Releases a Vacuumed Victim

TECHNICAL ADVANCES many times are complicated by new problems in medicine. The development of the modern jet engine is one example of this generalization. One dramatic aspect of the jet engine is its power to suck into its intake objects which are in too close proximity. The unwary human is as vulnerable to this vacuum-cleaner-like action as many other objects. For a human to be completely sucked into an aircraft by its jet engine has been, as far as can be determined, a uniformly fatal experience until recently. There have been recorded instances when a human was only partly engulfed in the aircraft where injuries have not been fatal. Newspaper stories and public comment, assuming asphyxiation or mangling, point up the fact that the mechanism of death is apparently not a matter of common knowledge.

This report records a case of an airman who recovered after being completely sucked into the intake of a jet aircraft and points out the mechanism on the injuries that occur.

CASE REPORT

A 19-year-old corporal, a student in jet engine school, in a moment of preoccupation, walked in front of an F-86 aircraft with the engine operating at 70 per cent of maximum rpm. His right shoulder came within 12 inches of the air inlet. Apparently at this time he felt the strong air currents rushing toward the inlet. He

One Came Back

turned toward the aircraft, was caught in the draft to the inlet (which at this point is of tornadic intensity), and was sucked instantly out of sight. The aircraft shuddered, the engine surged, and at once the power control was cut off and the switches turned off.

The airman was found to be between Number One and Number Two islands; apparently he had been stopped at this position by an aluminum cone. (The accessory cover over the forward end of the engine.) He lay on his left side, with arms folded as though to protect his head. His head and arms were against the aluminum accessory cover and his knees were flexed, almost as though drawn up in sleep.

He was on the right side of the duct and the right side of the accessory cover showed signs of damage. A pitot tube one foot behind the intake was sheared off. The internal skin lining of the intake duct was drawn in, apparently as the result of the surge of low pressure as the body entered the duct. The duct is about 23 inches high and 25 inches wide at its narrowest, and about 20 inches high and 30 inches wide at the point where the man was found.

After about four or five minutes, the airman was removed from the aircraft. He was bleeding from ragged cuts of the scalp, with the only visible major wound being just over the left ear. He moved in an aimless fashion and spoke occasionally in a completely irrational manner. He was removed to the hospital by ambulance.

Upon admission to the hospital, physical examination revealed the cuts described in the preceding paragraph, bruising and swelling of the left shoulder, and multiple scraped areas of the left arm, forearm, hand and fingers. There was no response to his environment, but he thrashed around vigorously. After the first 72 hours, his level of consciousness became normal. Amnesia for the period during which the accident occurred is still complete at the time of this report.

After the patient recovered from his head injury to what seemed a safe and stable condition, x-ray studies were made for other injuries. Suspicion had been directed to the left shoulder and skull. These suspicions were confirmed by the report of a line fracture of the skull down the forehead, and a broken left shoulder. In addition to these injuries, some of the vertebrae in the neck had been broken.

The patient has continued to improve and it is expected that he will be discharged to full duty. He desires to go back to servicing jet engines.

DISCUSSION

The purpose of this report is not to describe treatment, which was the usual regime used on head injuries complicated by other injuries, but to record the fact that being sucked into a jet aircraft is not necessarily fatal, and to discuss the mechanisms of injury and correlate these mechanisms with the injuries actually sustained.

The velocity of the air current entering the intake duct is in the neighborhood of 200 MPH. Partial blocking of the intake causes acceleration of air currents to 500-600 MPH. Because the shoulders of a man being drawn into the duct almost fill the intake, the force applied to his body by the very rapid air currents is phenomenal and result in his very rapid acceleration into the duct. The widest portion of his body, the shoulder girdle, is likely to receive trauma at the intake duct. As evidence of this fact note the broken left shoulder in this patient. This is the widest point of the shoulder girdle, and since he seems to have entered the duct with his left side down one would expect the greatest damage to occur on the dependent side—as did actually occur in this case.

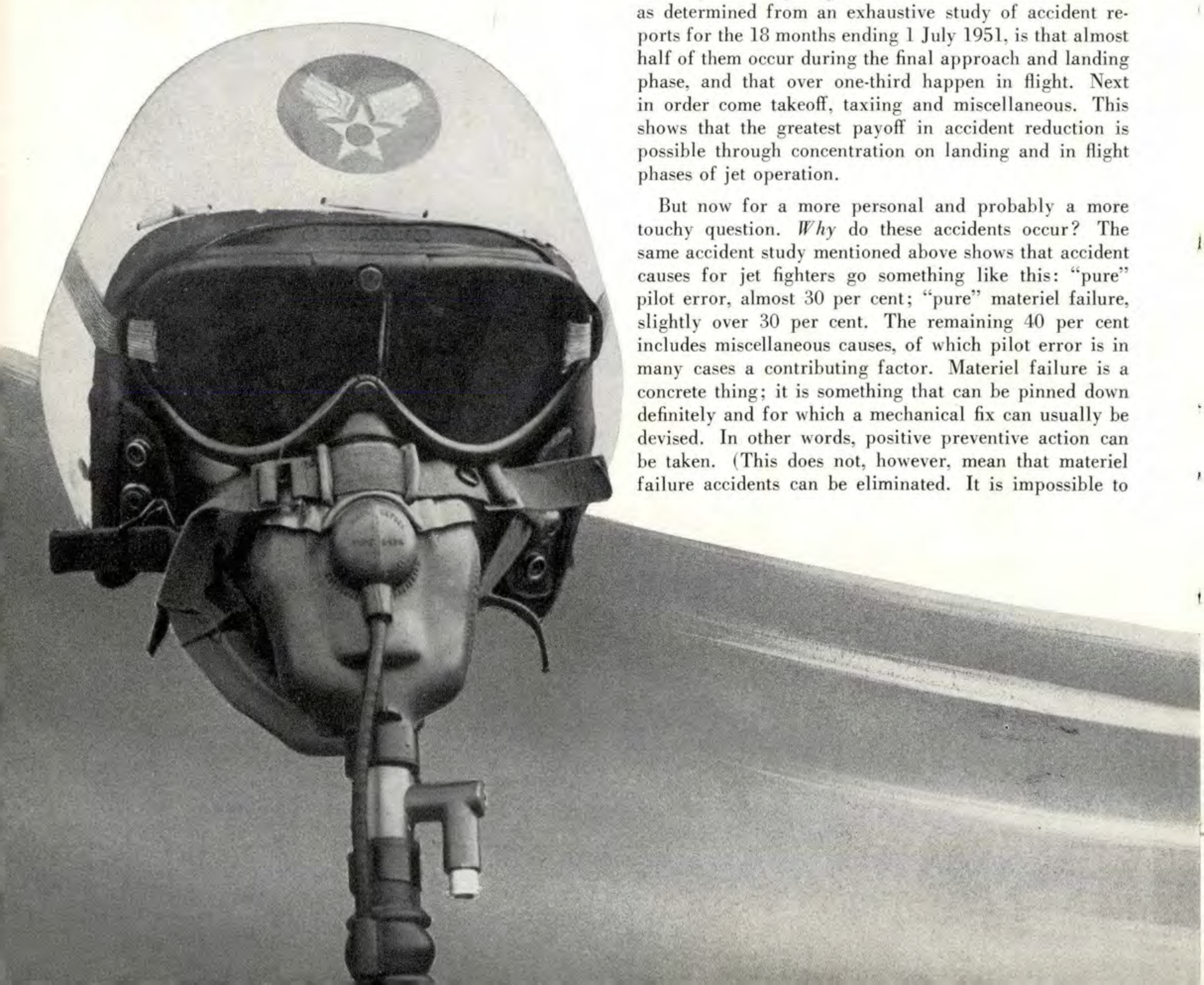
After the shoulders get the body steered into the duct, cuts may occur as the result of a pitot tube that projects into the duct. The only other obstruction that the body can meet is the accessory cover, an aluminum cone-like structure over the forward end of the engine. Since the body is being moved at considerable speed by the air current and since the victim is usually sucked in head first, the effect is exactly as though the patient had fallen on his head. In this case again the injuries substantiate this postulation for the patient sustained a skull fracture and evidence of a blow on the head. In addition, the force of the blow was transmitted down the neck resulting in damage to the bones of the neck. This too is not an uncommon complication of injury sustained as the result of a great force applied to the head.

It is probable that the fact that the engine in this case was operating at only 70% of maximum RPM reduced the speed of the body through the duct to a point where the force applied did damage that was sublethal in its extent. It is to be expected that the cause of death in fatal accidents of this type is severe crushing injury to the head with possible associated damage to the spine and spinal cord.

Expressed Air Force policy is to provide some type of retractable protective screen in all future Air Force jet aircraft. This should in large measure prevent the recurrence of the fatal type injuries mentioned in this article.

But even then, as now, the watchword for those who work around jets must be "Keep Your Distance."

JET JOCKEYS ARE HUMAN, TOO



Increased Speeds of Jet Fighters Leave Little Margin for Error

ONE OF THE GREATEST troubles with pilots is that they are human. And a tendency to make mistakes has always been one of the many human shortcomings. Since pilots are born with the handicap of belonging to the human race, they shouldn't be blamed if they make mistakes which cause accidents to the airplanes they fly. Or should they? You answer that one for yourself. The fact is that they are blamed. An accident for which responsibility cannot be fixed must be one for which no corrective or preventive action can be taken. And who has the temerity to suggest that there can be no preventive action for accidents caused by pilot error?

Although this discourse applies in many respects to all pilots, it is meant primarily for pilots of jet fighters. The statistics given, the errors cited and the corrective measures recommended were all compiled from study and research involving hundreds of jet fighter accident reports. Reading them should help any pilot, however.

When do most jet fighter accidents occur? The answer, as determined from an exhaustive study of accident reports for the 18 months ending 1 July 1951, is that almost half of them occur during the final approach and landing phase, and that over one-third happen in flight. Next in order come takeoff, taxiing and miscellaneous. This shows that the greatest payoff in accident reduction is possible through concentration on landing and in flight phases of jet operation.

But now for a more personal and probably a more touchy question. *Why* do these accidents occur? The same accident study mentioned above shows that accident causes for jet fighters go something like this: "pure" pilot error, almost 30 per cent; "pure" materiel failure, slightly over 30 per cent. The remaining 40 per cent includes miscellaneous causes, of which pilot error is in many cases a contributing factor. Materiel failure is a concrete thing; it is something that can be pinned down definitely and for which a mechanical fix can usually be devised. In other words, positive preventive action can be taken. (This does not, however, mean that materiel failure accidents can be eliminated. It is impossible to check every operating unit and every structural member of an airplane before each flight and guarantee that it will not break or malfunction. Some materiel failure accidents have to be expected.)

But pilot error is different—or it should be different. Actually, it isn't expected that such accidents can be eliminated. This goes back to the beginning of this article—pilots are human and must be expected to make mistakes.

The things that are alarming are the number of mistakes and the kinds which are most prevalent. After all, there is such a thing as being *too* human. Psychologists, physiologists and just plain jet experts have put their heads together to analyze the mistakes that jet fighter pilots make. They have come up with some clear-cut trends of human errors which can be clearly identified and which can be corrected. These trends have been broken down into the categories of poor judgment (which is considered to play a part in about 70 per cent of jet pilot error accidents); lack of vigilance (responsible for over one-fifth of the accidents); errors in controls manipulation and in navigation account for the remaining less than 10 per cent.

JUDGMENT—Definitely, there is a connection between the facts that most jet pilot error accidents come under the heading of poor judgment and that most jet fighter accidents occur during the final approach and landing phase of flight. Landing is undoubtedly the part of flying which demands good judgment if it is to be successfully accomplished. If a pilot does not have good judgment, it will most often show up in his approaches and landings.

Again, the question, "Why?" For the answer, let's compare the technique of landing a jet fighter with that for landing an F-51, the "pre-jet" fighter. First of all, the F-51 is supposed to be landed just as it reaches a stall over the runway. Although most jets (the F-86 is an exception) *can* be landed in a full stall, the practice is to land them just before the stalling speed is reached. This means that whereas the F-51 touchdown speed is in the neighborhood of 90 miles per hour, jets touch down at speeds ranging anywhere from 120 to 145 mph. What has happened to time for thinking and correcting erroneous judgments? It has dropped drastically at a critical stage of flight. More accidents occur.

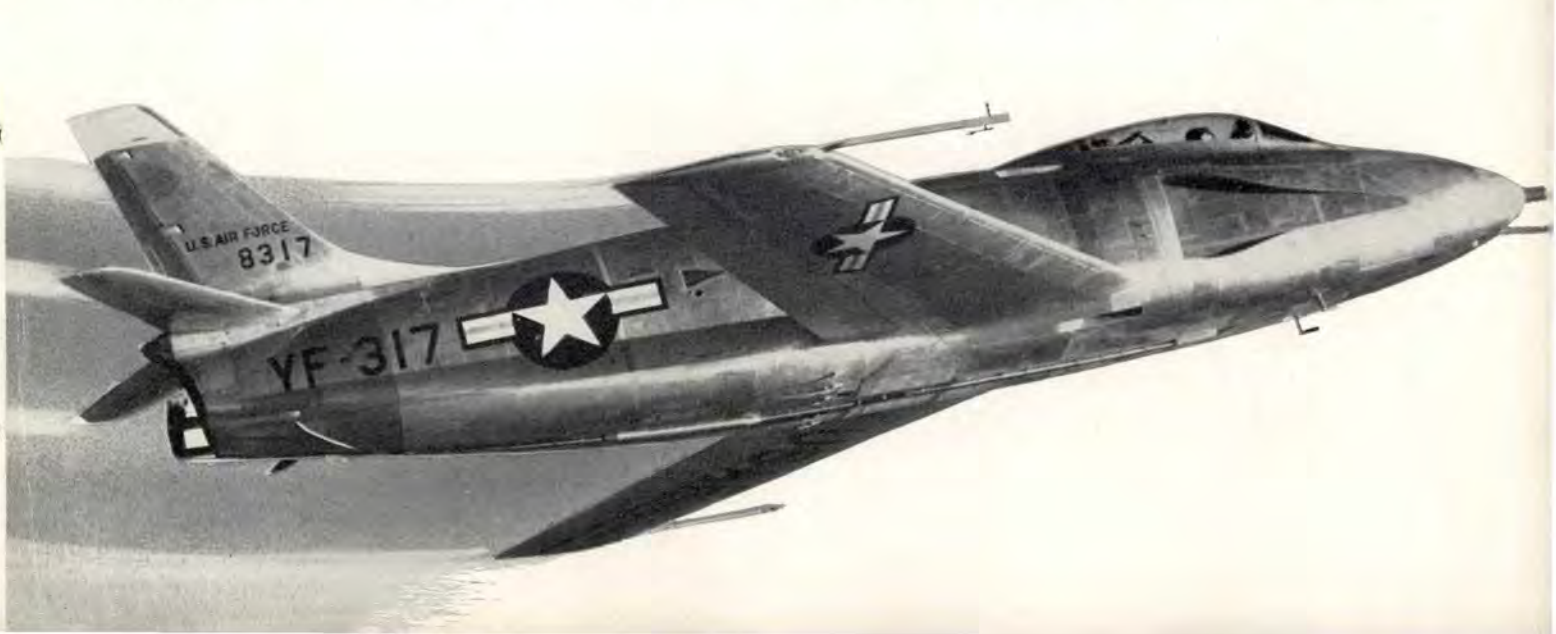
This higher landing speed, plus the well-known fact that jets accelerate for go-arounds more slowly than conventional planes, has induced pilots to attempt shorter landings than previously. They reason that at higher speeds and with no windmilling props to slow them up, they'll need more runway to stop the rolling plane. They're right. They also reason that since go-around acceleration is slower, they'll need to decide earlier, while plenty of runway is left, to go-around. Again, they're right. So they try to land shorter. This is logical and certainly is justifiable.

But, here's where poor judgment has a field day. It's not easy to plan an approach for a landing in the first foot or even the first hundred feet of the runway. Many pilots aim short and by the time they've discovered they're short, the low acceleration rate means that they stay short. As a result, *undershooting the landing strip is the most frequent error of jet pilots.*

Briefly, there are several reasons for jet fighter pilots landing short of the runway. One is that the pilots tend to use habit patterns developed while flying conventional aircraft. The very different acceleration characteristics of jets make this of extreme importance. Another reason is that higher landing speeds in jets are required and on relatively short fields, pilots feel that they must use every available inch of the runway. They try to land as close to the head of the strip as possible, and any judgment error can "make the difference."

A third reason for undershooting is that once a pilot has committed himself to land, he is quite hesitant to execute a go-around. Slow acceleration, blast from preceding jets, gusts, plus any doubt about his own technique, make him wary of going around when there is still a chance that he "might make it."

Poor judgment is also important as a factor in inflight accidents. The high speeds which make quick and accurate decision of prime importance leave little time for changing the decision, once made, and provide for little mercy if those unchanged decisions are wrong ones.



If a pilot had plenty of time to think over his decisions before making them, quite probably most decisions would be in keeping with sound judgment. But, even in conventional fighters, there is not sufficient time to make certain that good judgment is always shown. In jets, quick reactions, not just in simple movements of controls, but also for arriving at complex decisions are at a premium. Thus, in many cases, good judgment actually becomes proper reaction.

Of particular importance is the fact that reading instruments, digesting their meaning and taking the proper action must at times be almost one process. And under certain conditions, it is no simple task to read instruments properly, let alone digest the meanings and act. Tests show that an increased G-load on a pilot from one and one-half to only three G's results in a significant increase in instrument reading errors. The error increases with further G-loads. Also, under these stresses, the pilot encounters difficulties in making the physical movement required to complete the action. Picture a jet pilot trying to read his instruments during a tight maneuver. He first reads the instrument wrong, therefore gets an incorrect interpretation, then after much physical exertion to reach the control, operates it incorrectly. Extreme, perhaps, but a possibility, and definitely an example of how poor judgment can cause accidents.

Actually, cockpit standardization and simplification of instruments will soon lessen considerably the chances of perceptual errors. And placing more controls in push-button form on the control stick will make it easier to actuate them. Something *is* being done.

In summing up this subject of poor judgment as a cause of jet pilot errors, we might say that the big factor is increased speed. As a basis for comparison, in the F-51 only 50 per cent of pilot errors come under the heading of poor judgment. In jet fighters, this has risen to 70 per cent.

What is the solution? Obviously, there can be no substitute for good judgment. The only course open is to raise the quality of judgment. This can only be done through local training programs and the elimination of those who obviously do not use good judgment. The training must include two phases: one to provide thorough familiarization with the airplane, both technically and operationally. The other phase comes with putting this information to practical use in the air. Learn it, and then practice it.

VIGILANCE—Compared with statistics compiled for the F-51, there is little difference in the relative importance of lack of vigilance as a pilot error cause factor in jets. Vigilance, which includes poor division of attention, accounted for 18 per cent of pilot errors in F-51's. For jets, this figure has risen only by one per cent.

Essentially, the problems are much the same as for conventional fighters. No one can fly his best while his mind is cluttered up with domestic or financial worries. The solution can only be to keep your mind on the business at hand.

Good physical and mental condition mean a good state of vigilance. This does not mean the jet pilot must be a super-athlete or a walking brain. It does mean he must take care of his body and that he must leave his cares on the ground so that his mind will be free to concentrate on flying.

About the latter, the mental or emotional problems, little can be said. It is up to the individual pilot to discipline himself mentally so that family, social or financial problems will not interfere with his flying. The best solution, of course, is not to have such problems. But it can't always be the case. So, good mental discipline can be the only answer.

About physical condition more can be done because it's something that pilots can control more easily. It requires only a little self-control and the good sense to stay on the ground when the condition is not controllable. Some of the things which affect physical condition adversely are:

- Excessive cigarette smoking.
- Empty or upset stomach.
- Inadequate rest.
- Colds, gas pains and other ailments.
- Self-medication.
- Excessive use of alcohol.

All these items lower physical resistance which in turn affects mental acuity. The remedy has already been given.

The factors given so far are those which primarily affect the state of vigilance, although they will also affect judgment to some extent. The factors, or stresses, are variable in that they are different not only among individuals, but they also vary from day to day in the same individual. There are other factors, known as natural stresses, which are more nearly uniform in their effects. Both vigilance and judgment suffer when they come into the picture. Regardless of which category is more greatly affected, the point is that when they are imposed upon the pilot's body during flight, they may drastically impair efficiency and therefore have a detrimental effect on safety.

Exposure to altitude without oxygen or with insufficient oxygen is one of these stresses. Hypoxia is something that reduces mental as well as physical efficiency of all humans. Plenty of oxygen is absolutely necessary for the proper functioning of the brain. Without sufficient oxygen, the pilot becomes less vigilant and also is more likely to make poor judgments. Sometimes a pilot lives through a hypoxia experience, but all too often hypoxia can only be suspected because there is no survivor to relate the story. The answer for pilots is to keep oxygen equipment in the best condition, insure a good mask fit, check the entire system frequently during flight and learn through low pressure chamber training what their "hypoxia symptoms" are . . . then be alert to take corrective action whenever required.

Noxious gases can be factors which bring about lessening of vigilance and impairment of judgment. Pilots can help to eliminate this as an accident cause factor by reporting to the flight surgeon whenever they have headaches or feel listless during or after a flight.

Other factors affecting judgment and vigilance, for which remedies are not so obvious, are exposure to G-forces, rapid altitude changes, noise and vibration.

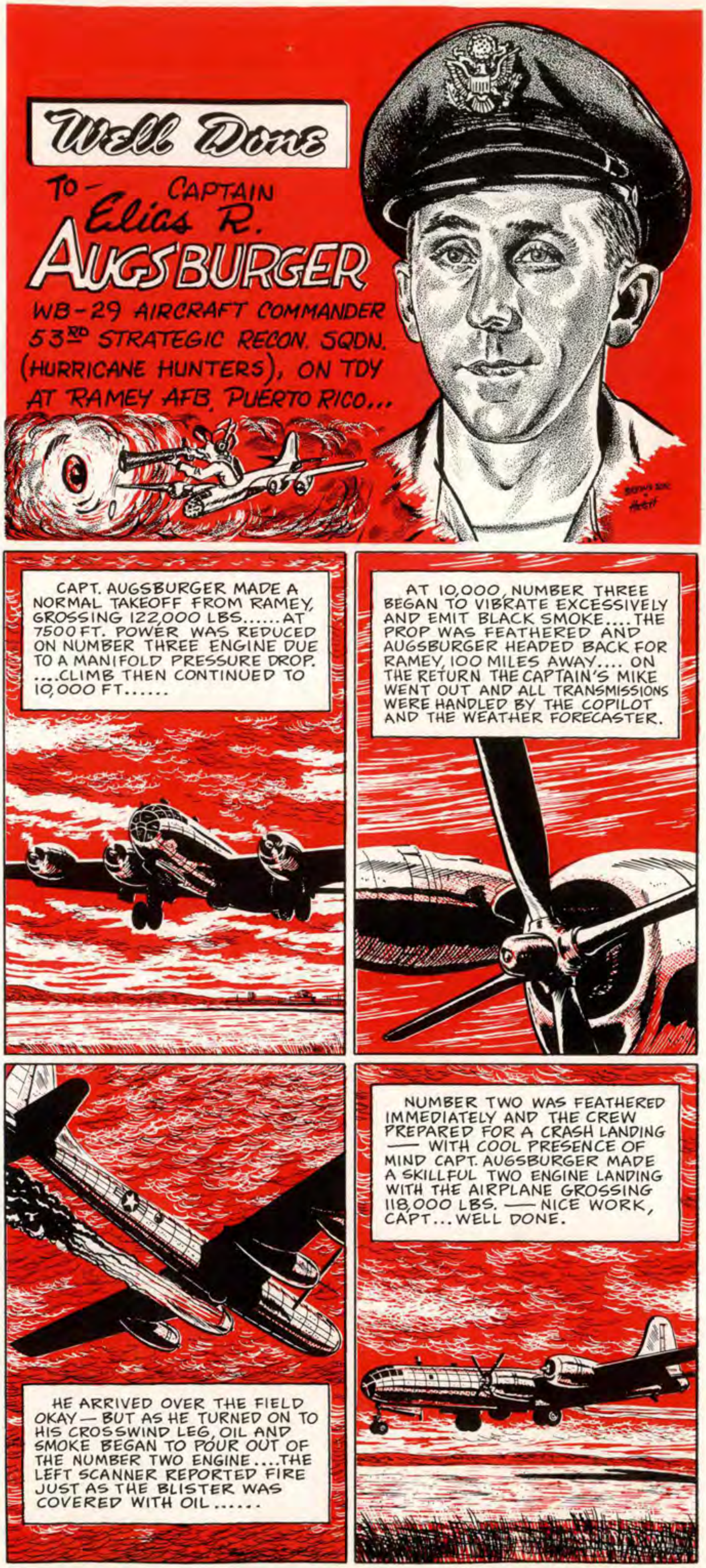
CONTROLS AND NAVIGATION—Little will be said here about jet pilot errors in the manipulation of controls. Actually, this appears to be less important in jets than it is in conventional airplanes. Whereas actuating the wrong controls or actuating them improperly accounts for 30 per cent of pilot errors in F-51's, it is responsible for only about seven per cent in jet fighters.

Navigation, which is responsible for an even smaller percentage, presents the pilot error possibilities which should be expected with greatly increased flight speeds. The frequency of navigation error in jets is higher than for F-51's, but still is only four per cent. However, the actual navigation is considerably more difficult than in conventional fighters. Higher speeds mean that the pilot has less time to figure his positions accurately, less time to use radio fixes. And the critical fuel factor in jets means that navigation errors are much more serious. There is little time to mill around trying to correct errors once made.

To aid the navigation problem, new jet navigation charts have been developed which are smaller in size, but cover more territory. Only important information is given in the form of a picture pattern. Radio information and a mileage scale are presented on the reverse side of the charts. Other aids to navigation, such as circular computers, are being developed and flight tested. For the present, the pilot himself must maintain a continual state of working familiarity with all navigational procedures and must practice constantly to insure that his rapid-fire navigation techniques are adequate and accurate.

What can be done to prevent jet pilot error accidents?

Corrective action will include anything which may raise the quality of judgment, keep the pilot's attention on his flying, prevent him from misusing the controls, and aid him in navigating accurately. For this last, and possibly also to prevent mis-use of controls, the answers may come in the form of mechanical devices or gadgets. For the first, judgment, the solution appears to be in more thoroughly familiarizing the pilot not only with his airplane, but also in proper techniques and procedures for flying it. Mental discipline will prevent errors caused by lack of vigilance.



☆ CROSS FEED ☆

AFGHANISTAN — I have received several pictures regarding the snow-removal operations in Kabul, Afghanistan. The Afghanistan Cavalry made available 200 horses for the purpose of stamping down the snow so the air attache aircraft might take off. I thought you might be able to use these pictures in FLYING SAFETY Magazine.

Maj. David J. Havard
Air Attache Branch
The Pentagon

SOUP CUTTER — Recently I invested in a gadget which I feel is the greatest boon to aviation since the invention of the airline stewardess. This 3 x 11 inch dojigger is dubbed the soup cutter.

It is a two-piece laminated celluloid object which contains a blank form for a flight log and tabulated information needed in VFR and IFR flying. Its surface is frosted so that it takes lead pencil markings which do not easily blur. However, the pencil markings are readily erased. My purchase was made in the Mitchel AFB PX to the tune of $1.30.

In case this piece of equipment has not been brought to your attention, I'll burden you with a brief description. The flight log contains columns for Radio Facility Chart page, station identifier, frequency, M.C., Miles, ETE, Time over C.P.R., Groundspeed, airway, altitude, fuel remaining, fuel required, and signal on the right. It also has a protractor, a 1:500,000 sectional scale; a 1:1,000,000 regional scale, and a scale graduated to Radio Facility Charts. In addition it contains position reports and change of flight plan request sequences, altitudes to be flown in various directions on and off airways and abbreviations to be used in copying ATC clearances.

I have found this equipment very handy in cross-country flights in such one-pilot airplanes as B-26s. It is much easier to use tabulated information on this celluloid article than thumbing through pages of charts, especially when it is cold and the pilot is forced to wear heavy gloves. Its usefulness might be limited to the above conditions, but I feel it's worthy of your investigation. Most pilots who have seen my Soup Cutter seemed to develop some enthusiasm for it. Perhaps a similar gadget could be made an item of issue in a modified form.

Maj. Alfred Kaufman
Asst. Prof. Air Science & Tactics, Utah State Agricultural College.

Ed. Note: At the risk of being accused of giving free advertising, we'll say we are familiar with the Soup Cutter and consider it a pretty handy gadget. Incidentally, it was invented by Capt. David F. McCallister (alias Davey Mach), whose article, "Spin Those Dials," appeared in the November issue of FLYING SAFETY.

PERSONAL EQUIPMENT — The September issue of FLYING SAFETY Magazine was especially interesting to me because it contains an article on personal equipment ("Personally Yours") which is my project in the Air Inspector's office here in the 137th Fighter-Bomber Wing.

For about two weeks I have been reading T.O.'s, AF Regs., and talking with the pilots and personal equipment technicians in the Wing. Naturally, when your article about personal equipment came to my attention I immediately grabbed for it and began reading it with enthusiasm.

So far I have some questions about the article and also some questions that have come up which might be answered by the author of the article.

My questions are as follows:

1. Where can we find instructions or obtain kits for modifying the P-1 helmets?

2. Do the wind screens for P-1 helmets have tinted plastic to take the place of sun glasses?

3. What is the opinion of the author regarding the K-2 nylon flying suits? A great many of our pilots object to them because they do not absorb perspiration, seams ravel or rip, and they believe nylon will melt and stick to the skin at lower temperatures than the old style cotton. Also in bail-out would snag and tear on parts of the aircraft or underbrush in walking back.

4. Is there anything out on the high top flying shoes you mention? Will they be available for issue or purchase, and when will something definite be officially published on them?

5. Would it be possible for me to get some information on the type of emergency sustenance kit recommended for fighter pilots? We are attempting to make up our own after making a concerted effort to obtain some.

6. What do you think of having fighter pilots wear side arms on all flights in the ZI for signaling purposes, if nothing else?

7. What first aid provisions are made for fighter pilots other than items contained in the emergency sustenance kits?

8. No provision is made in T. O. 00-10-40 for issuing knee boards to fighter pilots. Do you have a sketch of a recommended knee board for instrument and navigation purposes?

We use your magazine in all phases of our Flying Safety program here in the Wing and it is considered one publication the Air Force definitely gets its money's worth in publishing. We enjoyed your articles on flame-out and learned plenty from them.

Capt. W. B. C. Plowden
Alexandria Muni. Arpt., La.

Ed. Note—Here are the answers:

1. Two thousand modification kits for the P-1 helmet were available at Ogden Air Materiel Area as of 1 October. The kits are known as "Kit A, applicable to small helmets," and "Kit B, applicable to large helmets." T.O. 13-1-40 (coded 1300 T.O. 13-1-40) is available for inclusion in the kit. All commands were queried as to their requirements for kits. Overseas commands are getting first priority and other commands are getting priority in the order of replies received.

2. The visors for the P-1 helmet are made of green tinted plastic material.

3. Laboratory reports from Air Materiel Command indicate that nylon is superior to cotton for providing protection from fire. Nylon material melts at or above 480°F., but does not ignite when exposed to temperatures as high as 1000°F. Cotton will ignite when exposed to temperatures as low as 550°F. Nylon fabric used in USAF flying suits is considered to be flashproof and combustion retarding.

4. The high top flying boot, Type A-17, is expected to be available about 1 January 1952. Type A-17 flying boots are for pilots only. It is expected that Table of Allowance, TA-1-21, allowing flying boots for pilots only will be published and automatic distribution started by December of this year.

5. There are three types of sustenance kits for fighter pilots, all of which are seat type:

A-1, very cold weather;
B-1, cold weather;
C-1, temperate zone.

These sustenance kits are being distributed first to overseas commands. Technical Order 20B-20-1 gives a description of the emergency kits.

6. It is believed that better means of signaling than by the use of side arms are available to pilots.

7. At the present time there are no first aid provisions made for fighter pilots other than those in the emergency sustenance kits.

8. Knee boards are locally designed and are of many varieties. It is recommended that if a need for knee boards exists in your Wing that one be locally designed for your particular use.

HYPOXIA WARNINGS—In your article on Hypoxia in the September issue of FLYING SAFETY, the statement is made that "There are no warning symptoms a pilot can count on." While this is fairly true, it should be elaborated on.

In the Physiological Training phase of advanced flying training, we try to give each student three flights to altitude in a low pressure chamber. In each of the three flights he goes to 18,000 feet with his oxygen mask *off*. Each individual has his own warning signs or symptoms of a lack of oxygen (Hypoxia). These symptoms may be shortness of breath, hot anger, cold flashes, breaking out in a cold sweat, etc. In this manner we try to get each trainee to learn to recognize his own initial signs or symptoms of Hypoxia.

Capt. Leo V. Knauber
Aviation Physiologist
Connally AFB, Texas

MORE HYPOXIA—Just before receiving the September issue of FLYING SAFETY (which contained an article on hypoxia), the 363rd Tactical Reconnaissance Group came up with this photograph. Unusable as a reconnaissance photo, it was lettered and has been posted in various spots throughout the base. The photo was taken from an RF-80. Excessively rough air caused the distortion.

Maj. Theodore S. Wood
PIO, Shaw AFB

MONDAY MORNING OR HYPOXIA

IF YOU VALUE YOUR LIFE DON'T FLY IN THIS CONDITION

MILITARY

By Brigadier General FRANK P. LAHM (Ret.)

THIS MONTH, December 17 to be more exact, marks the 48th anniversary of flight with a heavier-than-air machine which was carried out by the Wright Brothers, Orville and Wilbur, on the sands of Kitty Hawk, North Carolina. This flight, of course, was made in 1903, yet it was not until years later that positive action was taken by the Army toward the purchase of a "flying machine."

Largely, this reluctance to accept the Wrights' claims of flying stemmed from lack of confidence and just plain disbelief that a man-carrying flying machine had been developed. And even after the Signal Corps was convinced and the specifications for an aircraft became known, Army officials were criticized for specifying flight performances that could "not be fulfilled at that stage of science."

After the bids and financial problems had been worked out, the formal contract between the government and the Wright Brothers was signed February 10, 1908, by Captain Charles S. Wallace on behalf of the Signal Corps, and by Orville Wright for his partnership.

The first plane, designated the "Wright Flyer," was delivered at Ft. Myer, Virginia, August 20, 1908, and the trials were started shortly thereafter with Orville Wright as pilot. The Army wings had begun to sprout slowly and just how painfully they were to grow was grimly emphasized a month later.

Lieutenant Thomas E. Selfridge, detailed as an observer at the Ft. Myer trials, on the afternoon of September 17 rode as a passenger on a flight with Orville at the controls. While making a turn of the field at an altitude of about 150 feet, one of the propellers struck an upper diagonal brace wire attached to the rudder frame in the rear of the machine. The "Wright Flyer" then went out of control and crashed. Lieutenant Selfridge died of injuries a few hours later—the first victim of an aircraft accident, and Orville remained in the Ft. Myer hospital seven weeks recovering from his injuries.

Today, in going back to the first few years of Army flying and summing up the many lessons learned by the early flyers through trial and error, safety in flight was one of the foremost problems. In those days safety was more a matter of just plain common sense on the part of the pilot.

Flight technique was often learned through bitter experience—that a stall invariably resulting in a crash would happen if the pilot attempted to stretch a glide; that a forced landing was an ever-present possibility, as was a structural failure which could be brought about by excessive maneuvers in strong winds.

Flying the early model Wright planes was an easy task. For a turn the wings would be warped in coordination with a small amount of rudder. Smooth turns were considered fine maneuvers for advanced piloting technique. Very steep turns were not made. Usually, the angle of bank would be about 35 to 40 degrees.

As commanding officer of the new flying school at College Park in 1911, Captain C. deF. Chandler was taught these advanced maneuvers by Orville Wright, who warned Chandler against the danger of stalling in steep type turns.

The next year, 1912, Captain Chandler made the first night mission when he was caught by darkness on a return flight to College Park from Annapolis. He landed safely when waiting mechanics, hearing the roar of the plane's engine, threw oil and gasoline on the field and ignited it. This experience stimulated interest in night flying and flights were then carried out using signaling lamps for runway lights.

Although more men were being assigned to aviation and the Signal Corps had outlined specifications for the Wright plane which were more than met, it was not until the spring of 1912 when planes were received equipped with engines of from 50 to 70 horsepower—approximately double the power of the first training planes—that safety dictated the need for more skilled piloting requirements.

Consequently, the War Department announced a new rating of Military Aviator as an objective for the Army pilots to obtain. Concisely, this new rating required attaining an altitude of at least 2,500 feet in an aircraft; flying in a wind of at least 15 mph; carrying a passenger to a minimum altitude of 500 feet followed by a dead

AVIATOR

Taught to Fly by Wilbur Wright in 1909, the Nation's First Military Pilot Reviews Some Highlights of Early Aviation.

Brig. Gen. Frank P. Lahm reads about the first eleven aircraft accidents in the March 1950 issue of Flying Safety.

stick landing within 150 feet of a designated point, and making a reconnaissance flight of at least 20 miles cross-country at an average altitude of 1,500 feet.

Two years later, in January 1914, more difficult requirements were added for the Military Aviator rating. They called for cross-country flights up to 100 miles and a dead stick precision landing from 1,500 feet altitude. Also added was a theoretical examination on the use of maps, navigation, repairs, meteorology and other phases of aircraft and flying.

Flying requirements were to go still higher as better designed airplanes were built. Hydroplanes and pontoon-equipped aircraft for over-water flying had entered the picture. By the spring of 1912 all three manufacturing companies, Wright, Curtiss and Burgess, were making planes equipped with pontoons.

In the United States, the best designed airplanes were of the bi-plane type and were equipped with one or two seats on the leading edge of the lower wing. The Curtiss machine had seats in front of the wings.

European designs during the 1909-1911 period favored the cockpit nacelle with pilot and passenger seated one behind the other, and with a tractor propeller instead of the pusher type. Now we can see how slow we were in

The men with the checkered caps are the "Early Birds," an aviation organization formed by the early flyers. Lahm was president of the group in 1949-50.

Above is the "Baby Wright," one of the earliest race ty airplanes. Left, Lieutenant Lahm holds to a strut as Orvi Wright gets ready for the takeoff. This was Lahm's first a plane ride, Sept. 9, 1908, which lasted for approximate six minutes and forty seconds.

adopting the tractor prop and later the simpler and faster monoplane. At the time, there was some doubt as to whether the advantages of the tractor type offset the higher propeller efficiency of the two slow-turning pusher props.

The original Wright plane that went into production, the Model B, had a top speed of approximately 43 miles per hour, carried two people, and with a full load had a service ceiling of around 8,000 feet. The gas supply was about two hours. It landed at a speed of around 30 mph and would glide steeply with little speed being picked up because the head resistance was so high.

This was the trainer in which military instruction was first begun by Orville and Wilbur Wright at College Park in the fall of 1909. Although intermittent training was carried on by the Signal Corps at various places in the United States, it was not until the inauguration of the flying school at North Island near San Diego early in 1913 that a permanent aviation school was organized on a solid basis. The North Island school grew in importance until World War I brought about the great expansion of our aviation establishment.

In crashes, early type planes would often be reduced to a mass of splinters and torn cloth.

Thus, our Army grew its wings the hard way. Aviation history is full and rich and recounts the struggles and disappointments of those who took part in its growth—of the minority who had vision and faith in the future and safety of flying.

While many factors hindered the advance of military aviation, encouragement was not always lacking. Tribute is due the enthusiasm and zeal of those who worked and maintained a faith in flying. These "early birds" could include the commanders of Civil War days; then the men like the General Greeleys and Allens and Major Squiers.

Tribute is due to younger airmen who cheerfully took on the risks of flying, the Wrights, Arnolds, Chandlers, Mitchells—and all of the military airmen pioneers. These were the men who had the courage and persevered in their efforts, undaunted by the lack of moral support and by the high casualty rate brought about in the development of the airplane.

A measure of their accomplishment is found in an act of Congress approved July 18, 1914, in which an Aviation Section was created in the Signal Corps and official sanction was given to the Army's wings.

In the first days of flying the airplane you soloed after a few flights instead of a few hours and nearly everything you tried with the flying machine in flight was a hazardous matter of experimentation which often as not turned out to be a disastrous undertaking.

General Lahm, who was involved in numerous crashes with the various early type airplanes, was flying military balloons and airships before the Signal Corps purchased the Wright plane. He holds Balloon Certificate No. 4, 1905, Airship No. 2, August 1908; Airplane No. 2, 1909; Military Aviator, July 1913, and was Expert Aviator No. 15, 1913. In Paris, 1906, General Lahm (then Lieutenant) won the first International Balloon Cup Race for the James Gordon Bennett Trophy.

With Major Henry B. Hershey of the Roosevelt Rough Riders as his companion, Lahm piloted the balloon "United States" from Paris across France to the westward, crossing the English Channel by night, and finally landing at Whitby in Yorkshire, England, covering 410 miles in a little over 22 hours.

Sixteen balloons took part in this race, representing seven different nations—America, England, France, Belgium, Germany, Italy and Spain. Lahm was the first American to bring an international air trophy to the United States.

Born in Mansfield, Ohio, in November 1877, Gen. Lahm graduated from the United States Military Academy in 1901 and began his military career as a 2nd Lieutenant in the Cavalry.

With the Signal Corps in Washington, D. C., he took part in free balloon flights and operated the first Army airship. He was on the military board for the Wright airplane. Lahm's first flight was with Orville Wright, September 9, 1908, in the Wright plane. This flight, made at Ft. Myer, Va., lasted approximately six minutes and forty seconds. Later, in October, 1909, he was taught to fly by Wilbur Wright at College Park, Md., and was checked out after approximately three hours dual instruction.

On a flight during this year (1909), Lieutenant Lahm carried Lt. George Sweet as passenger, the first Naval officer to fly in an airplane.

In 1911, Lahm won the National Balloon Race, Kansas City, Mo., to Laport, Indiana, and was second in the Gordon Bennett Race. Subsequently, he organized the first military aviation in the Philippines in 1912. Now known as the "Father of Randolph Field," General Lahm, during 1926 to 1930, was responsible for the selection of the site, and planning and supervising the construction of the "West Point of the Air."

In September, 1941, as Major General, AUS, Lahm was in command of the Air Corps training center. He retired two months later at the age of 64, with the permanent rank of Brigadier General. Now in California, Gen. Lahm is kept busy working with aviation groups, and generally keeping up with the progress of aviation today.

WHERE'S THE MISTLETOE?

What this picture needs is a sprig of strategically suspended mistletoe. But the mistletoe isn't there, so mind your manners. You'd best mind your manners in your flying, too, so that you can be sure of being around when Christmast comes. After all, it might be the best one ever. So, don't be missing at Christmas time—like the mistletoe.

Photo—Terry Moore, Columbia Pictures Corp.

Mal Function

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