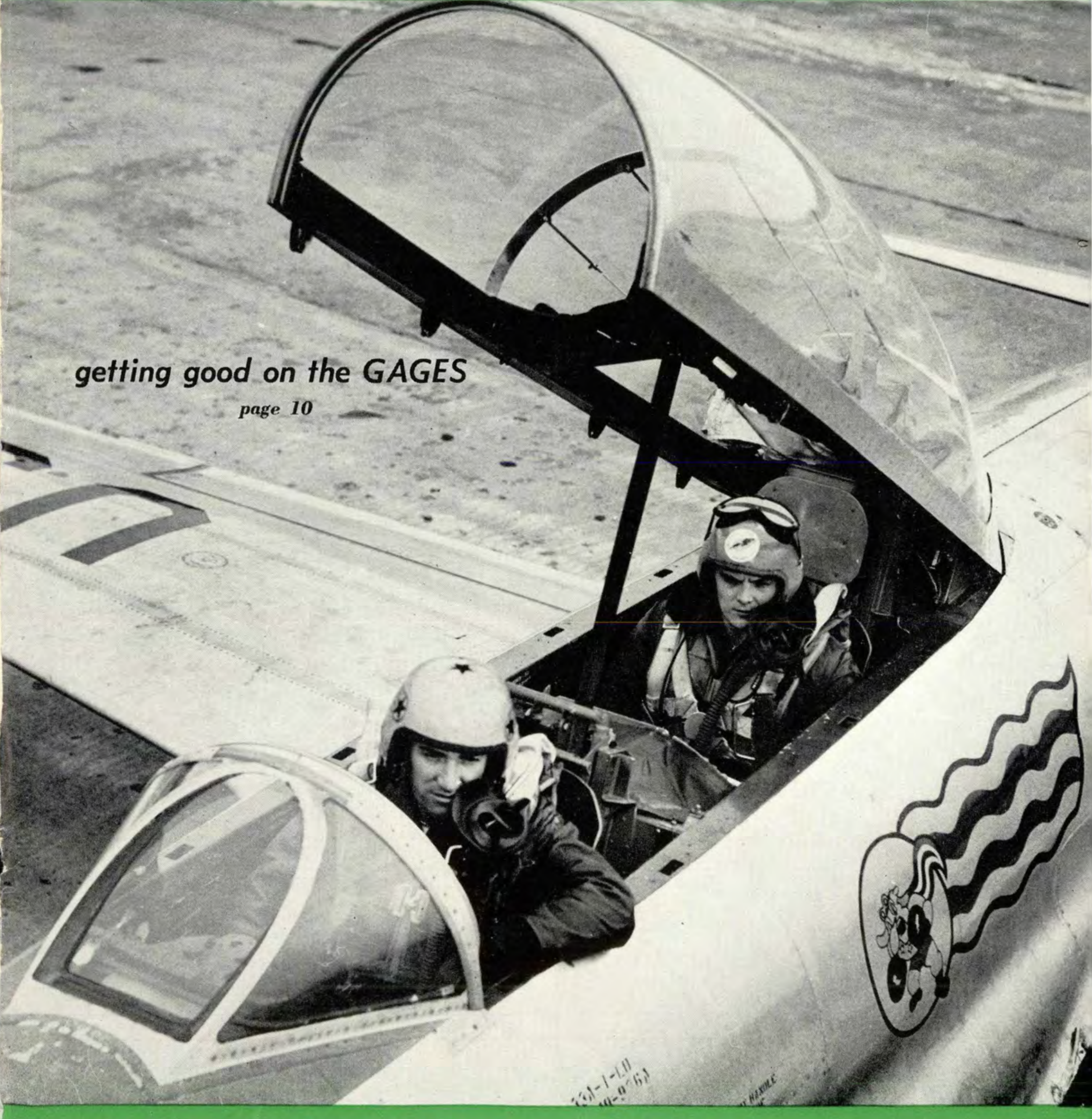
Flying Safety

HEADQUARTERS UNITED STATES AIR FORCE · RESTRICTED

APRIL, 1951



getting good on the GAGES

page 10

With SAC Units Over KOREA by General O'DONNELL

RESTRICTED

OPERATIONS *in the* CLASSROOM

As a change from the old lecture method to one of learning by doing, the Flight Operations Section of Williams AFB Academic Department has in operation a new flight planning course in an effort to familiarize students with the problems of instrument flying.

A mock Base Operations has been constructed in the classroom, complete with charts, NOTAMS, dispatch board, and a weather station. Another room, called the Radio Room, is equipped with microphones and headsets which are monitored by the instructor.

This method of instruction familiarizes the student with instrument flight procedures which he will use many times in the air upon graduation. It is expected that this training will eliminate many of the common errors made on instrument flights before the student takes his first solo IFR cross-country.

Photos, Top to Bottom:

The student is given his take-off time and plane number. It is then his responsibility to make out his charts, get a weather briefing, and fill out the form 175. Here a flight planning instructor briefs students on the route to be flown. The aviation cadet in foreground is preparing his charts and flight log.

Miss Jeannette Thede (only female instructor in the Flying Program) assists aviation cadets in obtaining weather information in one of the classroom weather stations.

Two students presenting their completed aircraft clearances (Form DD-175) to the acting operations officer and flight planning instructor (Capt. R. C. Vehlow) for final approval.

After his flight is approved by the acting operations officer he goes to the Radio Room. Here the work begins. The student simulates the IFR flight from the time he calls for take-off instructions until he closes his flight plan at his destination. The instructor, or controller, has a check sheet which has the proper information listed. The student is responsible for radioing to the instructor the proper position reports, ETA's, and fuel consumption. A grade on the course is obtained by the correctness of this information.

Maj. Gen. Emmett O'Donnell, Jr., Commanding General, Fifteenth Air Force and, until recently CG of the Far East Air Force Bomber Command, has been flying since 1928. In 1941 he led the first squadron of B-17's across the Western Pacific, fought in the Philippines and Java. In November, 1944, he led the first B-29 attack on Tokyo. His article reflects years of "know-how."

WITH SAC UNITS OVER KOREA

SAFETY SPELLS SUCCESS

By Maj. Gen. Emmett O'Donnell, Jr.

A NEW SAFETY RECORD for the operation of big bombers against an enemy was written in the skies over Korea by the sure, steady hand of experience that is the basic strength of the Strategic Air Command. Overcoming serious operational and weather difficulties, the seasoned combat crews, backed up by equally seasoned ground crews, accomplished their systematic destruction of the war-making potential of North Korea with actually a *lower* accident rate than normally suffered during training missions within the United States.

The B-29 Superfortresses that comprise the Far East Air Force Bomber Command have had the advantage of not being seriously hampered by either enemy fighters or enemy flak. Nevertheless, poor weather, mechanical failure, tension, fatigue, carelessness and other accident hazards hovered over SAC's mission in Korea just as they have over every flight since the birth of the airplane. Knowledge and experience licked these problems virtually to a standstill. In fact, such a high degree of flying safety was established that a record utilization of the average assigned 130 B-29's was possible since the activation of the Command.

Four Bomb Groups from the United States—the 22d, 92d, 98th and 307th—joined the 19th Bomb Group and the 31st Strategic Reconnaissance Squadron already based in the Far East to make up FEAF Bomber Command. Much has been said about the way these groups were actually dropping bombs over Korea only nine days after being alerted at their bases in the States.

The point that has not been stresssed is that these B-29's flew to FEAF from as far away as Tampa, Florida, in this record time without a single mishap. In many cases, the aircraft carried heavier loads of equipment and spare parts during their ocean crossing than they normally would when loaded with bombs.

This number of combat-ready airplanes and precision trained crews ready to move great distances safely when needed did not, like Topsy, "jest grow'd." It was, instead, the outgrowth of SAC's rigorous round-the-clock training program that has been progressing steadily since the end of World War II. For example, the aircraft hopped the Pacific to FEAF without incident largely because it was *not* their first long flight in five years. Almost all the groups had gone on long rotation flights to England, Germany and Japan for TDY as part of their training.

And it is this continuous training program carried on in SAC which, I believe, holds the key to the excellent safety record the planes scored—and maintained—after their arrival in the Far East. Bombing mission results are a direct reflection of the maintenance of the aircraft and equipment utilized in the problem and the state of training of the crews. The fact that both components in FEAF Bomber Command, aircraft and crews, were veterans of World War II is significant to the safety record, but for divergent reasons.

In the case of the aircraft, the fact that the B-29's had aged five years since last they carried bombs against a Far East aggressor could have created a dangerous situation. However, consistent preventive maintenance throughout the years had the planes actually in better shape than they were in 1945. This maintenance followed the planes to their Far East bases and mechanics, who through long experience had become experts in their fields, kept the planes in readiness as consistently

Besides attacking strategic targets as signified by bombs being painted by these crew members, B-29's dropped supplies, leaflets.

Out of long experience in safety, SAC crewmen carefully inspect all equipment before taking off on a training or combat mission.

under combat conditions as they had under training conditions in the United States.

In the case of the B-29 crews, the five years of added "know how" gave them a fund of experience that made them more valuable than the planes they flew. Since 80 per cent of the flying personnel were combat veterans of World War II, it has been estimated that each B-29 that took to the air, carried in its ten or eleven-man crew a combined total of 70 years' flying experience.

Like good wood, these men had seasoned and mellowed with age. Gone from both the flying and ground crews were the cocky "wild blue yonder" men who jauntily streaked the skies during World War II and became fabled in films and fiction. Long years of flying had produced sane, sober "professional crews" who did a thorough, professional job. The majority of the pilots and crewmen were family men, well accustomed to responsibilities. Because they had matured in aviation, they were well aware that strict adherence to safety procedures was as vital as a properly loaded gun to their own survival in combat. They had no wish to be haphazard heroes. Instead, they were ever aware of the seriousness of their work. They did it realistically, conscientiously—and well.

Among the most important safety factors in our operations was GCA. Again, previous training was important. Because of SAC's longstanding rule that all take-offs and landings even within the United States be GCA, the B-29's were regularly able to take off and land safely with GCA in the Far East, despite extremely difficult flying weather. The proficiency developed through long instrument training has made SAC an all-weather air force.

Careful briefing and target study before each flight, insured that each crew was thoroughly ready for its mission. In contrast to the old days when crews leaped into their planes immediately after briefing, the SAC crewmen first had a stand-by inspection of all equipment by the aircraft commander. Also, each man utilized a detailed checklist for his station which itself had evolved out of long experience in safety.

Special attention was given to take-off procedures, including use of landing lights and instruments on night take-offs, non-reduction of power and non-retraction of flaps until safe altitudes had been reached, insistence on correct use of safety belts, and proper technique of feathering an engine on take-offs.

The SOPs that grew out of trial and error were followed to the letter and standardization boards were ever at work overseas to see that new and better methods of operation were utilized throughout the Command. Also, constant checks on the efficiency of aircraft commanders and crews were continued. Promotions and demotions made on the findings assured that *only* the very best men were manning the aircraft.

These are but a few of the factors that kept the flying accident ratio over Korea so strikingly low. However, a great share of the credit deservedly goes to the maintenance men who, working under the most difficult conditions, delivered us air-

". . . . SAC combat crews had no wish to be haphazard heroes . . . .
. . . . Like good wood, these men had seasoned and mellowed with age . . . ."

Capt. Grey, radar op. in USAF 9½ years, flew 287 combat hours in B-24's during last war.

M/Sgt. Tinsley, crew chief, 8½ years, was in ETO and has crewed B-29's for past three years.

T/Sgt. Blatterman, a CFC gunner, has 1700 hours in the air, flew B-29's during World War II.

M/Sgt. Bivins, flight engineer, 11½ years in AF, was C-47 vet prior to assignment in B-29's.

Capt. Marx, aircraft co mander, 4,000 air hou and 76 combat missio is only 29.

craft in A-1 shape, day in and day out. Whereas old time mechanics used to say "to hell with the paperwork and records", while in combat, the professional maintenance men of today even increased their paperwork overseas. Their careful and constant count on the pulse of each B-29 played a great part in the consistency with which the aircraft were able to operate.

One other point that should be noted in connection with the safety record of the FEAF Bomber Command is that it was maintained despite the fact that B-29's were often called upon to perform many unusual missions not normally part of their job. Because the situation demanded it, the Command's activities have become very diversified. Besides bombing strategic targets, B-29's were forced to do everything from attacking trucks, tanks and soldiers in bivouac to dropping supplies and propaganda leaflets. Nevertheless, the safety level remained high, proving that versatility of attack and unusual assignment need not reduce the efficiency of operation among men who *know* their job.

The FEAF Bomber Command is continuing its work of supporting the ground forces in Korea in whatever way possible. Many of its planes and crews have rotated back to bases in the United States where they are currently undergoing even more advanced and rigorous schedules of training than, in some cases, those they flew in combat in the Far East.

Korea was but the first flexing of the mighty muscles of the Air Force's bombing power as consolidated and developed by the Strategic Air Command. As I have stated before, we learned no dramatic *new* lessons in strategic bombardment from the Korean operation, though we have improved and expanded to some extent the recognized and accepted methods.

Nevertheless, Korea proved more conclusively than ever before that responsible and seasoned men who thoroughly know their weapons can safely operate bombardment aircraft with devastating effectiveness, regardless of weather and mechanical hazards. Accidents and acts of "fate" which we thought inevitable 10 years ago have been conquered to a great extent by the thinking mind and wealth of human experience that form the core of the Strategic Air Command.

As the Air Force enters a period of tremendous expansion, SAC is faced with the problem of assimilating many new men into its team, some of whom will initially lack the experience necessary for completely safe operation of big bombers. SAC welcomes these men to its fold and proudly passes on to them the sound techniques and fine traditions which have grown through its relatively short life.

I believe that rigorous training which stresses the proven principles of safe and scientific flying will bring these newcomers to the same high level of proficiency as that attained by those who flew so well over Korea. These men will soon give SAC even greater strength to accomplish its vital mission — that of maintaining itself in constant readiness to carry on only a few hours' notice strategic destruction anywhere in the world.

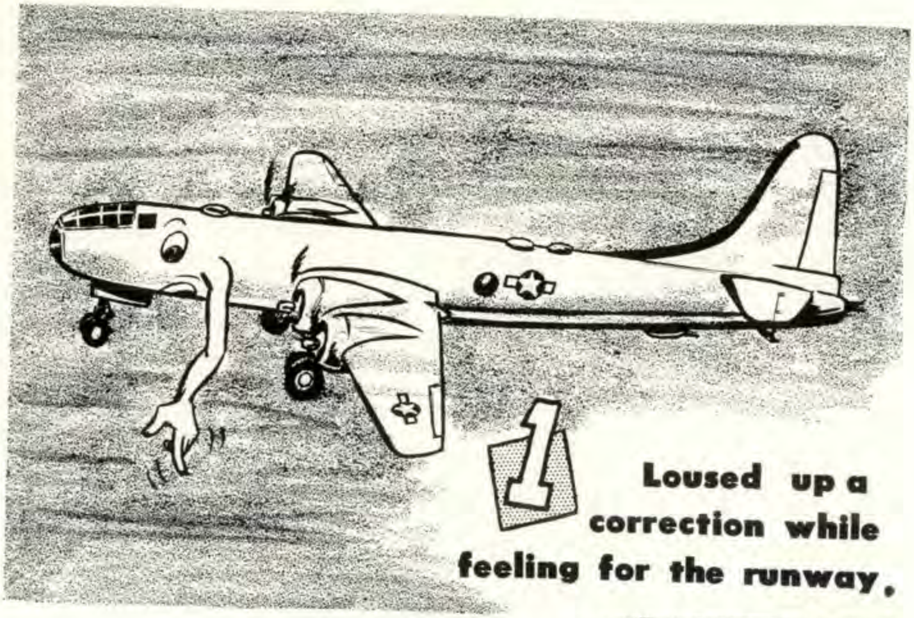
9 GCA ACCIDENT ERRORS

2 Hit trees below glide path.

2 Ran out of runway.

2 Hit short of runway (1 mile) damaging nose gear.

1 Hit a bridge as he was too low on glide path.



Loused up a correction while feeling for the runway.

Dropped in a go-around in O-O wx hit hard and damaged the gear.

The nine accidents depicted here all occurred during the final phases of GCA approaches under actual weather conditions. They all occurred during 1950 and they serve to point up the errors which are being made by Air Force pilots executing GCA's.

It is interesting to note that none of the pilots involved could be called "desk-pilots," although only two were green card holders. They averaged over 25 hours of weather time in the six months preceding their accidents, and almost 16 hours in the preceding 60 days. This indicates that although practice may make perfect, a pilot can't become careless just because he has done a lot of practicing. Each instrument flight demands the preparation and care of the first one, and each GCA demands complete concentration and cooperation with the controller.

In all the accidents illustrated on this page, the pilots were found primarily at fault. In one, the GCA controller contributed and in another malfunction of GCA equipment was a factor. But these two accidents would not have occurred if the pilots had not violated regulations by descending below the minimum altitudes. The same may be said of four other of these accidents. Two-thirds of the nine accidents would not have occurred if the pilots had not descended below GCA minimums. The lesson is simple enough.

Above all else, pilots must remember that GCA is not a blind landing system. It is a landing approach aid for use in poor weather conditions. GCA altitude minimums have been established at each base employing the equipment in recognition of the fact that the system is not intended for "zero-zero" use. There is no question of injured pride at having to pull up and go to an alternate to land. If visual contact has not been established by the time the minimums are reached, then regulations require that the landing attempt be abandoned. The fact that six of the nine accidents shown here resulted from pilots ignoring the regulation is proof enough that the regulation is a worthy one.

HAIL

Thunderstorms May Spawn Ice Pellets Large Enough to Damage Aircraft

Prepared by USAF Air Weather Service

THE RISK of severe hail damage to aircraft in flight is very small when considered on the average for a large area such as the United States. However, there are times and places for which the risk is much greater than at others, so much so that a knowledge of the risk distribution will permit the pilot to take practicable precautions to avoid dangerous storms.

The pilot cannot judge his chances of meeting hail simply on the basis of the probability of thunderstorms. The average annual ratio of hail to thunderstorm occurrence for points in the United States is less than 20 per cent; the ratio, however, varies markedly with season and region; it may range from 100 per cent to less than one per cent. At sea level in lower latitudes, hail at the ground is rare even where thunderstorms occur nearly every day.

Although hailstorms are a familiar occurrence over land areas in middle latitudes, meteorologists have little reliable data on their frequency and other characteristics. This is because of the very small area of a hailstorm compared to the distance between weather reporting stations, and to the variations in hail intensity in the vertical columns which are not accessible to routine direct observation.

Unfortunately, when one turns to the statistics on hail frequency as reported by regular Weather Bureau stations and summarized in numerous publications, a very misleading impression of the actual risk is obtained, although the locations of the regions of high and low frequency may be indicated approximately correct. This defect was strikingly brought out in a recent study of hail in the High Plains region. Whereas Weather Bureau stations indicate that the frequency of hail is the same in Western Kansas as in Missouri, insurance statistics of hail damage to crops show the risk is nine times greater in Western Kansas than in Missouri.

The High Plains Hail Belt—From consideration of actuarial data and from airline experience, the maximum frequency of hailstorms damaging to aircraft is believed to lie in a North-South belt including New Mexico, the parts of Colorado, Wyoming and Montana east of the Rockies, southern Alberta, and the western parts of Texas, Oklahoma, Kansas, Nebraska, South Dakota and North Dakota. In this belt, any small area of 500 square miles chosen at random probably experiences over 30 days per year with hail reaching the ground. Yet any individual weather station in this area will report less than nine days per year on the average. It is obvious that the former figure is the more indicative of the true risk to which aircraft would be exposed in flights across the region.

The annual total frequency is, of course, not the whole story, for these 30 hail-days per year per 500 square miles are largely concentrated into the warmer months and into the hours from 1000 to 2000 local time. In this belt of maximum risk, the frequency increases from about one or two hailstorms per month in the late winter to three, four, or five per month in June, and decreases again to one in September. The Denver-Cheyenne-North Platte region probably contains the most hail-dangerous of the heavily traveled air routes in the United States, with the western half of Texas a close second.

Hail Risk Elsewhere—The hail-damage risk for aircraft is very slight over most of the rest of the country. However, there is significant danger locally over mountainous areas such as the Rockies, the Ozarks, Appalachians, etc. Several other local areas—the region extending southwest from San Antonio, Texas, and eastern South Dakota and southeast North Dakota—appear to have risks approaching those of the maximum belt farther west. Thunderstorms are frequent in Spring and early Summer over the Iowa-Missouri-eastern Kansas-eastern Nebraska-Oklahoma area, but the proportion of them producing noticeable hail, even aloft, probably does not exceed 40 per cent.

Although the thunderstorms are largely confined to the warmer half of the year, and in most places reach a maximum in spring and summer, the actual number of thunderstorms is so much greater in mid- than early or late season that the maximum hail frequency is also in mid-season.

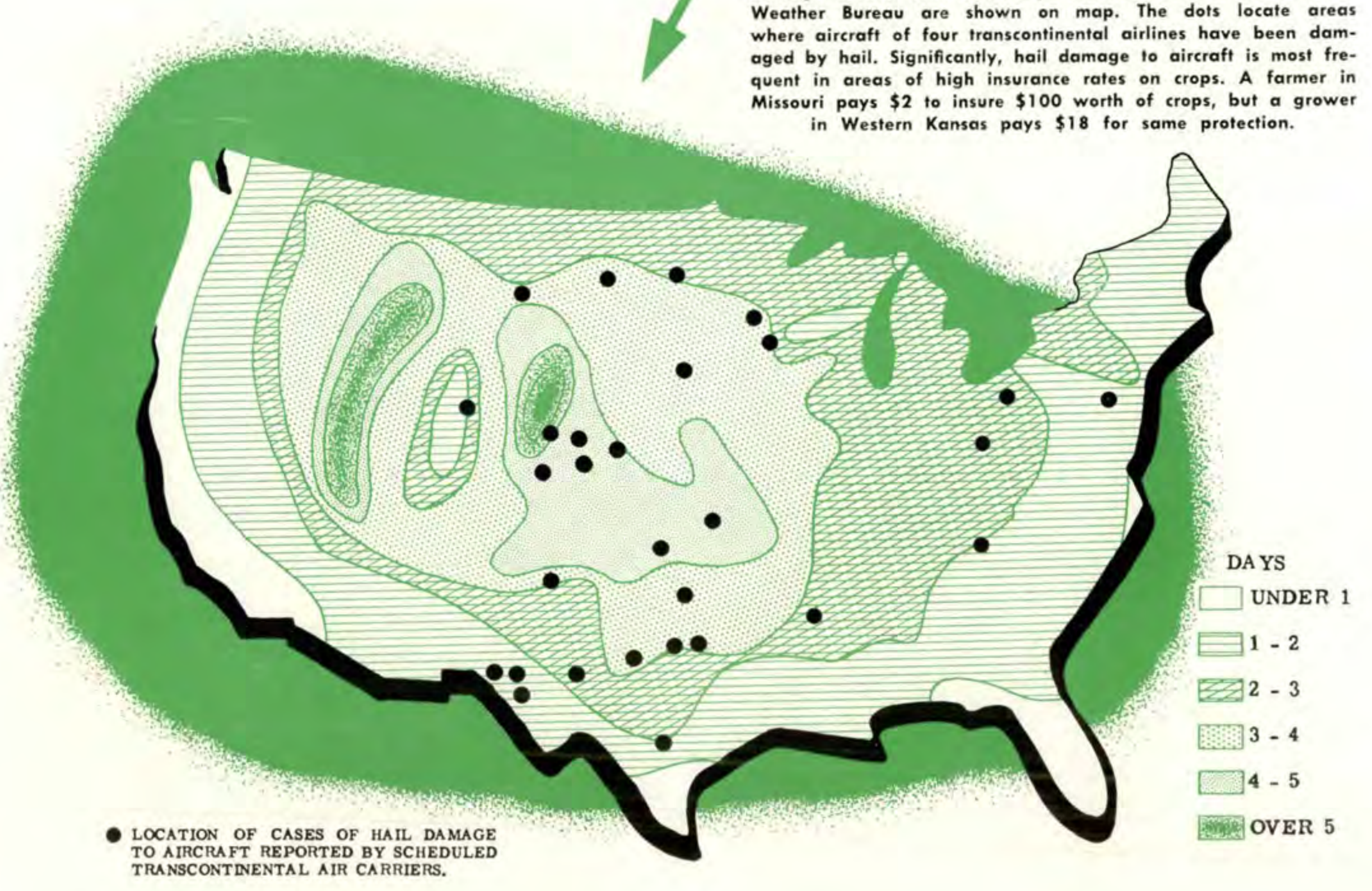
Hail is rare over the oceans and in the Far North of the continent. On other continents, the plains of eastern Europe, plateaus of India and South Africa, and western Argentina are noted for frequent heavy hailstorms.

Is Hail More Likely, Near the Freezing Level?—The hail concentration within the cumulonimbus cloud should be greatest and the hailstones largest in diameter in the region between the 0° and —10°C isotherms. Above this layer the concentration and size will gradually diminish with altitude but at a rate which is variable from case to case and from time to time during the life of the storm. The greater the vertical extent of the cloud above the freezing level, the greater the chance of large hailstones being formed. Below the freezing level, the stones are subjected to rapid melting, the amount of which must be proportionate to the distance and time they have fallen in the warmer air. The initially large stones have a greater chance of reaching the ground. The high freezing-level undoubtedly has something to do with the rarity of hail reaching the ground in the lower latitudes (Gulf Coast, Florida).

The view is gaining ground that every thunderstorm contains some hail. A promising theory of thunderstorm electricity, recently developed by Workman and Reynolds, says the presence of hail is an essential condition for the electric charge separation which causes lightning. The region in a thunderstorm within 5000 feet of the freezing level is very likely to have hail of some size. Apparently, pilots penetrate many thunderstorms near the freezing level without reporting hail. This is probably due to the fact that small-sized hailstones less than ¾ inch in diameter are not easily visible, and have a tendency to create only a mushy, whitish blur as they disintegrate upon striking the aircraft. As a result, the pilot believes he has encountered either rain, snow, or sleet.

Horizontal Distribution of Hail Shafts—Tracks of hailstorms vary from a few yards up to 75 miles in width. The instantaneous area of the average fall is about 20 square miles, usually an elongated area about 10 miles long and two miles wide. Often there are separate and parallel bands falling from the same thunderstorm; these may be peculiar to mature thunderstorms which have more than one cell, or to a line of thunderstorms along a front. Experience with hail in flight seems to indicate that roughly the same dimensions and patterns of hail shafts are encountered aloft. Since the

Average annual number of days with hail as reported by U. S. Weather Bureau are shown on map. The dots locate areas where aircraft of four transcontinental airlines have been damaged by hail. Significantly, hail damage to aircraft is most frequent in areas of high insurance rates on crops. A farmer in Missouri pays $2 to insure $100 worth of crops, but a grower in Western Kansas pays $18 for same protection.



width of the hail shaft is considerably smaller than the width of the thunderstorm, it can frequently happen that an aircraft will cross a thunderstorm area without encountering its hail shafts. Moreover, the life of a given hail shaft may last anywhere from a few minutes to hours. This would explain how two aircraft have passed through a storm 15 minutes apart on the same track, yet only one encountered hail.

On a research project of the Navy Department, penetrations of thunderstorms with specially instrumented aircraft found that most of the hail was encountered in a zone where the light rain changed abruptly to heavy rain as seen on the radar scope. Without radar particularly designed for weather navigation, the pilot cannot make use of this type of information to avoid hail.

The Thunderstorm Project conducted in Florida and Ohio recorded hail on only 25 per cent of its aircraft traverses of thunderstorms, with maximum frequency in middle levels of 10,000 to 25,000 feet; the frequency decreased rapidly below 10,000 feet. The hail shafts appeared to be associated with particular cells within the storm, most of the cases being in the mature stage of the storm. There was some evidence that the cells with hail have greater than average up-draft speeds, exceeding 50 ft/sec in every case, though by no means all strong up-drafts carried hail. Cases of hail with down-drafts were also observed, chiefly at levels below 15,000 feet and with speeds below average. The drafts were usually less than 15,000 feet wide.

The occurrence of hail shafts aloft is not limited to the inside of the cloud or rain area at flight level. There are many cases on record of severe hail damaging aircraft while flying as much as five miles outside of a squall line. The hailstones were spewed out of the sloping sides of the cloud or fell from an overhanging anvil.

Dimensions of Hailstones—Stones reaching the ground range in size from less than one-fourth inch to over four inches in diameter. The diameter of the commonest size varies with the region but is generally less than one inch. A given storm has a range of sizes, the smaller sizes predominating. For the United States, it has been estimated that about one hailstorm in 400 will produce stones the size of walnuts or larger at the ground. At flight levels it must be assumed that the proportion of storms with large stones is much greater, for the stones melt very rapidly in falling through the warm air below the freezing level. The very large stones tend to be more widely scattered than the smaller ones.

A United Air Lines Meteorologist says—

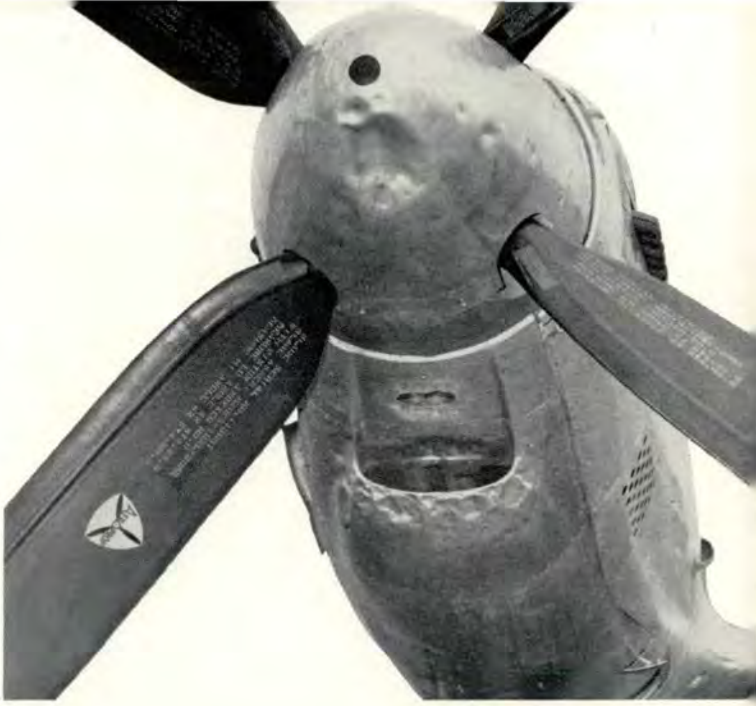
"We know that the hailstone which reaches the ground is about the size of a pea to a marble and that one-inch stones constitute a very small minority of those which actually reach the surface. What we do not know, though, is how big a marble-size stone was before it left the freezing level on its descent through warmer air below; also, it is not very pleasant to contemplate how large a baseball-size stone on the ground might have been before dropping out of the clouds above. Stones of that size are known to drop to the ground somewhere over the Western Plains or the east slope of the Rockies every year although the odds against any particular airplane flying into such a hail shaft are certainly incalculable. We can theorize and guess that a one-inch stone would shrink to marble size after falling from 15,000 feet to the ground but this would not be realistic because the refrigerating effect of the hail itself might be so great that the temperature inside the shaft would be far different than that in the free air surrounding it. About all that we can say definitely is that hail encountered near the freezing level will certainly be larger than the same hail flown through at 5,000 feet."

The CAA has recently completed experiments with

While on an instrument training flight, pilot under the hood, this airplane entered a cloud which, to the observer, did . . .

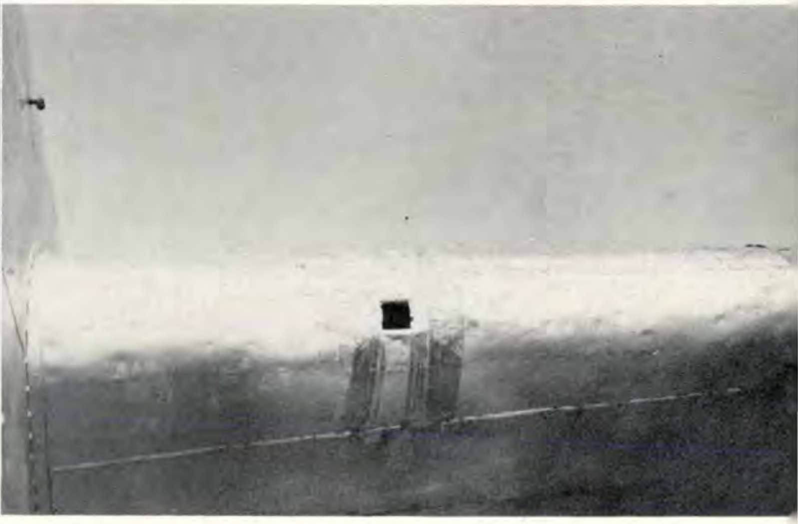
. . . not look too rough. Immediately a heavy patting of rain was heard, followed by heavy hail. Simultaneously, the plane . . .

artificial hailstones of various sizes blown into aircraft sections at different speeds. It was concluded that only stones over one inch in diameter cause measurable damage to wing edges at 260 mph; one-and-one-fourth-inch stones made .04-inch indentations at that speed, and two-inch stones had the same result at 160 mph. The importance of reducing airspeed when caught in a storm is emphasized by these figures. The metal surfaces of operational-type aircraft parked on the ground would probably not be dented by hail less than two-and-one-half or three inches in diameter. Fabric surfaces are, of course, more vulnerable.



Flight Procedure—Because no method has yet been discovered for forecasting which thunderstorm situations will produce damaging hail, pilots flying in the regions of large hail damage risk should regard every thunderstorm as dangerous. In the Spring, the heavy hailstorms of the region just east of the Colorado Rockies occur mainly to the rear of a cold front or of a deep "cold-low" passing eastward, but in other months there does not seem to be any particular relation to air-mass, fronts, lapse-rate, height of freezing level, or wind pattern. The importance of reducing airspeed when in a storm has already been mentioned.

. . . was lifted 2,000 feet in an updraft. The pilots immediately started a 180° turn. They were in the cloud less than two minutes.



Speed is an important factor, but size of the hailstone has the greatest effect in damage, such as to F-51 above and B-25 below

The appearance of a storm cloud from a distance may indicate its stage of development. A growing storm with hard "cauliflower" top reaching above 25,000 feet is more likely to be very turbulent and have large hail than old storms with extended anvils and numerous disorganized cells. However, imbedded in old complex multicellular storms there may be new vigorous cells, hidden from view. At night, these distinctions cannot be made without radar, though some authorities claim that a predominance of cloud-to-ground lightning indicates a young storm and cloud-to-cloud lightning an old one.

For the present at least, it appears that there is no real substitute for good judgment on the part of the pilot in avoiding damaging hail and severe turbulence in thunderstorm conditions. In order to be in a position to exercise good judgment, however, the pilot must have a sound basic knowledge of the overall weather picture before leaving the ground and be aware of the potential developments so that he can recognize and evaluate them properly when they loom up ahead of him on his flight path. This is where operations supervisors and the weather forecaster fit into the picture. Their responsibility is to insure that a thorough analysis is made of the weather situation at the flight planning stage and that any major or unexpected developments occurring after the aircraft takes off should be relayed to the pilot in flight. It is only in this way through a combination of careful analysis on the ground and the pilots' cockpit view of the situation, that the hazards of thunderstorm navigation can be kept at a minimum.

getting good on the gages an all weather job

Two Schools With a Single Thought Turn Out Proficient Instrument Pilots at Selfridge AFB

One moment the jet fighter was on top of an overcast, the next it had vanished in a letdown into the damp, gray murk. Turbulence was encountered and the fighter plane rocked and bobbed, but the pilot handled the plane confidently because he was proficient and had been thoroughly checked out in a training course at a jet fighter instrument school. Staying on the gages very definitely requires precision flying. And the degree to which this skill is developed can and does in many cases determine whether a pilot and his crew live or die.

Now, more than ever before, the skill of instrument flying may determine much more than just whether or not the pilot and his crew live. The proficiency or lack of proficiency of Air Force pilots may also decide whether or not many Americans are killed—whether or not American cities are bombed.

Col. F. S. Gabreski, Commanding Officer of the 56th Fighter Interceptor Group and one of the outstanding fighter pilots of WW II, put this fact both briefly and aptly when he said, "Fighter aircraft must take off under all conditions, intercept and destroy enemy aircraft, and return to their bases. Expert training in instrument flying is a big step toward creating a fighter force that can accomplish its mission in any kind of weather."

Following the words with action, Colonel Gabreski directed the establishment within the 56th Fighter-Interceptor Group of a jet fighter instrument training school. This school was formed and began operations on 5 October 1950, under the supervision of Lt. Col. George L. Jones, Group Operations Officer. Up until the middle of February, 1951, the six T-33's used by the school had been flown over 680 hours, of which 500 were logged as instrument instruction, and 40 pilots had been graduated from the one-week course.

That sounds like instrument training is receiving considerable emphasis, but that's only half the instrument story at Selfridge AFB. Jet pilots aren't the only ones who get intensive instrument training. There is also a school, this one a two-week course, for all pilots of conventional aircraft at Selfridge. It was begun at Marshall AFB, Kansas, and moved to Selfridge with the 10th Air Force Headquarters, beginning operations in May, 1950.

Both the jet and conventional instrument schools are fundamentally based on the premise that to get good instruction you must have good instructors. And where do you get expert instructors? Well, in the Air Force, the best instrument instructors are graduates of the Instrument Pilot School at Tyndall AFB, Florida. And these are the men who teach other pilots the skill of instrument flying at Selfridge. Tyndall graduates are being used as they are meant to be used. The results have been that the schools at Selfridge were organized and have been operated on proven principles rather than on a trial-and-error system. This enabled effective and correct instruction to be given from the very beginning of the courses.

The jet instrument school, now under Capt. T. H. Orrick, has three full-time and one part-time instructors, all of whom attended the Instrument Pilot School at Tyndall. These instructors have for the past few months averaged over 50 hours of T-33 time per month. They are all eager about their jobs, recognizing that they play an important part in raising the proficiency of all pilots in the group to the level required to complete the mission.

They agree that one of the first steps in establishing a school such as theirs should be setting up SOP's and minimums for actual weather training flights. For example, if the objective is to qualify pilots for white instrument cards, then scheduled training flights should be flown so long as the weather is not below white card minimums. And at Selfridge a considerable amount of the school's instrument instruction must be given in actual weather conditions.

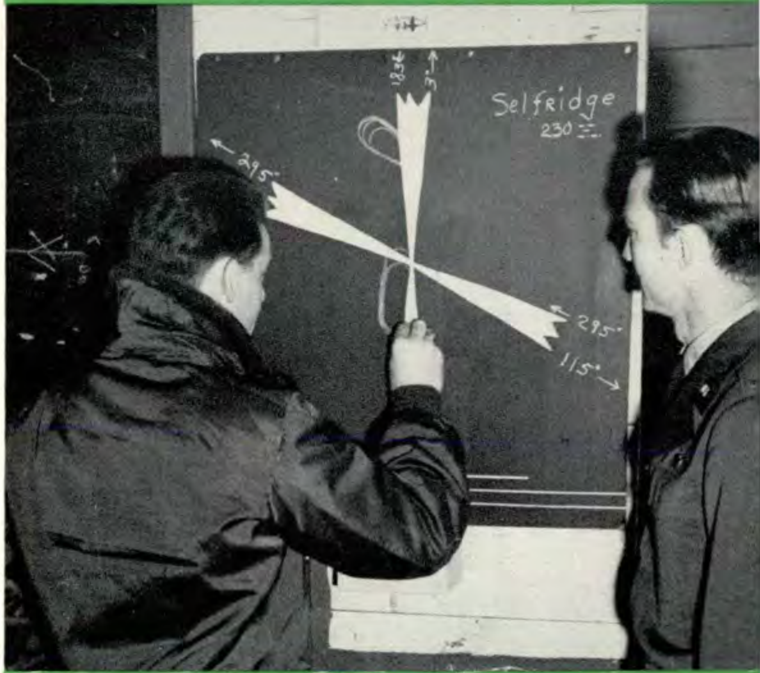
An all-weather flying area which lies to the northwest of Selfridge has been established for the use of the jet school. The only requirement is that the planes stay VFR and below 2500 feet until they have crossed an airway several miles north of the base. From there on they are unrestricted and can execute any maneuvers desired so long as they remain in the area. This has eased one major problem of the school, operation in weather conditions. A homing beacon is being located on the north leg of the Selfridge range beyond the airway to further ease the procedure for returning to base from the weather flight area.

The jet instrument school was originally envisioned as temporary, to give squadron commanders, operations officers and flight leaders a short refresher course on instrument flying. It met with such success that the decision was made to run all group pilots through. This was not as easy as it sounds, for only the group headquarters and the 61st Fighter-Interceptor Squadron are based at Selfridge, while the 62nd and 63rd Squadrons are at O'Hare and Oscoda, respectively. This problem could only be solved with the whole-hearted backing of the higher-ups in the group. The backing was there.

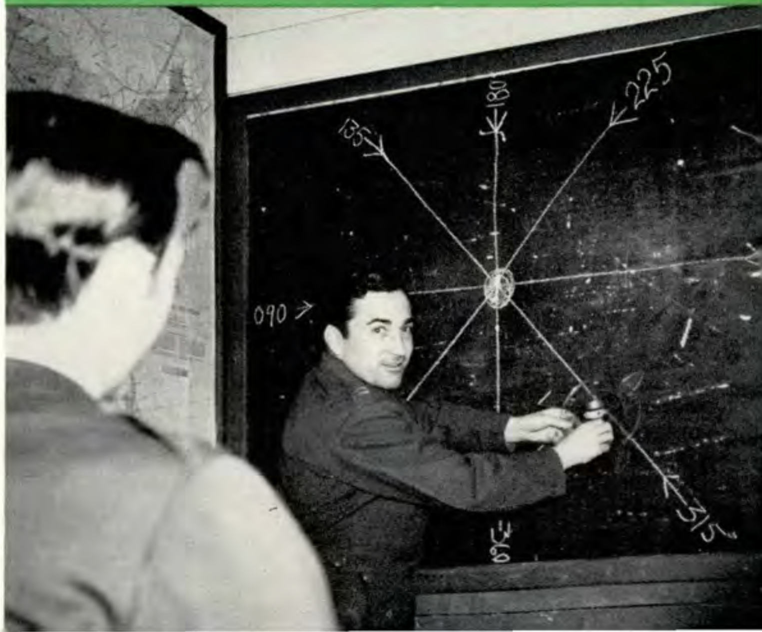
First, all T-33's of the group, including those originally assigned to the outlying squadrons, were gathered together at Selfridge and orders were issued that they would be used only for instrument training and for transition of pilots newly assigned to the group. Under one maintenance section and one scheduling officer, this resulted in savings of time, effort and personnel, as well as better utilization of aircraft.

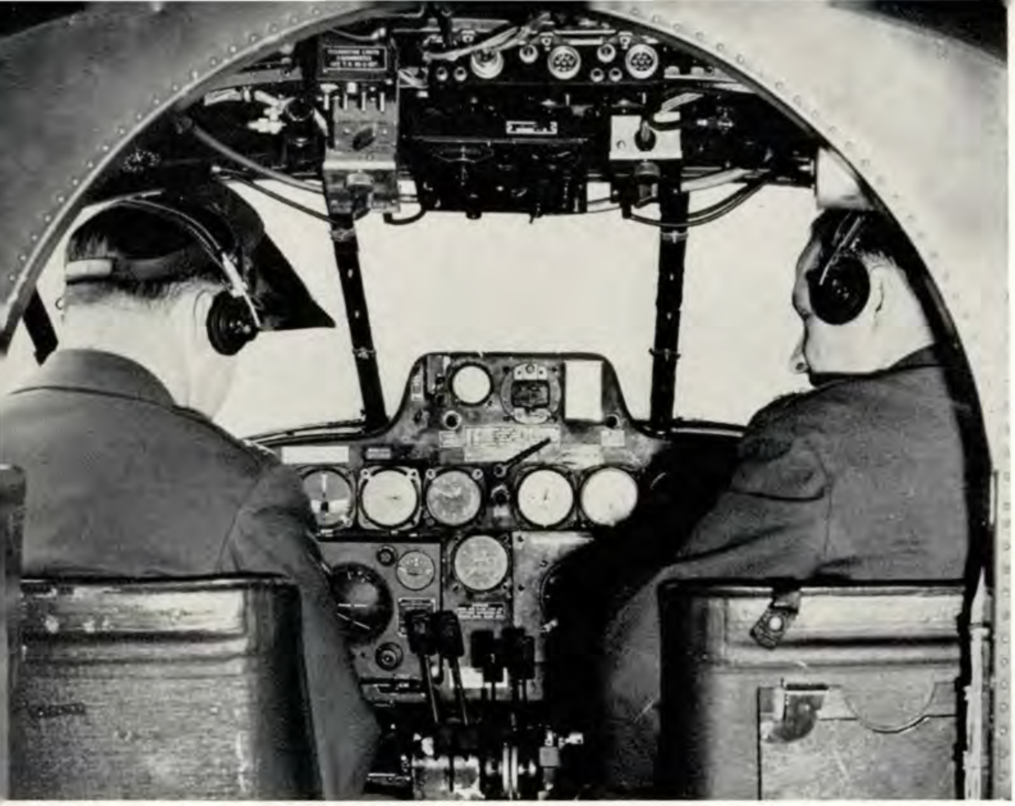
To insure that all units of the group get in on the training, each squadron is given a weekly quota of students. For example, during one week, the 62nd at O'Hare Field may be required to send two students to the school at Selfridge. These pilots receive temporary duty orders to the school and have no other duty assignments while they are undergoing instruction. The same applies to pilots stationed at Selfridge. All are given temporary duty orders to the school so that there will be no other duties to interfere with their instru-

Here, students receive a briefing on cockpit of a jet fighter. Below, they work out a letdown procedure for Selfridge AFB.

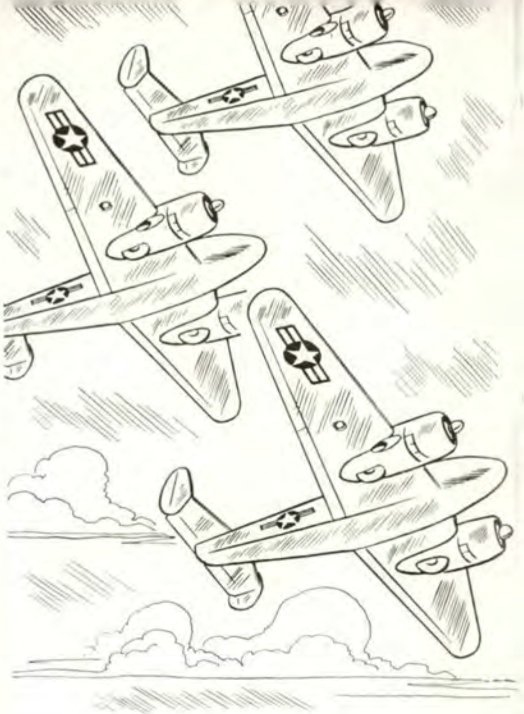


Capt. Orrick, who supervises the jet instrument school, goes over several radio compass problems with some of the students.





Using C-45's for in-flight instruction, the multi-engine half of the school catches pilots who are rusty on instruments.



ment training. This, of course, could not be done if the group commander and his staff were not firmly behind the program.

Instructors in the jet school may at times seem to their students a bit hepped on the subject of recovery from unusual positions. But there's a reason for it. A quick survey of accident records shows that a large percentage of jet fighter instrument accidents have occurred to wingmen who have become lost from their leaders during actual weather flight. At such times, a quick transition from visual formation flying to the gages is necessary. Usually, when this happens, it is during some sort of maneuver and the wingman finds himself actually in an unusual position. Since, as the records bear out, too many pilots have failed to recover in such situations, unusual position recovery is emphasized in the jet instrument school.

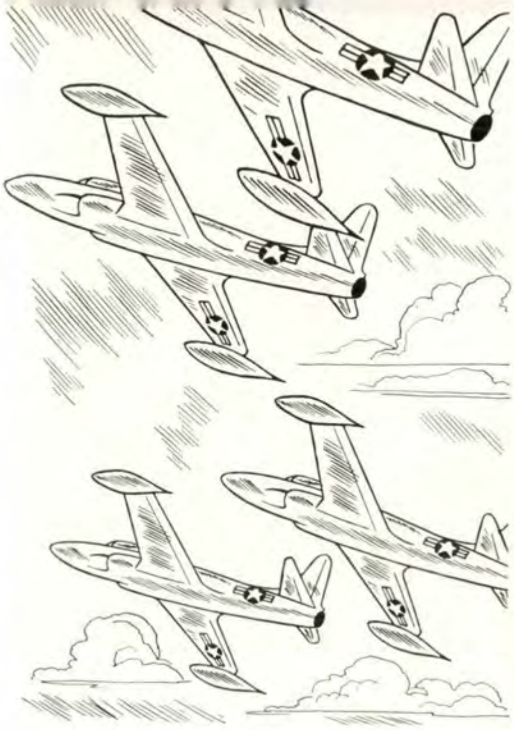
Instrument technique improves noticeably and confidence goes up by leaps and bounds when a student finds himself on his back a couple of times and recovers properly during training flights.

Another point which receives emphasis concerns GCA. Students had a lot of trouble with airspeed, glide path and directional control during final approaches until instructors eliminated airspeed as a problem. This they did by requiring that proper approach airspeed be set up just prior to entering the glide path. Now, flaps are dropped and a throttle setting which will give the desired airspeed is set just before reaching the glide path. All the instrument pilot has to do to maintain the right airspeed is to drop his nose as the glide path is reached. GCA's are much easier and directional control is much truer since "throttle-jockeying" for airspeed is practically eliminated.

The actual flying phase of the jet instrument school consists of five 2-hour flight periods, the last of which is normally an instrument check. If any particular student needs more training, he gets it. On each flight, from the time he lines up for takeoff until he is ready to touch down, the student is under the hood. The ground school course complements the flying phase. A part of the ground school training is given by the conventional aircraft instrument school, as are all written instrument exams.

One problem which plagues the jet school is that of retaining instructors. Instructors, just like everyone else, are rotated and reassigned to fill quotas and commitments in accordance with Air Force policy. There can be no argument with this—however, it does hamper the operation of the school. Instructors are much more capable after they have instructed a few classes and have established themselves a routine and an instructional technique. The word for any outfit considering the establishment of such a school is to plan way ahead. Choose pilots who are low on the list for reassignment, send them to the Instrument Pilot School at Tyndall, then insert them into the local instrument training program. The organization will receive maximum benefit from this procedure.

The other half of the Selfridge instrument story is not so glamorous as that of the jet group, but it's just as effective and just as necessary. The Air Base, or the 56th Fighter-Interceptor Wing (as differentiated from the Group), instrument school uses C-45's for in-flight instruction. Although it sounds like a much simpler task



On each flight in a T-33 trainer, from time he lines up for takeoff until touchdown, the student is under the hood.

than teaching jet instruments, it is not. And one of the major reasons it is not is that this school catches all the behind-the-lines pilots who don't fly every day and therefore need considerably more brushing up.

Students for this school come from 10th Air Force Headquarters, 661st Aircraft Warning Squadron (which includes pilots from outlying radar warning stations), 30th Air Division, University of Michigan students, Wayne University students, and others such as ANG Instructors from various 10th Air Force stations, as well as the usual base pilots. Few of these pilots fly as regularly as do the pilots of the jet group,, and their instruction must be geared to this fact.

On the other hand, there is a bright side in that the students here are also on temporary duty orders to the school, so that with a few exceptions they have no other duties to interfere with their training. The two weeks are well spent, with students normally getting about 20 hours flying time, of which 10 are under the hood. If any student needs more instruction before taking his instrument check, he gets it. As a sideline this school also gives instrument checks to pilots who are not students at the school. Such pilots may be given anywhere between two and 10 hours of instruction before taking their checks.

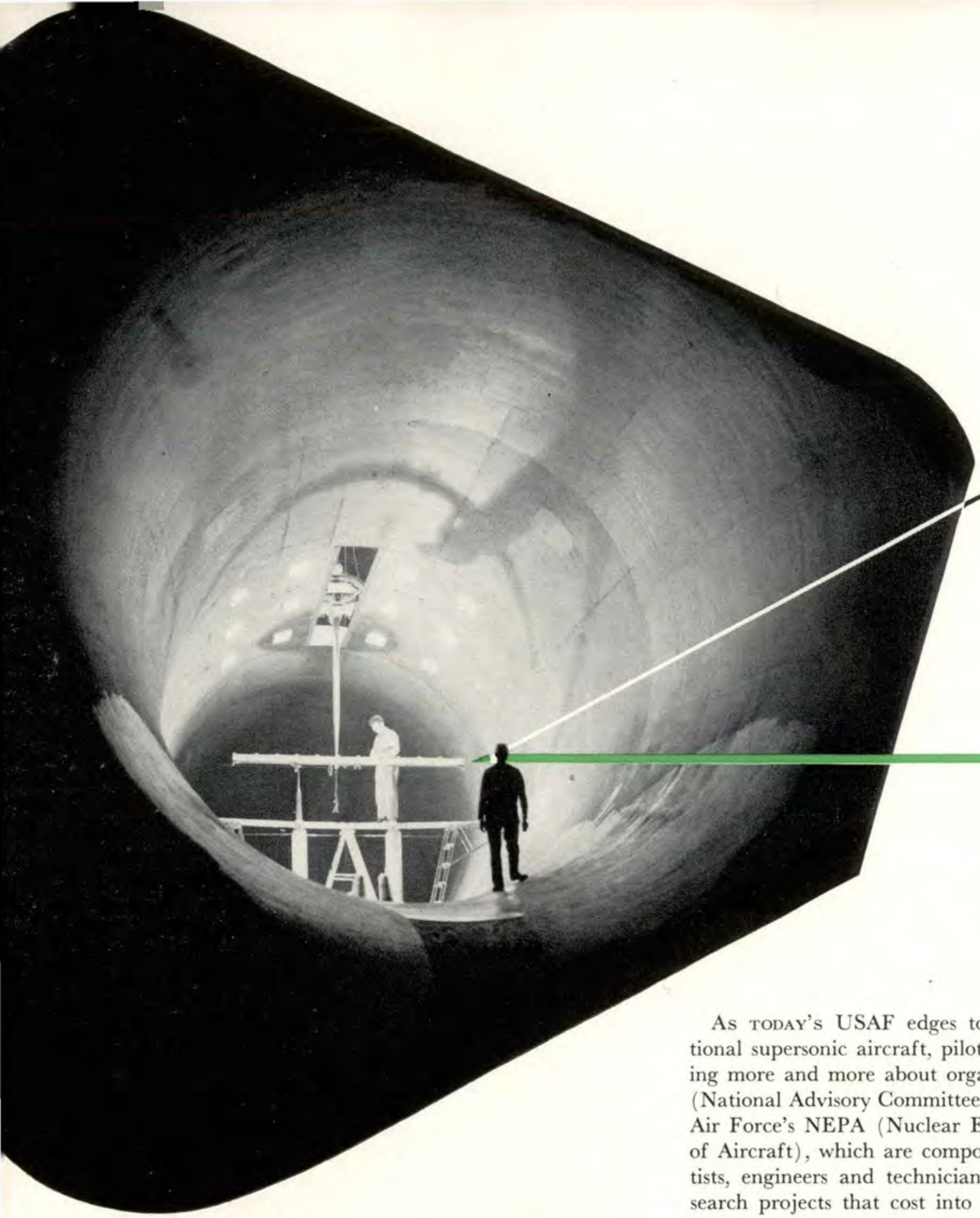
The school is run by Capt. M. T. Vance, who though not a Tyndall alumnus is well qualified to give instrument instruction. His assistants are all graduates of Tyndall and have attempted to model their abbreviated course after the Air Force school in every possible way.

The base instrument school began operating at Selfridge in May, 1950, and by the end of the year it had graduated 125 pilots and issued 318 instrument cards. In doing this, the five C-45's assigned to the school and an occasionally borrowed C-47 were flown 1,678 hours. This, with three full- and two part-time instructors, is not a bad record, by far.

Forty hours of ground school are included in the curriculum and this instruction is given by the same pilots who give instrument flight instruction. Much of the material used in the ground school admittedly comes almost verbatim from the Air Force Instrument Pilot School, but that insures authenticity. The instructors have devised and had mimeographed a text book for use in the ground school which they were recently advised would be adopted as a Tenth Air Force manual for use by all units. This attests to the fact that the instructors are putting out the straight stuff.

Written comments of graduates of the school are almost unanimous in praising the quality of the instruction as well as the cooperation of the instructors, NCO's and line crewmen. Most negative comments concern the classroom facilities, which are none too swank, and of course some individuals, as would be expected, disagree with the amount of emphasis placed on certain phases of instruction. All do agree, however, that the instructors are eager and sincere about their work and that the course is of great value.

The work that these two instrument schools at Selfridge AFB are doing shows a true appreciation of the all-weather objective of the Air Force and an honest attempt to reach that objective. The only prerequisite for the establishment of such an instrument training program are eager, well-qualified people to operate it and the whole-hearted backing of those in the drivers' seat.



SCIENCE, SAF

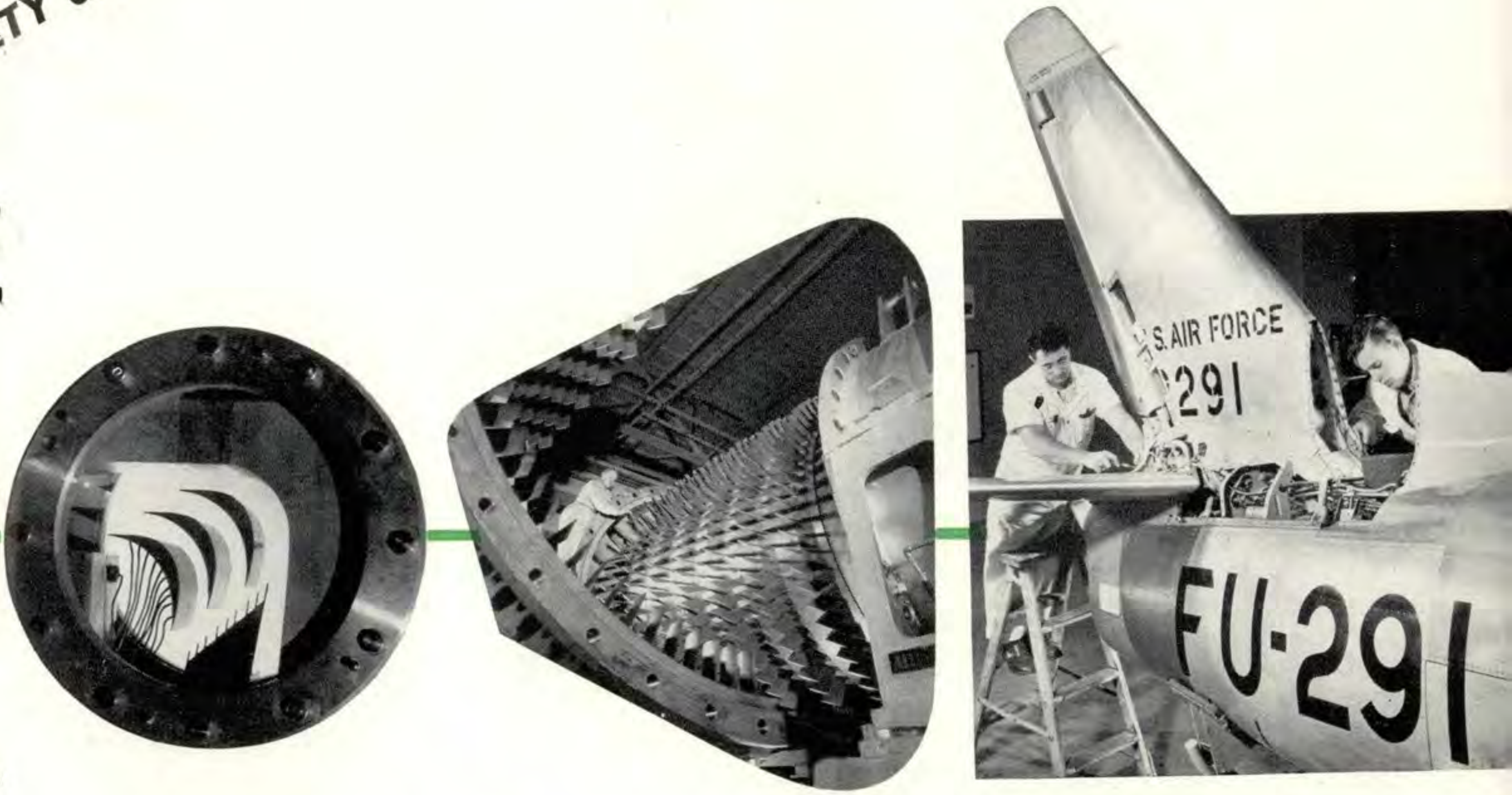
As TODAY's USAF edges toward the day of operational supersonic aircraft, pilots and crewmen are hearing more and more about organizations like the NACA (National Advisory Committee for Aeronautics) and the Air Force's NEPA (Nuclear Energy for the Propulsion of Aircraft), which are composed of hundreds of scientists, engineers and technicians working on Flight Research projects that cost into the millions of dollars.

Since a large part of these efforts and monies expended go toward tailoring tomorrow's airplane for the human body, the pilot and crewmember should know more about how science plays a major role in the never-ending search for more and better safety in flight.

One of the first and leading aeronautical organizations to get into this search for better planes is the NACA. In the decade following the first powered flight of the Wright brothers, the need for organized scientific study of aviation became increasingly apparent. To meet this need, Congress in March, 1915, established the NACA. Now, after 36 years, the influence of this research shows clearly in present faster and cleaner-designed airplanes.

There are three NACA research laboratories, employing a staff of thousands. These research centers are located at Langley AFB, Virginia; Moffett Field, Cali-

ETY and the USAF



SCIENCE AT WORK—Above, left to right, are NACA research scenes showing a wind tunnel. The circle shows compressor blade models mounted in test section of supersonic cascade tunnel. Next, a mechanic inspecting the 1,137 blades of a seven-stage axial flow compressor designed to push air through a supersonic pressure wind tunnel. At the far right, before flight testing special instruments are installed in F-86 tail structure to obtain research information. Lower left, an F-84 is "flown standing still" to obtain pressure distribution measurements on the wing and to study possible stabilty effects due to the wing-tip fuel tanks. At the point where the full-size F-84 is mounted the tunnel is 40 feet high and 80 feet in width.

fornia, and Cleveland, Ohio. The Langley Lab, founded in 1916, is the largest as well as the oldest establishment of the three. Through operating its own laboratories, the NACA coordinates the fundamental research programs of other aviation agencies. It also supports aviation research in scientific institutions.

Just how the NACA science has helped the military pilots and crewmen in the past is best shown by a few examples. For instance, during World War II a certain type of fighter plane newly accepted for military use showed a tendency to shed its tail surfaces during high-speed dives. Something was obviously wrong and the job of finding out was turned over the NACA Lab at Langley. There, research scientists diagnosed the problem and offered recommendations for design changes. These were carried out by the manufacturer and the plane subsequently became one of America's most potent weapons.

Another first line fighter was found to be inferior to enemy fighters in rolling maneuverability. NACA scientists took over again, and after laboratory study, a redesign of the ailerons gave the advantage to U. S. pilots. Actually, these wartime activities of the Laboratory represented somewhat of a departure from the long-range purpose for which it was intended, but they were, and continue to be, of significant importance in the safety, development, and improvement of Air Force and Navy planes.

Still another time, scheduled work was hurriedly set aside while a new heavy bomber awaiting mass production was installed in a large wind tunnel to determine a means of eliminating a severe tail-buffeting encountered in early flight tests. The trouble was located and once again science had scored for safety. Of equal, though perhaps less spectacular importance were the problems brought about by the "growing pains" of military airplanes — problems associated with increases in weight and power; changes in armament and other equipment, or revisions in design. In a five-year period the Langley Laboratory took part in the development of 137 aircraft, including virtually all of the types placed in actual military service.

NACA research touches on all phases of aviation. For convenience of description the research work can be roughly divided as follows: Aerodynamics, hydrodynamics, propulsion, aircraft loads, airframe construction and materials. These are the principal elements of aviation research which is carried out in dozens of NACA wind tunnels of specialized types and uses, seaplane testing basins, and other service facilities.

After the analytical and theoretical studies comes the flight testing phase—and here again is where NACA takes part. Working on a cooperative basis with the Air Force and the Navy, the NACA follows most of its research right in to the Flight Test Unit at Edwards AFB, California, which has been busy since 1946 testing all types of unconventional and experimental types of planes. For the highest margin of safety, the test unit was located at Muroc on the bed of a dry lake that provides a level take-off and landing field more than five miles long. Also, the desert visibility is better for the men doing the flying.

A typical NACA project would include problems of aircraft operation. Some of these during recent years have been icing, gust loads and ditching technique, most of which have been encountered or experienced by pilots and crews of the USAF. The NACA thermal ice-prevention system provided the pilot with a means for virtual elimination of icing hazards to propellered aircraft.

A B-29 ditching model being set up for a test in tank at Langley. Blewo, a scale model is filmed and studied for spin characteristics

Research over a period of years, ending in more than two years of safe flight research through icing conditions proved the system and provided enough information to protect any equipped airplane from danger of icing.

Icing of jet engines and a few other problems remain to be thoroughly worked out. Operations have shown that axial flow units are vulnerable, and means of protection for these and other types is the subject of further research.

Work in turbulence and gusts has resulted in a large amount of data, a lot of which has been applied to the development of new planes and flying techniques. But the problem of gust loads increases in importance with increase in speeds, and much knowledge remains to be gained about gusts and how to ease the loads.

Ditching investigations are being carried out continually on new military types and transport planes in order to establish an SOP for the aircrew. Here, work continues on new safety devices and modifications.

Research on cabin heating and ventilation becomes of added importance as airplane speeds go up. Even high subsonic flight brings the need for cockpit cooling. Looking ahead to supersonic flight, many problems of cooling and heat radiation come into consideration, not only in relation to the pilot and the crew, but to protect the airplane structure itself. The temperature rise accompanying supersonic speeds may prove to be a limiting handicap to high-speed flight. The questions of friction heating and heat radiation must be answered before any cooling requirements can be determined. But this is only one of many new problems posed by future supersonic flight which calls for a different approach and vigorous thought.

As the NACA, the USAF, Navy and other scientific research organizations go deeper into these new problems of flight, the more difficult they become from the standpoint of the human element. And with the move toward the supersonic Air forces of the future science has the heavy responsibility of finding the answers in the never-ending search for ultimate safety in flight.

Years of research are behind every mission flown by USAF pilots

---safety comes in BIG packages

New Techniques and Precautions are Used in Flying the Massive XC-99 Global Transport

By Capt. RUSSELL D. WEBB
Kelly AFB, Texas

AT 1100 ONE BRIGHT MORNING last summer the world's largest operating airplane was letting down over San Diego for a landing. The XC-99, experimental cargo version of the B-36 global bomber, had left its home field, Kelly Air Force Base near San Antonio, Texas, six hours earlier. It had encountered some minor trouble on the way with one of its half-dozen powerful engines, but the difficulty had been fixed in flight. Now, with all six engines humming in sweet unison, the XC-99 was settling lazily onto Lindbergh Field.

The pilot, Col. Frederick Bell, pulled his switch to lower the landing gear. The big plane hesitated in its slow descent, and then a voice sang out on the intercom:

"Fixed fairing on the left main gear is damaged, sir —it's mangled and hanging loose." The voice came from one of the two scanners stationed in the body of the airplane to observe the behavior of its gear and engines in flight. As in the B-36, the wings of the XC-99 are so far aft of the cockpit that the pilot can see only their tips. The brief conversation that followed went something like this:

Colonel Bell: "Is the gear damaged?"

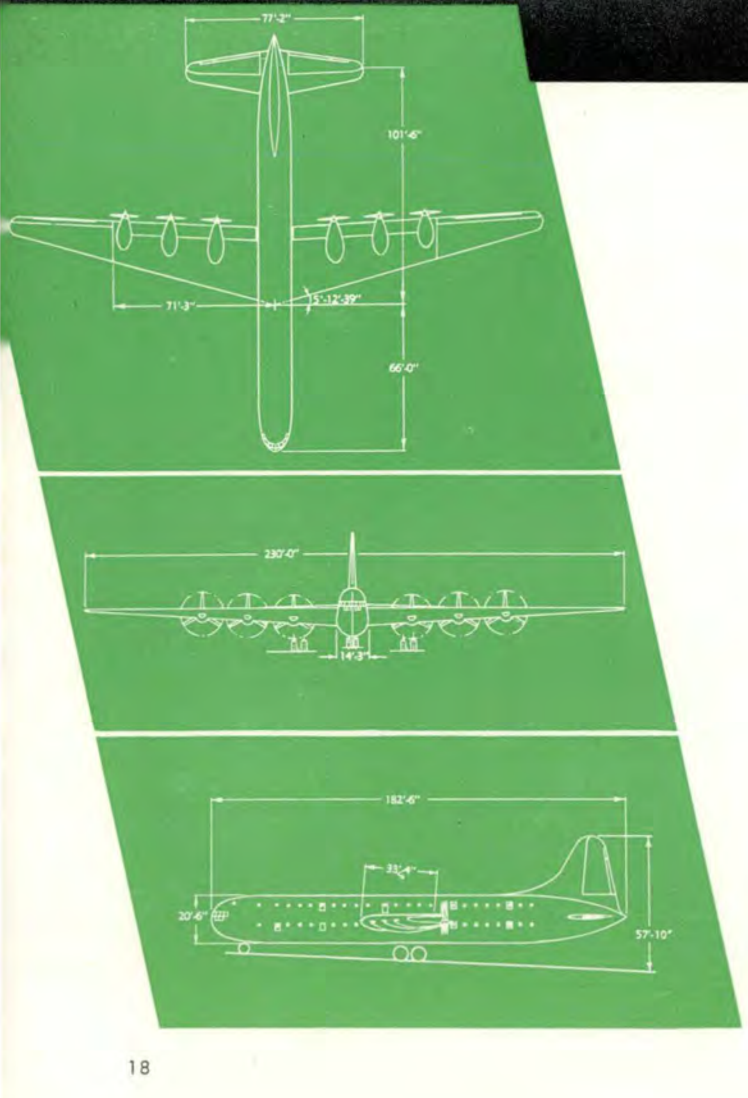
Scanner: "No, sir. The fairing keeps fluttering, but the cables on the gear look secure."

Colonel Bell: "Roger. We'll set her down." And at 1112 the wheels touched down on the broad runway and the plane rolled to a stop in a normal landing.

This small incident is typical of the new techniques and precautions used in flying the massive aircraft of the global era. The day when a pilot was able to oversee and control every part of his plane with his own eyes and fingertips is just about over. Tomorrow's pilot—already exemplified in the men who fly such craft as the XC-99 and the B-36—occupies a post resembling that of the captain on the bridge of a battleship. From his lofty perch he directs and supervises its maneuvers. But it requires many hands and eyes at distant stations in the plane, and an elaborate system of communications, to execute his will.

The XC-99 is no ordinary plane. The only specimen of its type built so far, it is uniquely valuable to the Air Force as a laboratory in which to study the behavior of mammoth cargo transports. An experimental craft—even a small one—must be handled with unusual tenderness. The XC-99 cost millions of dollars. Its loss would be a tremendous waste of money, besides removing the only freight carrier in existence that is now able to ferry such heavy loads of men or material to any spot on earth.

The XC-99 can lift more than 100,000 pounds of freight on its two long cargo decks and haul them up to 2,000 miles. With the addition of jet pods similar to those on the B-36, to get the XC-99 into the air with a heavier load of fuel, it can fly the same amount of cargo more than 2,400 miles—the longest overwater hop in any air-freight route flown by the Air Force. Or, it can carry 404 passengers—two airborne companies fully equipped for battle—or bring home 305 litter patients with 20 hospital attendants, in addition to its normal crew of 11.



To protect these valuable burdens, and the plane itself, the XC-99 has all the safety devices built into other airplanes, and then some. It carries several specially-designed items that are found in no other operational aircraft. The fuel tanks, for instance, have a CO_2 purging system using gas manufactured from dry ice. The system, an idea suggested by Colonel Bell before he was transferred to other duty and relieved by Col. Theodore W. Tucker as the XC-99's commander, was built and installed at Kelly AFB. The dry ice is contained in six ice boxes, fitted with electric heaters to assure sublimation of the dry ice at extremely cold temperatures. This constant purging of the tanks minimizes the danger of explosions. The engines and accessories likewise are protected by a methyl-bromide fire-extinguishing system.

Another dry-ice box enables the crew to carry a two weeks' supply of perishable food for a series of long missions, in addition to cold drinks for refreshments. Hot meals can be prepared in the plane's own galley. Five bunks are available to the crew for rest between periods on duty. All these are safety factors as well as creature comforts. By increasing the well-being of the crew, they also sharpen the physical and mental coordination with which the XC-99 is handled.

Regular flight equipment includes heated flying suits, life rafts, Mae Wests, axes, flares and other items that could be of use under one or another set of conditions the plane might encounter. Arctic gear is provided for possible missions in far northern latitudes. Oxygen is

THE XC-99 presents a dramatic appearance in night-time loading operations. Above, in flight with the gear down, this "Queen Mary" of the skies floats sedately along with two scanners keeping a watch on the behavior of its gear and engines. At right, these crewmembers called themselves "Colonel Bell's Rough Riders" while the XC-99 was being flight-tested last summer. In operation, the big job for the big plane was hauling high-priority cargoes in support of the Far East fighting. The "99 can lift more than 100,000 pounds for a 2,000 mile flight.

available at each flight station. A carbon-monoxide warning system guards all the heating outlets, flashing a signal light on the flight engineer's control panel if any trace of this deadly gas escapes inside the cabins. Throughout the plane, heat is delivered by exchanging air through the engines. Anti-icing with hot air is possible on leading edges of all airfoil surfaces.

At night the scanners are provided with lights which illuminate the wings. With Aldis lamps from the two windows at their stations, the scanners can observe the engines, flaps, and landing gear, and keep the engineer and pilot informed of their operating condition. In congested areas at night all the lights inside the fuselage are turned on, except in the pilots' compartment. They are too far aft to be seen by the pilot, but other planes can distinguish them. From a distance the XC-99 looks rather like the Queen Mary passing by, with portholes shining through the darkness.

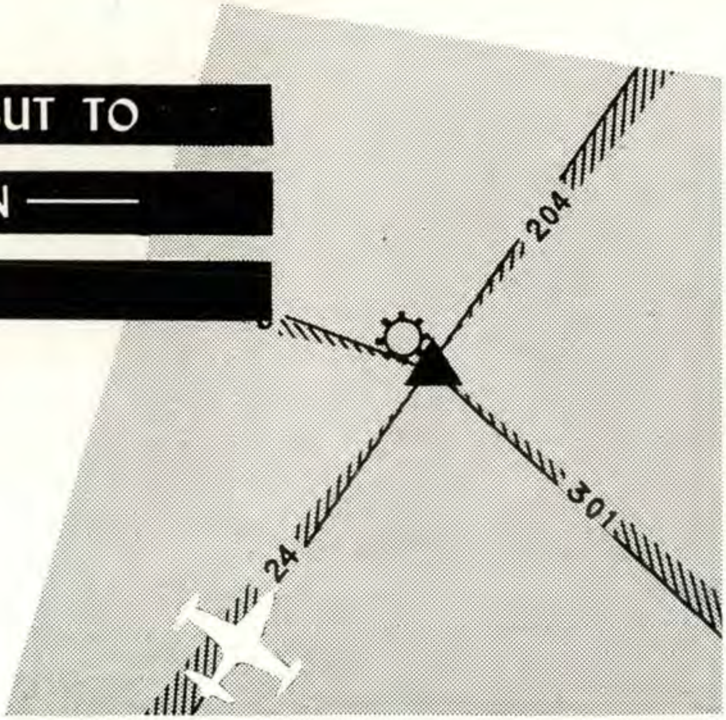
Instead of a hydraulic power-boost to actuate the flight surfaces, the XC-99 uses a "flying servo-tab control." The pilot's control moves a small tab, and this in turn governs the action of the large control surface by directing the force of the slipstream on it. Pilots who have flown the plane agree that it is extremely light on the controls, in spite of its huge size. It handles more easily than most transports of far less weight and girth.

Other pilots watching the XC-99 take off are sometimes alarmed by the high angle at which it leaves the field. They shouldn't be. The terrific horsepower delivered by the six engines—21,000 altogether—and the pusher-type propellers give the XC-99 a high-performance takeoff with a very short run. In case of an aborted takeoff the props can be reversed with a wide-open throttle to bring the ship to a quick stop. Fully synchronized in reverse pitch, the props are used for braking in nearly all landings.

Since October, when the XC-99 was placed in regular operation by the Air Force and assigned to Kelly AFB, it has hauled more than 1,200,000 pounds of cargo. It carried high-priority supplies such as aircraft engines which are too bulky or too heavy to be transported in smaller planes. It has made one record non-stop run across the continent from Sacramento, California, to Macon, Georgia, with 85,000 pounds of freight. On its first overwater hop, from Shreveport, Louisiana, to Puerto Rico, the big plane ferried 87,000 pounds.

On its return from Puerto Rico the XC-99 was temporarily grounded so that a stronger landing gear could be installed. Other modifications, based on the operational experience of its crew, are to be made at Kelly before the plane returns to active duty early in the spring. It is classed as an experimental type while the Air Force studies its performance. The XC-99 has already shown that a cargo carrier approximately twice as large as any other now in ordinary use can be operated efficiently, economically, and—above all—safely.

CIVIL AIRWAYS ARE BROAD, BUT TO AVOID A HEAD-ON COLLISION —— FLY ON THE *Right Side*



A FIVE - HUNDRED - FOOT CEILING, with intermittent drizzle spread a blanket of apprehension over my elation as I prepared to make my first flight in a military aircraft since the war. The scene in the operations room was a familiar one, and with the exception of the ancient, too-tight, uniform, I felt that I was at home. The rush of pilots with their Forms 175, the chatter of teletype machines in the adjacent weather office, and the occasional racuous blare of the squawk box, brought a wave of nostalgia.

I might have settled into serious reminiscing had it not been for the voice of Lieutenant J. at my elbow with a brisk, courteous, "Ready, Sir." (These capable young men of today's Air Force make no distinction in their courtesies between the week-end reservist and the regular officers.) Smiling, I said, "Yes" and *tried* to walk in a nonchalant, but military, manner to the waiting B-25. He walked, correctly, on my left. I watched and listened while he made a confident, capable check of the aircraft, and chatted informally with the Crew Chief. I was satisfied. "Now, if he can only fly instruments," I thought.

I copied his ATC Clearance. "Blank ATC clears Air Force 1234 to the blank airport via Green five. Maintain five thousand, contact XYZ radio approaching, for further clearance."

The takeoff and climb was in keeping with my earlier opinion of the capabilities of the young man on my left. I tuned in the range ahead, listened to the On course, then the identification and switched to compass, watching the needle swing around and settle on zero. We were leveled off at five thousand now, cruising down that broad highway in the sky marked by the North course of XYZ range. The overcast was broken cumuliform clouds, permitting an occasional glimpse of earth and sky. After the first 20 minutes of cruising, I glanced at the pilot, noting his relaxed, efficient maneuvering of the controls. As he did the job he probably loved best, I thought, "Here is a Master—an Artist." And, he was.

His position report at XYZ range was prompt and according to the book. The needle on the radio compass swung around to 180° and I started checking for the frequency of the next range ahead. I found the frequency, made a mental note of it, and decided to wait 15 minutes before attempting to tune it in. I settled back and lit a cigarette, to wait. Then it happened! We broke out of a particularly large cumuliform cloud into dazzling sunlight, and—Something else!

Dead ahead of us and only slightly above, a four-engine airliner, her nose pointed downward, was closing at a rate which caused us both to instinctively duck, as Lieutenant J. pushed hard on the control column. In later thinking about this, I do not believe that we would have collided, even without the abrupt dive we made, but the possibility is a terrifying one.

What the devil was an airliner doing that close to the altitude assigned to us by ATC? I switched my selector switch to compass and listened to the Dah Dit of the range. We weren't very close to the On course. The "N" was clear.

Lieutenant J. was attempting to contact XYZ radio to ask what the trouble was, and probably chastise ATC in words approaching an FCC violation, when a great light dawned on me. **The "N" should have been an "A"!** I signaled him frantically to "shut up" and switch to interphone. He did, and I explained that he had drifted to the left hand side of the airway. "So what?" he said.

The answer to the whole thing we found later in the following quotations from the ANC Procedures (ANC 2.0301) for The Control of Instrument Flight Rule Traffic, Civil Air Regulations, Part 60, and Air Force Regulation 60-16:

Right side separation: Opposite direction traffic flying on opposite sides of a well defined track which can accurately be determined by radio.

Right side separation shall normally be applied only to effect altitude change. Aircraft shall be considered as occupying all space from the On course signal to the right edge of the airway. (CAR 60 requires only that a pilot remain to the right of the center line of an airway.)

60.45 Right Side Traffic: Aircraft operating along a civil airway shall be flown to the right of the center line of such airway unless otherwise authorized by Air Traffic Control.

AFR 60-16

Section II, Par 11. Right Side Traffic: Aircraft operating along an airway will keep to the right of the center line of the airway except:

- a. When impracticable for reasons of safety.
- b. When otherwise authorized by Air Traffic Control.

It will be seen at a glance that right side separation is a recognized and accepted form of separation, for altitude change (or emergency under Par. 2.03021 of the ANC, not shown here).

What a great many military pilots seem not to know is that such separation is frequently used by ATC Centers for climbing and descending traffic under their control. Why not use it? All regulations require that the right side be clear of opposite direction traffic except as authorized by ATC or as in the case of AF Reg 60-16: where impracticable for reasons of safety. (Obviously the Regulation is attempting to provide for the pilot operating on an IFR clearance who is able to fly visually. Otherwise, there can be no safety on the left hand side of an airway.)

Since the occasion noted here, I have delivered several intercom lectures, on the subject of Right Side Operation, to Air Force pilots who were drifting to the wrong side of an airway while in the soup. I have not since allowed one to go so far.

This is written in the hope that it will save someone from committing a tragic and costly error as Lieutenant J. and I almost did.

—Lt. Col. USAFR

IFR SHORTHAND

Have you had trouble reading back an exceptionally long or complex IFR departure clearance? Even some of the "Old Timers" become a bit confused copying a long clearance when in a strange area or when a deviation is made from the routine or expected route. This shorthand code is used by CAA tower operators and will prove effective to improve pilot proficiency in copying clearances accurately.

IFR Shorthand

ABOVE	abv
AIRPORT	a
ALTITUDES	
5,000	50
10,000	100
15,000	150
etc.	
APPROACH CONTROL	apc
AT	@
BELOW	blo
ATC CLEARS	c
CLIMB TO	↑
CONTACT	ctc
COURSE	crs
CROSS	×
CRUISE	→
DELAY INDEFINATE	dla ind
DESCEND TO	↓
EAST	E
EXPECT APPROACH CONTROL	Eac
HOLD	H
IF NOT POSSIBLE	or
INSTRUMENT FLIGHT RULES	ifr
LEFT SIDE	ls
MAINTAIN	m
NO DELAY EXPECTED	∧
NORTH	n
NORTH EAST	nE
NORTH WEST	nw
OVER	—
RANGE	R
REPORT REACHING	RR
REPORT LEAVING	Rl
REVERSE COURSE	Rc
RIGHT SIDE	RS
REMAIN 500 ON TOP	$\underline{5}$
SOUTH	S
SOUTH EAST	SE
SOUTH WEST	Sw
TAKEOFF	T/o
TOWER	z
TRAFFIC IS	tfc
TRACK	tr
TURN LEFT	lt
TURN RIGHT	rt
UNTIL	til
UNTIL FURTHER ADVISED	ufa
VISUAL FLIGHT RULES	vfr
WEST	w
FOR FURTHER CLEARANCE	fc

EXAMPLE

ATC clears (Ident.) to St. Louis Airport, cruise 9,000, takeoff south, turn left after takeoff, maintain 3,000 until 5 minutes east, report reaching 5,000.

c stl a → 90, T/o
S, lt, m 30 til 5
min E, RR 50.

"I Was Hunted"

Self Discipline and Training Can Overcome Obstacles to Survival In Unfriendly Territory

By Capt. RUSSELL G. FITZGERALD
USAF Aeronautical Chart and Information Service

WHEN THE B-29 EXPLODED over Singapore one bright January morning six years ago I learned by the hard route what every one of us in the Air Force ought to realize:

We've got to be fighting men just as much on the ground as in the air.

And if we want to fly again after our aircraft have been downed in enemy territory it will help to be prepared for such a crisis, which will call for every bit of thought and imagination, coolness and courage and fighting spirit we possess, not to mention just plain luck.

I had a lot of luck or I wouldn't be here to tell about some of the tough lessons I learned. I don't propose to invade the field covered by the survival and escape manuals with all their valuable suggestions for living in the desert or in the Arctic, of which I know nothing, or even in the jungle, with which I've had some experience. What I'd like to do is to pass on some warning of the physical and mental obstacles most men must overcome in order to stay alive and uncaptured. Perhaps the points can be illustrated best by some of the things that happened to me.

But, first, let me emphasize that if anything of the sort should happen to you, *you'll be on your own.* It will be strictly up to you to get out of your predicament, which won't be exactly like any other man's. In the last analysis what you do will depend upon the circumstances in which you find yourself and, though you may find help, upon yourself. It can't be done by the numbers.

The first hazard is the conviction that "it won't happen to me." That's the way I felt. There is truth in the statement that an airman who expected to be shot down would be struggling under a bad handicap. But that's no argument against his being prepared, just in case. He is painstakingly trained in every element of aerial operation within his responsibilities. He will do well to consider what he must do if and when he has lost his plane. I was only half-prepared for that contingency, as this account will show.

It all happened with stunning suddenness. We were on our bomb run when the plane was hit by flak, and I lost consciousness. The next thing I knew I was coming down in my parachute. The plane had disappeared. Somehow I had been blown clear. How my chute opened I do not know, but I suspect that the pack had been ripped open. I was wounded in the head, legs and body, and my head was throbbing.

My mind raced as I recovered consciousness. Here, I realized later, was a time when a man could be broken. I could hear machine guns, and anti-aircraft weapons still were firing. There was a horrible sensation of being watched by the enemy. There's no place to hide in the sky. Then came a terrible feeling of being completely alone. The plane was gone. There was no trace of the men I'd worked with for months. I recalled the warning of the briefing officer that we'd probably be killed if caught in Malaya. A score of other disturbing thoughts came swiftly. They added up to what seemed an insurmountable chaos of confusion and fear, which can numb one's normal action and thought.

I cite these emotions to reassure others that self-discipline and the training of the military man can overcome even this obstacle. For, in seconds, the will to fight and to live had dispelled them. I remember being thankful that I'd worn my chute instead of parking it nearby, an all too common practice. There came to mind the briefing officer's warning to make for the hills of Malaya where there were friendly guerrillas. Scraps of information I'd absorbed from the escape and evasion manuals and from bull sessions came to mind. Suddenly I was filled with a determination not to let the enemy get me, no matter what odds were against me.

As I dropped lower, I examined the lay of the land, trying to see where there was open country, jungle, or signs of enemy troops. I was headed for open water, and managed to slip my chute. I came down on a point of land with no cover. No troops were visible to me, but I could hear the whistles and bugles of man-hunting soldiers. There was no time to bury my chute, as the rule book advises. I had seen thickets a couple of hundred yards away and I ran for them picking what seemed the best. I burrowed into the mud under a thicket, smearing mud on my face and bare arms, and held my automatic pistol ready for use if I must fight.

This was another critical period. Within five minutes the Nips were combing the neighborhood. I lay still, but it was the hardest thing I had ever done. The impulse was to fight, but it was a panic impulse. Action releases tension, but this, I knew was not a time for action. Perhaps I recognized it because I had hunted in the forests of Maine since early boyhood and had observed the tactics of the animals I had hunted. Now I was the hunted.

At any rate, I did not move, even when two of the enemy raked my thicket with their bayonets, missing me by inches. The search went on until dark. The whistles kept blowing. My wounds began to pain, but they had to wait. My life itself was the main stake, and I could lose it by moving. But with darkness I was able to get at my jungle kit, which miraculously had held to my belt by a single strand, to extract the first aid materials and attend as best I could to my hurts.

For three days and two nights I remained in my hiding place. There was no water to drink, although it rained hard every afternoon. I forgot about the food in the kit, but maybe that was just as well because there was no drinking water.

By the end of the second day the enemy whistles and bugles, which had become fainter as the search left my vicinity, were no longer audible. But I feared the enemy had posted sentries near me and I learned later that they had. This is a critical period for a man in hiding. Later, the guerrillas told me of men being captured because they could not wait. Feeling a false sense of security and longing for human help, they did not realize that such security was only imaginary. So I delayed another day before moving out in the dusk of the third night. All that time I had been thinking and planning. I must head for the hills; I must keep away from villages; I must avoid roads, and even trails except when absolutely necessary. And I must rest as much as possible until my wounds had healed somewhat; open wounds in the jungle can bring death. But I must have water, not only because of a raging thirst but also because I had taken sulfa for my wounds, without water. I found a stagnant pool, and I drank my fill. I slept in a tree that night. You cannot travel in jungle darkness. That is a fact to be remembered when choosing a spot for the night.

In the days that followed I headed for the hills, traveling at first only in the half-light that exists just before dawn and at dusk, but later in the daytime through the jungle. My compass was a big help; then, too, the picture of the terrain I'd gotten in the air remained fixed in my memory. My progress through the jungle was about a mile in 24 hours.

Once I pushed ahead too fast, and learned another lesson. Avoid excessive fatigue. It can affect you mentally, numb your thinking and your hope, and make you think, "what's the use?" Unless despair is resisted, it can end in crack-up and death.

I lost track of time, but that was of no importance. Time was about all I had. I lived sparingly on the rations I had in the kit, bananas left by monkeys, bamboo shoots and wild pineapples. I learned that wild animals are not really to be feared, although I was trailed several times by leopards and other big cats. They never attacked me although one was within a few feet of me one night. I held my fire through fear that a shot would betray me to the enemy or that I might miss or only wound the beast. Fortunately, it sneaked off.

Mosquitoes were another matter. Here was a case of bad preparation. In the heat of India where my squadron was based we had cut the sleeves out of our flying suits. The mosquitoes made me wish I hadn't. And my footgear wasn't the best. I was wearing some native India shoes and I was sorry I hadn't stuck to tough military boots.

Time went on. My wounds were healing; my strength grew and, with it, my self-confidence. I was using medicine sparingly because I knew it might have to last a long time. I was getting enough to eat to keep me going. One source of food was gardens on the fringes of native villages. I got it by hiding in the jungle and "casing" a place thoroughly during the days, and stealing in at night or at any time when I knew the villagers and their dogs, especially the dogs, were not in the neighborhood.

Help finally came, through my examination of one such village. It puzzled me because, after prolonged surveillance, not a sign of life was to be seen. Finally, I entered it and found it deserted, with some household articles still in the huts. I dug some potatoes and ate them raw. Suddenly, a man appeared. We watched each other. He smiled. He dug some potatoes and boiled them. Still smiling, he offered me some. I accepted. It was the first cooked food I'd had since the disaster over Singapore. Then I heard voices and two other men appeared. I got my .45 out of the shoulder holster, but they smiled, too. They conversed, but I could not understand them. Nevertheless, I made certain that they did not get too close, or behind me. That is a cardinal rule —never let yourself get in a position where you can be overcome. It's a *must*.

By signs, the first man told me that they were friendly and that he would return for me at dusk. I learned later that he and his companions were guerrillas and had returned to dig potatoes at the risk of their lives, the Nips having moved all the inhabitants out of that village because of their contact with the guerrillas.

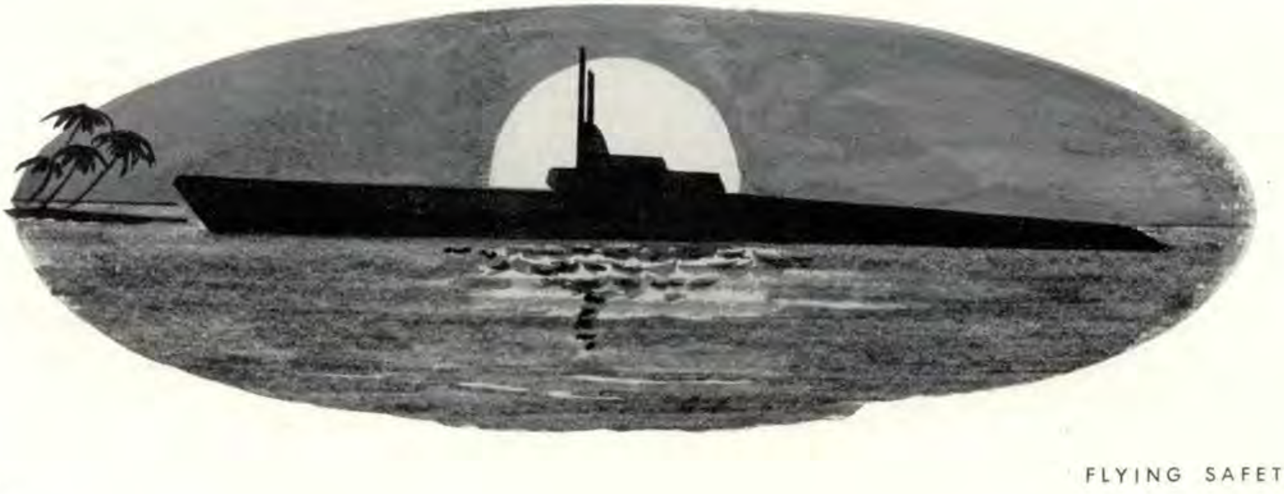
At that moment, however, I didn't trust him. You can paste it in your hat never to trust anyone fully at such a time and place. (Later, one of their own members betrayed the whereabouts of some guerrillas to the enemy for cash. They found him out and executed him.) So, after the trio left, I hid in the jungle and watched. At dusk the man returned with his two small children. No others appeared and, after a time, I joined the man and the youngsters.

That night in a distant village I was given a feast, chicken soup, chicken rice, fish, and hot tea. One of the men spoke a little English. He assured me that I was in the hands of friends, but so great was their caution that it was not for a couple of weeks that they admitted they were guerillas. Then they said that members of their band, having seen me parachute down, had been looking for me after the enemy left the vicinity, but that I had kept too well hidden.

After the feast that night we made a long jungle journey and reached a new hide-out. There followed months with the guerrillas, jungle and hill marches when the enemy got too close, drenching rains, hunger and feast, alarms and quiet periods. If there was a lesson, other than caution, that this experience taught me, it was that a man at such times must never burden his rescuers but must do his full share. Finally, other Allied airmen who had been downed, joined the group. Tales which impressed me were of other men who were captured because they would not hide long enough, but longing for the company of their fellows, had set out to join them while the hunt was still on.

Five months after I landed in the jungle a British submarine appeared offshore one night and took us to Australia. Hospitalization there taught me one final lesson. When a man has reached safety after a long period of flight from a relentless enemy, he tends to let down completely. That is a time of real danger. Doctors and nurses try to do everything for him, and from very relief and idleness he can slump into apathy or worse. I've seen cases. My advice is to "treat him rough." I don't mean that literally, but I do mean to keep him as active, even to mopping floors, if necessary, as his phyiscal condition warrants.

A man must not be pampered after he has fought for his life.



KEEPING CURRENT

MATS GETS C-97C — The first transport in a new series of C-97 Stratofreighters has been delivered to the USAF by Boeing Airplane Company. Assigned to Continental Division of MATS, the new airplane is designated a C-97C and is the seventh new model in the Stratofreighter line. The only outward change in the double-deck plane is the elimination of two antennae which protruded above the control cabin of the C-97A and beneath its lower lobe. The plane will carry an additional ton of payload.

* * *

NON-SKID BRAKES — Skid-detecting devices now keep all B-47 and B-51 planes on the straight and narrow, no matter how hard pilots step on the brake pedals. The Air Force plans to equip other planes with the devices, which have been used by railroads for some time and may have possible applications for trucks and busses. Of two distinct types, both devices "sense" a skid and release pressure on the brakes until the skidding stops, thus limiting skids to only a fraction of a second, reducing tire wear to a minimum and cutting landing roll.

* * *

NEW SCHOOLS—USAF is opening a basic pilot training school at the Columbus AFB, Mississippi, with California Eastern Airways, Inc., being awarded the contract for the operation of the school. This is the second basic pilot training school to be opened in recent months. The Graham Aviation Company of Butler, Pa., was recently awarded the contract for the operation of the Greenville (Miss.) AFB.

* * *

AUTOMATIC CONTROL SYSTEM—**An AMC project is currently underway to adapt the B-50 type aircraft engines to control by an Automatic Flight Controller, Mark III. This engine control system will allow the airspeed demands of the Automatic Flight Controller to be met, within powerplant limitations, during any phase of flight, it was reported. Also, this control system will allow the manifold pressure and RPM of all four engines of the B-50 to be controlled simultaneously by the movement of one lever in the cockpit.**

* * *

FLIGHT PLAN ERRORS — A recent survey has revealed that out of a total of 122 flight plan clearance errors committed by base operations personnel and pilots possessing their own clearing authority, 45 errors were made by filing IFR to stations that did not have a published instrument let-down procedure, while 38 IFR plans listing no alternate were filed. Other major errors noted in the survey included eight IFR plans filed with incorrect course, and eight with insufficient fuel to reach alternate.

Although the survey was made only in the area of the Hamilton Flight Service center as a matter of general interest, the mistakes discovered in a 15-day period are considered a cause for alarm.

Where possible, Hamilton Flight Service notified the clearance authority of the error. However, the screening of flight plans for errors was removed from the mission of Flight Service when its "flight following" was eliminated and the advisory service was greatly reduced on 1 July 1950. Since that time, responsibility for accuracy and completeness of flight plans has been delegated to the clearance authority concerned — either the man with the green card or base operations.

* * *

JET TRAINERS — With the increased appropriated funds available for defense this year, the Air Force now has on procurement 186 C-11 jet instrument trainers. This device will be used in conjunction with jet advanced flying schools, instrument schools, fighter bomber/escort and interceptor schools. Preliminary report of an evaluation project conducted on the C-11 trainer by the USAF Instrument Pilot School is enthusiastic in indorsement of this trainer as an adjunct to actual flight in the T-33 aircraft. The Air Force also has under procurement 51 jet flight simulators. The eventual Air Force program will provide one flight simulator for each fighter interceptor squadron and one for each bomber group.

Practically every condition of flight can be closely simulated in these devices. In addition, most emergencies which could occur in actual flight can be simulated. The use of flight simulators should certainly tend to reduce jet aircraft accidents because pilots will have the opportunity to learn emergency procedures to a degree heretofore impossible.

* * *

MARTIN DESIGNS UTILITY PLANE —Specifications for a new combination twin-engine trainer, staff transport and utility cargo airplane has been presented to the U. S. Air Force and the U. S. Navy by The Glenn L. Martin Company. The basic mission of the proposed plane is carrying 15,000 pounds of cargo over a combat range of 1500 miles at 270 miles per hour.

Designated the Martin Military AIRLIFT 4-0-4, the airplane has the characteristics of range, payload and versatility comparable to those formerly assigned to four-engine aircraft. However, it retains many of the advantages of twin-engine planes—short landings and takeoffs, high cruising speed on low fuel consumption, low maintenance costs and aerodynamic efficiency, according to the Company.

Two versions of the AIRLIFT 4-0-4, using different types of engines, are envisioned in brochures presented to the military leaders. One version would be powered by conventional piston engines, the other by turboprop powerplants.

* * *

SABRE SUPER TANKS—A $4,000,000 contract has been let for production of super-streamlined combat fuel tanks for Air Force North American F-86 Sabre jet fighters. Designed and built to fit the aerodynamic contour of the sleek jet fighters, the combat tanks give the Sabres longer range without sacrifice of maneuverability and control.

The tanks fit the Sabre's "streamlining" in a way that they do not materially cut the airplane's speed and do not have to be dropped during combat operations, as do other types of external fuel tanks. The tanks will be used on three versions of the Sabre: the F-86D, now in operation in Korea, two new versions of the Sabre now in production, and the F-86D jet interceptor and F-86E "super-controlled" jet fighter.

* * *

BRIEFLY NOTED—**Both the Army and Air Force have pooled funds for development of a convertiplane which can take off vertically like a helicopter, and fly forward like a conventional plane. Seventeen companies have submitted plans for such a plane, to be evaluated by Air Materiel Command.**

* * *

A WING AND A PRAYER—It's an old story, but it's still new if you haven't heard it. And it's worth repeating for some of the new Air Force men.

The four-engine bomber, on three engines, was headed toward the home base with a more or less worried pilot at the controls. Several miles out from the field the pilot began calling the tower:

"Tower this is Air Force one-zero-two-four, fifteen miles west of the field . . . Am on three engines . . . request landing instructions . . . what shall I do?

"Tower to Air Force one-zero-two-four. You are cleared for straight-in approach. Land on runway two-six. Crash equipment will be standing by."

A few moments later the pilot of the bomber answered, "Tower, this is one-zero-two-four, I've just lost number three . . . Am now on two engines . . . what shall I do?"

The voice from the tower droned back: "Maintain altitude if possible, you are still cleared for runway two-six. Crash trucks are standing by. The area is clear."

Then came the strained voice of the bomber pilot, "I've just lost number two and am now on one engine, what shall I do?"

In clear, sonorous tones the voice from the tower answered calmly, "Repeat slowly after me . . 'Our Father Who Art . . '

The Pilot's Friend

THE FLIGHT SURGEON is on the pilot's team—to save his life, to act as his counselor, to prevent accidents due to the **Human Element.** The Flight Surgeon's special training and skill make him particularly fitted to deal with human and personal factors which, after all, make the pilot "tick" and determine the operational effectiveness of the USAF which is still largely dependent on the human elements. Over 60 per cent of all aircraft accidents are ascribed to pilot error as the cause. That is, some act, emotion, anxiety, preoccupation, or forgetfulness contributed to or directly caused the accident.

The need for personal data which get at cause factors is very great in an attempt to prevent further accidents in the pilot-error category.

Accident-inducing factors, such as hypoxia, fatigue, G-forces, temperature, noise, continuous pressure from personal protective equipment are being studied in Air Force laboratories and the results are to be applied by Flight Surgeons in the field. These factors of stress cause accidents and sometimes these accidents are charged to pilot-error because further research and better reporting of personal factors in accidents are needed.

An F-51 pilot was involved recently in a major landing accident because of his mental pre-occupation. The alert Flight Surgeon at the base where the accident occurred obtained the personal history of this pilot in a sympathetic non-incriminating fashion. The factors uncovered by the Flight Surgeon in the objective investigation of this pilot's motivation point toward a more real understanding of what makes pilots "tick."

Following is the Flight Surgeon's report, with names deleted:

"This major accident appears to be a near classic example of temporary psychological predisposition to trouble in flying. The pilot was born and raised in an eastern city, one of three children of a successful salesman. His mother was tolerant and indulgent, while his father depended mainly on an ever-ready heavy hand. The subject remembers having been troublesome to the authorities as a youngster—although he was never submitted to court action or public discipline of any kind. Through adolescence and early maturity, he had a definite tendency to get into more fights than the average individual. He has always been active and able in sports and is presently on his airfield basketball team. His father tells him that his manner of argument is irritating to others and his wife says he tends to be cocky and headstrong. Growth and development is otherwise normal.

"The subject was in a high school specializing in aviation crafts at the outbreak of the last war. He entered service as an enlisted man in 1943, and Aviation Cadet Training in 1944, after one year as an airplane mechanic. The subject was highly motivated, and had little difficulty in cadets and later transition to P-40 and F-51 aircraft. He was in a replacement training unit when the war ended. This pilot was discharged at the convenience of the government in May, 1946, worked for a while at an Air Force base as an airplane mechanic, and then became a lineman for a telephone company. He was advancing in responsibility and remuneration at the outbreak of the Korean War, at which time he went directly to an Air Force headquarters and became one of the first volunteers for active service. He wanted to continue flying and make the USAF his career.

"Although he still preferred single-engine aircraft, he was placed on orders to train as a twin-engine instructor. Since that time, September, 1950, he has enjoyed the experience in new types of aircraft. He has compiled about 100 hours twin-engine and six hours single-engine time since return to active duty. On his previous tour, he had approximately 450 hours single engine.

"The morning of the accident he was informed that he would cease present activities and become assistant adjutant in a motor vehicle squadron. He did not like this and decided immediately to get a transfer. He first volunteered for overseas duty and then, he got an F-51 to fly to another Air Force base to see a friend about a possible transfer.

"Arriving at the base in a high dudgeon, he made two overhead approaches before being accepted on the third for entry into the traffic pattern. He performed his first 360-degree overhead since returning to the service, and on landing, heard the aircraft behind announcing a go-around because the aircraft that had just landed was apparently on fire. On the basis of this information, he brought the airplane to a stop and got out to find that his tailwheel had not extended. I found him on the wing filling out his forms and in a somewhat jovial mood—considering what had just happened. He did not recall seeing the warning light or hearing the warning horn. He did not specifically recall going through his before landing procedures and check. He did state that he felt somewhat rushed inasmuch as this was his first tight pattern since 1945.

"Deduced from the foregoing, the following must be considered as causative factors in the accident:

- Changed assignment without proper reference to experience and preparation of individual concerned.

- Changed assignment without proper orientation and explanation to individual concerned.
- Failure of the officer involved to maintain equanimity in the case of apparently illogical assignment.
- Memory lapse and conscious or unconscious act of defiance in individual, predisposed to same by:
  a. Mild existing personality patterns of aggression and defiance, and,
  b. Intense anxiety to perform well and advance in the Air Force in a primary flying capacity."

It is important to note here that no two pilots react in the same manner or have the same personality makeups, experience, and the like. This is why the specialized training and experience of the Flight Surgeon is so greatly needed.

The Flight Surgeon-pilot combination represents a cooperative team in enhancing the operational effectiveness of the Air Force and this team will be hard to beat when they work in close harmony on the following points:

- *How effective has the pilot's overall training been?* — Preflight checking, preflight briefing, emergency training, skill in handling emergency equipment, skill in instrument and tactical flying.
- *What evidence is there of—physical defects* or illnesses; mental worries or anxieties (financial, family, promotion, special assignment); unfavorable attitude toward flying and the Air Force; unfavorable attitude toward himself or others; serious apprehension about this type of flying, i.e., night, instrument, formation, etc., excessive fatigue, emotional conflicts, nightmares, and moody spells?
- *Psychological factors: Any indication of vertigo,* misreading of instruments, poor visibility (weather or windshield), accidental activation of controls, inability to use oxygen equipment, "freezing" at the controls, sudden illness during flight, "cockpit hypnosis," black-out or red-out, effect of having been in or witnessed a previous accident, motivation—why in the Air Force, reluctance to use parachute, ejection seat, anti-G suit, unavailability of T.O.'s, SOP's, or adverse morale factors due to quarters, etc.?

It is not intended that all the points in this outline be checked for each pilot, but that the outline be used as a guide to get at the significant human factors.

With serious and searching attempts on the part of Flight Surgeons working with the pilot to gain crucial data bearing on the human element, the operational effectiveness and readiness of the Air Force will be greatly enhanced.

Flying Safety

RESTRICTED

DEPARTMENT OF THE AIR FORCE
THE INSPECTOR GENERAL, USAF

Major General Victor E. Bertrandias
Deputy Inspector General
For Technical Inspection and
Flight Safety Research

DIRECTORATE OF
FLIGHT SAFETY RESEARCH
Norton Air Force Base, California

Brigadier General O. F. Carlson, Director

Vol. 7, No. 4 **APRIL 1951**

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Cover Picture:

Captain Thomas H. Orrick, who has the jet instrument training school at Selfridge AFB, Michigan, gets set for a hop on the gages with a student who will remain under the hood for the duration of the flight.

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RESTRICTED

Weight AND Balance

Balance is vital to an airplane's stability, and improper loading cuts down its performance and maneuverability.

Like the desert winds warped this old plank road, turbulence and sudden maneuvers will shift and upset a cargo not properly tied down.

Don't fly an airplane if you are not satisfied with its loading and balance.* This condition will:

Increase
- **TAKEOFF DISTANCE**
- **STALLING SPEED**
- **PILOT'S CONTROL FORCES**

Decrease
- ***AIRCRAFT RANGE***

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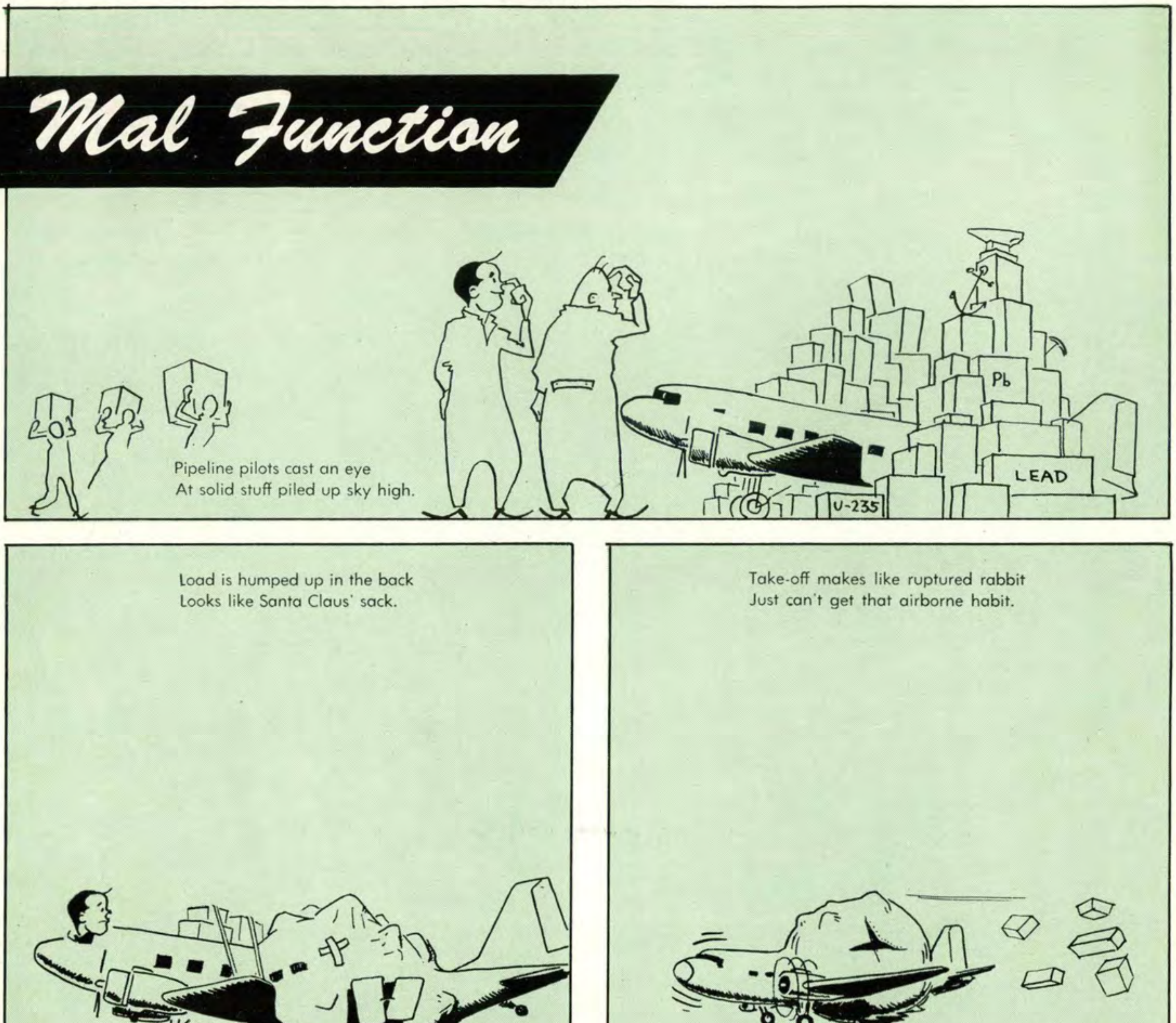
*Ask for T.O. 01-1B-50 at your Engineering Office or Tech Library.

Mal Function



Pipeline pilots cast an eye
At solid stuff piled up sky high.

Load is humped up in the back
Looks like Santa Claus' sack.

Take-off makes like ruptured rabbit
Just can't get that airborne habit.

Old overloaded loses bet
Jet ejected boxes yet.

Mal gets lesson from his mate
On where and how to place the weight.

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