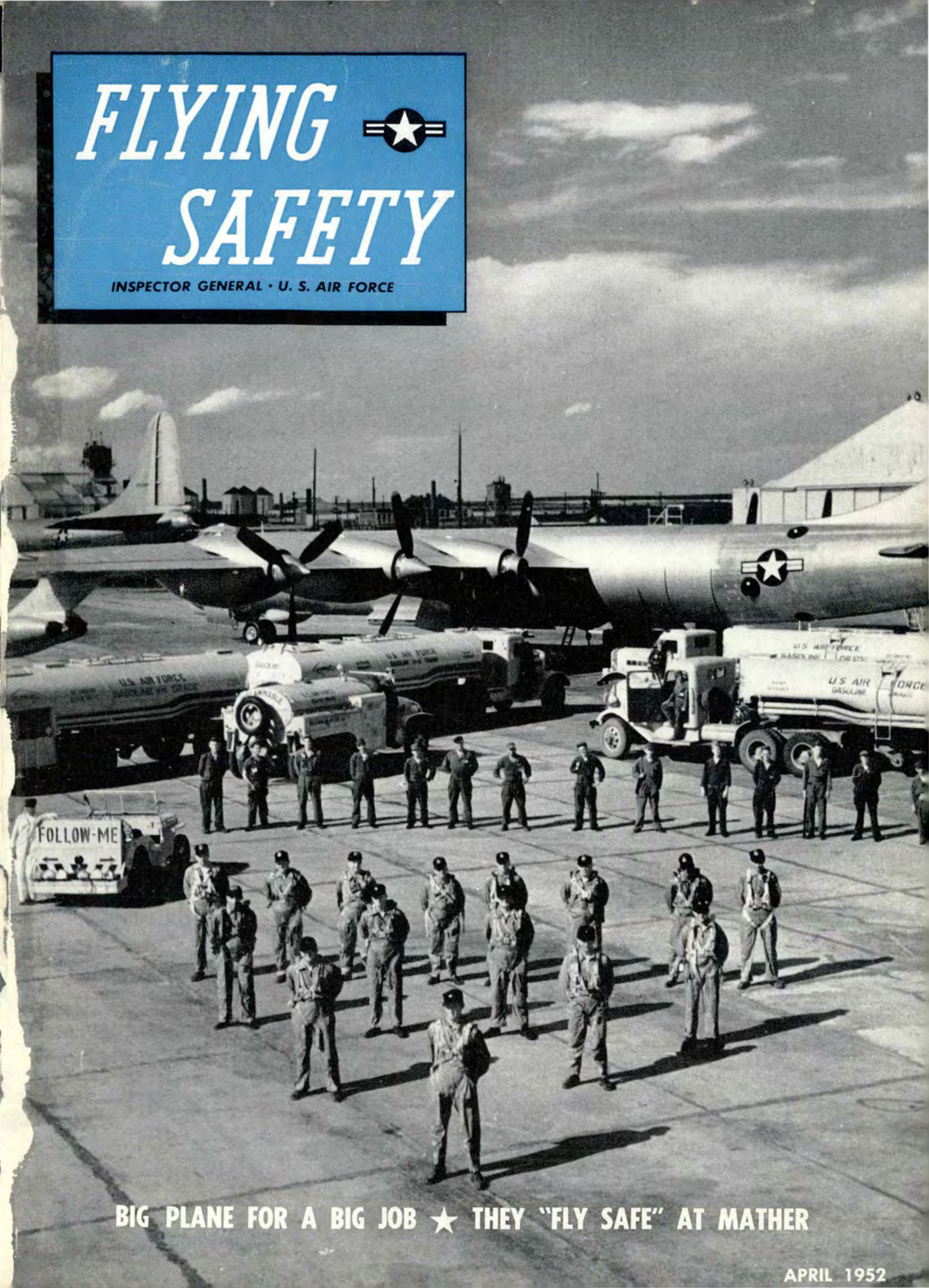
FLYING SAFETY

INSPECTOR GENERAL · U. S. AIR FORCE



BIG PLANE FOR A BIG JOB ★ THEY "FLY SAFE" AT MATHER

APRIL 1952

MAN . . .
The Principal Problem of Flight

IN the past fifty years, aviation has probably shown more progress than has any other field of human endeavor in twice that many years. Airplanes have grown from stick and fabric contraptions which flew along a few feet above the ground at speeds of under fifty miles per hour, to the modern all metal, jet-powered machines which now can even surpass the speed of sound. With the advancements in aircraft design, there has also been a tremendous increase in what is demanded of the pilot, both physically and mentally.

While airplanes have become very complex machines since the Wrights first flew, there has been no change in the make-up of man which would allow him to accommodate the increased demands on him. He still has but one head and two hands. His reactions to any particular set of circumstances are highly unpredictable. Among individuals, the time required to respond to an emergency or to a signal of any kind varies greatly.

Physically, man has changed since the stone age, but he is still limited by many things. His heart beats at a certain (though slightly variable) rate; his blood pressure must be maintained within certain limits; the efficiency of his body, and his brain as well, is influenced by such things as fatigue, hunger, altitude, anger and some say even by the weather.

Is it any wonder that accidents occur when we attempt to place this ancient mechanism, man, in the modern airplane, a machine which carries him tens of thousands of feet into the air, at velocities near the speed of sound?

What has happened that man is not able to master completely the product of his own brains and hands? Possibly, today's airplane was developed too rapidly. In its development, the designers may have forgotten that their final results must be operated by mere humans. They have designed a machine to do a job without regard for the man who must operate that machine.

Plans for aviation's future recognize man's limitations. Eventually, aircraft of war may, and probably will, not have human operators. Until that time, there are definite things which must be done. From the designers' standpoint, further developments must be accompanied by some means of preventing additional demands on the pilot and crew. Designers realize this and accept it.

Those who select men for aircrew training must devise a means of insuring that they choose the best qualified for the job. Right now, there is a comprehensive program in operation with the goal of establishing and defining what qualifications, physically, mentally, and psychologically, go into the make-up of successful pilots. The answer is believed to be in sight.

But for the present, what can be done? We now have airplanes whose operational characteristics make them difficult, to say the least, for humans to fly safely and effectively. The only solution lies in training to a high state of proficiency and then maintaining that proficiency.

The free world depends upon our Air Force, and in so doing depends upon our having expert pilots to man that Air Force. Only through proper training can we have expert pilots. It is a challenge which must be accepted.

THIS MONTH

The article, "They 'Fly Safe' at Mather," which leads off this month, tells how one of the best, if not the best, flying safety records of all time was established. Flying safety is a part of Mather AFB . . . it's something you can almost feel. If a man isn't flying safety conscious when he arrives at Mather, he soon becomes that way. Nobody can take credit for the excellent record. It's something that couldn't have come about without everyone's help and cooperation.

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A "BIG JOB"

The boys who fly the biggest bomber in the world, the B-36, definitely do not have a soft life of it, in spite of the built-in oven, refrigerator, bunks, etc. To the article on the "Big Plane for a Big Job," page 14, we herewith add a salute to the B-36 crews. Theirs is a job which requires the utmost in training, discipline, ability and courage. Our country and our way of life depend heavily on them.

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SHARE THIS COPY

If you don't think our Air Force has been expanding with a rush during the past year, you should be sitting in our circulation manager's seat. Authorized printing for the magazine was increased by 15,000 copies for this fiscal year, but even that hasn't been enough. Right now, requests for FLYING SAFETY far exceed the number of copies available. And it's giving said circulation manager fits trying to stretch available copies to meet the demand. As a result, some Air Force bases will have to take cuts in their magazine allotments so that new organizations and bases can get at least a token distribution. Which, of course, means that personal files of FLYING SAFETY must be discontinued. Pass them around! Meanwhile, we'll try to obtain authorization to print more copies.

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MAL FUNCTION

Mal, on the back cover, may seem a bit out of character this month, since usually he's a pilot. He has pulled so many bonehead stunts, though, that we thought it would be to the best interests of safety if he were temporarily grounded. But, alas, characters like Mal seem to be as dangerous on the ground as in the air.

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WE INVITE YOU

Do you have anything remotely concerning flying safety that you'd like to get off your chest but just don't know where is the best place to unload it? If so, try the Editor, FLYING SAFETY Magazine, Office of The Inspector General, USAF, Norton Air Force Base, San Bernardino, Calif. We promise that all gripes, criticisms, suggestions, etc., will be referred to someone in a position to take proper action. If you should send something suitable for publication in FLYING SAFETY, either as an article or as a letter for the Crossfeed section, so much the better.

Flying Safety

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THEY "FLY SAFE" AT MATHER

There must be a reason when a base with a very active flying program can go almost five years without an accident.

Future "triple threat men" being briefed on bailout, ditching and crash landing procedures by mission pilot Lt. Richard A. Dorsey. Preflight briefing on emergency procedures is SOP.

ACCIDENT prevention and flying safety programs are taking on an ever increasing importance in the Air Force with the advent of multi-million dollar bombers and fighters costing several hundred thousand dollars apiece. From major commands down through individual bases, constant research, planning and programming are aimed toward the prevention of costly accidents.

The Training Command can point with particular pride to Mather Air Force Base, home station of the 3535th Bomb Training Wing, as an example of what originality and hard work can achieve in a safety program.

Mather AFB has demonstrated over a period of 58 months what results can be attained in accident prevention when a continuous flying training syllabus is combined with an aggressive flying safety program. Mather's record, which ended in January when a B-25 on a test hop crashed while attempting a single engine landing, was compiled in spite of a heavy training flight schedule that totaled 255,787 accident-free hours and averaged 4410 hours per month for the 58-month period.

One of the major contributing factors to this outstanding record is the Instrument and Transition Section of the 3537th Flying Support Squadron. The I & T Section is directly responsible for maintaining the high degree of proficiency and standardization required of all pilots stationed at Mather. The section, commanded by Captain Edward J. Mysicka, is composed of two flights. One, the instrument school flight, is commanded by Capt. Dowd L. Cooper and has five Instructor Pilots. The other, the transition school flight, is commanded by Capt. Francis E. Strom, with four IPs assigned. The three commanding officers are veterans of WW II and average slightly under 4000 hours flying time each, principally in multi-engine aircraft. Total time for the eleven instructors in the section is 35,593 hours for an average of 3,235 hours per man. Ten IPs are Senior Pilots and all of them hold green instrument cards.

The Forms 5 of all pilots reporting in to Mather are carefully screened to determine whether or not the pilots are current in the B-25 or T-29, the two aircraft used in the training program on the base. A pilot whose records show that he is current in one or both of the aircraft is given a comprehensive recheck by an IP to insure that he meets the standardization requirements set up as minimums for the base.

The check ride includes demonstrating proficiency in all normal phases of aircraft operation, ability to accomplish safely single-engine landings, go-arounds and loss of an engine on takeoff and in the pattern. Any weakness in technique is corrected by keeping the pilot in the transition school for additional instruction until it is overcome.

All those not current in the aircraft are put directly into the transition flight and take the full course of instruction. This course consists of 21 hours of ground school and an average of 16 hours flying time for the B-25 and 22 hours for the T-29, depending on the progress shown by the student.

Ground school instruction, which is given by the IPs, includes local flying area and regulations, the aircraft in general, all systems and equipment, emergency operating procedures, a review and a final test. The flying covers all phases of day and night operations and stresses emergency procedures, particularly those involving single-engine operation.

Graduates of the Air Force Instrument School are the only newly assigned pilots exempt from going through

Students in the Mather Instrument School get checked out in the latest weather techniques by Captain D. L. Cooper.

the instrument section course. The instrument school, which is patterned after AFIS, is of two weeks duration. Students are given 44 hours of ground school, 12 hours in link trainers and between 8 and 12 hours of flight instruction, contingent upon the students' progress.

Ground school covers instrument use and operations, and all phases of radio procedure and equipment. Flight instruction starts with basic instruments, goes through unusual positions, emergency procedures and partial panel to all radio work. Radio instruction covers radio range and letdowns, GCA, ADF tracking and holding, missed approach procedures, ILAS and VHF/DF homer utilization.

Particular emphasis is placed on the use of check lists for all procedures from visual inspection of the aircraft to stopping the engines. Students in the transition school are given amplified check lists detailing every phase of their particular aircraft operation minutely. Later, after they have been checked out, more condensed lists are adopted for regular use.

The heavy training schedule limits cross country flights to an absolute minimum and the majority of training missions must be flown VFR. Great stress is placed on instrument practice in the local area to compensate for this. A minimum of 1:45 hours real or simulated instruments must be logged by all pilots each month, with a minimum of one GCA landing, one radio range letdown and one ADF problem. While this time is a standard 60-2 requirement, it is felt that by putting it on a monthly basis a pilot will have a better chance to maintain proficiency and usually will be able to log far more instrument time than bare minimums.

Another means of keeping standardization constant has been instituted through a system of cross-checks given to all assigned pilots at periodic intervals. Every six months they are scheduled with an IP from the I & T Section. The ride includes an instrument review and all operational procedures, particularly single-engine work. If any part of the ride fails to meet the set standards, the pilot is given a brief refresher course and then a recheck by another IP in each pilot's assigned section. If there is any question concerning flying technique, the pilot is sent to the I & T Section for further instruction. Finally, the flight leaders in each section are required to fly with each member of their flights at least once a month and run a brief check.

This system of checks stops careless or dangerous habits from forming and makes it relatively easy for all pilots to remain standard in technique. It has been definitely established that even the best of pilots can form potentially dangerous habits and methods. At Mather these are corrected before they can become firmly entrenched in the individual.

Another innovation used as an accident prevention measure is the use of forms that are filled out after a near accident or an actual emergency.

Recently, at the conclusion of a normal training mission, a B-25 was landed a few feet short of the runway on the over-run. The pilot, instead of shrugging it off as one of those things that occasionally happen, went to the I & T Section and requested a check ride. After the ride, which was satisfactory, he explained that he wanted to be sure he hadn't developed any habits which could result in an accident. Later he went to his own section and filled out a near-accident report form, giving in detail his complete procedure prior to the landing.

This near-accident report form and another for actual emergencies which is used in the event any emergency, such as the loss of an engine is encountered, have proven invaluable in accident prevention. Mission pilots run bad weather critiques in their sections any time flying has been called off, during which these reports are analyzed and discussed. All procedures used during the flight which are pertinent to the report are gone over, and recommendations, additions and changes are proposed. These are given to the fly-safe project officer in the squadron, who, in turn, brings them to the attention of the base Flying Safety Officer and the I & T Section for possible adoption.

The critiques also are used as school periods where new operational and emergency procedures are taught, new equipment is explained and analyzed and new ideas and projects are discussed.

Pilots are encouraged to turn in near-accident reports on any occasion that warrants it, and as they understand that the ensuing standardization ride is not disciplinary in character, but merely another means of keeping flying proficiency on par, there is no hesitation in submitting the report.

Actually, the 3537th Flying Support Squadron, which includes the mission pilots who fly all the training flights, is still working on its own safety record, now in the 61st month of accident-free operation. The average of 1750 hours flight time per man, the training and standardization program, the near-accident and emergency procedure reports and the diligent use of check lists, plus the originality the individual pilots show in devising new methods of accident prevention, are all contributing factors to this fine record.

Mission pilots are trained in their sections to fly the various types of training flights required by the 3535th Bomb Training Wing and its principal training unit, the 3536th Bomb Training Squadron. These missions, flown to train students in radar flights, optical and radar bombing and radar navigation, involve specialized flying skills that must be mastered prior to carrying navigation, bombardier and radar observer trainees.

These trainees are stationed at Mather for varying periods of time, depending on which course of instruction they are taking. The training program is designed primarily to turn out "triple threat" bombardier-navigator-radar observers, but other specialized courses in variour phases of advanced electronics are in operation as well.

One course at Mather for Radar Observers is primarily a radar refresher course from which students go directly to Randolph Air Force Base, CCTS, where they are integrated into B-29 crews.

Students in the 1025 SSN program are rated pilots who have received navigation training at Ellington AFB. At Mather they are trained in optical and radar bombing and radar navigation and upon completion of the course will be absorbed by SAC units as specialists. They will have four aeronautical ratings of pilot, bombardier, navigator and radar observer.

A third course is for "scopies" or triple threat men. They are already rated either as bombardiers, navigators or radar observers, usually with wartime experience. Before reaching Mather they are given a refresher course in their specialties and while there will receive advanced training in radar bombing and navigation to qualify for a 1037 SSN. As SAC assignees they will be utilized on aircraft requiring their three-in-one ratings.

Still another class is made up of SAC crewmen, frequently Korean veterans, who are being given advanced training in new equipment and then will be returned to their respective units.

This year's projected program at Mather and other Training Command schools will be entitled the Single Observer Program. As planned now, this program will provide all cadets and single-rated officers with basic training in bombing and navigation and a broad, comprehensive electronics background. After completion of the basic training, students will be sent to advanced schools and tailored for a particular type of aircraft or operational mission. Students at Mather will be given training as "triple threat" men to qualify them for B-26s, B-50s, B-36s and B-47s.

Suggestions from Korean veterans now serving as instructors in the school, together with regular reports received from TAC and SAC are used to shape the program to meet present day combat requirements. These reports are supplemented by one from Lt. Col. John E. Petersdorf who was sent on TDY from Mather to Korea as a liaison officer. Many of his suggestions and recommendations have been incorporated into the present training syllabus where emphasis is directed toward present and future combat techniques.

Student trainees are kept fully cognizant of the safety program at Mather. They are briefed by the mission pilot prior to each flight on ditching, crash landing and bailout procedures for the particular aircraft in use. They have been familiarized with all phases of crash survival and are trained in the use and care of crash kit equipment. That flying safety plays such an important role in the accomplishment of Mather's mission is nothing to wonder about when the following comment of Col. John W. White, Commanding Officer, is considered:

"In accomplishing our primary mission of training bombardment observers, both air and ground crews must be constantly alert to the matter of flying safety. Only through the adoption of a professional attitude, that is, an attitude which holds 'We have to be really good at our job in order to survive,' can our mission be accomplished with a high degree of safety. Such an outlook on this business of flying has, in my opinion, been largely responsible for Mather's excellent safety record."

Graduates of Mather have achieved the training necessary to fulfill their assigned missions and have received through observation, instruction and example a consciousness of flying safety that may someday be converted into dividends for the Air Force in the form of saved lives, equipment and money.

KEEP

Don't be a fool about fuel—handling it carefully and according to the rules makes for much safer flying.

FAMILIARITY does not always breed contempt, as the old adage implies, but there can be little doubt that it does invite carelessness and even neglect. Being a creature of habit, man has an inherent tendency to become casual about those things he accepts as commonplace. Fortunately, aviation is a jealous mistress who dictates strict obedience to the rules of courtship she has established. The penalty for slighting any established procedure can be terrible, if not fatal. Most pilots are aware of this and no valid reason appears to exist for excusing from the same sense of awareness those whose sole duty is the servicing of aircraft.

In the countless millions of words that have chronicled the progress of aviation, few indeed have made more than passing mention of the fundamental importance of fuel to send the aircraft into the air and keep it there. Fuel has become such a commonplace item that the tendency to regard it casually and haphazardly is growing. Therein points a signpost to danger.

Safety gets a severe kick in the backside when, for example, an aircraft is serviced with the wrong kind of fuel. Petroleum people anticipated such a possibility when they dyed the fuels various colors—purple for highest octane gasoline required in combat types of engines; green for next performance rating required; blue for the transport grade of lower octane value; light amber for jet fuel. Coloring, combined with myriad other safe-

Here is a side view of the F-6 semi-trailer refueling unit, showing the micronic filter with the inspection panel posted on access door.

IT CLEAN!

guards, would assure that the wrong fuel never would be pumped into the wrong tanks, the petroleum people thought. They were wrong. It has happened; very infrequently, to be sure, but closer attention to established servicing procedures—such as painting fill plugs, fuel lines and hoses with the color code—would eliminate even a single instance.

At least one Navy base has added another safeguard to the markings on trucks and pumping systems. After a TBM Avenger had been serviced inadvertently with JP-3 fuel, a brass plate bearing the legend, "jet fuel," was attached to the hose nozzle. Petroleum experts have discovered that even a small amount of JP fuel can so contaminate standard aviation fuels that their operating performance is reduced drastically. The amount could be so minute that only laboratory analysis would disclose its presence, yet it could cause dangerous power reduction in a conventional engine.

Contamination, of course, is the cardinal sin. Instances of difficulties directly attributable to contaminated fuel are legion. Contamination presented a serious problem in the early days of the Korean conflict. One fighter group was virtually immobilized for a time because the fuel it received from a tanker had been fouled by mud and silt.

Because contamination can have such dire consequences, the subject receives the lion's share of attention in manuals, tech orders and other publications pertaining to aviation fuels. A recent issue of *Petroleum News Letter*, emanating from Air Materiel Command Headquar-

What's wrong with this picture? Stumped? Well, the refueling unit operator should be standing by the pumping compartment checking for leaks and/or fires. A tech order amendment requires the operator to be at the pumping compartment during refueling operations.

The 100-mesh nozzle strainer screen on the refueling unit must always be clean and in first-class condition.

ters, sums up the case in the observation that the quantity of fuel delivered "doesn't mean a thing unless the product is clean and water free."

To meet requirements for clean fuel, strainers are used in all handling facilities from the moment the fuel leaves the refinery until it enters the plane. Yet, the *News Letter* points out, these "are so common that there is a tendency on the part of many operating and maintenance personnel to disregard this piece of equipment unless operations are slowed down and they are forced either to clean the screen or replace it so that the fuel will continue to flow in volume."

This observation is borne out in a staff study prepared by Maj. C. M. McCoy, petroleum inspector for the Air Force Directorate of Technical Inspection. The study, based on review of inspection reports on 13 bases having jet aircraft, recited the fact that 37 of 118 total discrepancies involving fuels concerned filter and straining screens.

The value of clean fuel takes on added importance in the jet engine. While most reciprocating engines will burn minute impurities, such as rust particles, without harmful effects, the jet engine presents a different problem because of its close mechanical tolerances and fine filtering devices. Even absorbed water can create a problem under freezing conditions, for it congeals into tiny ice crystals which build up on the filtering device and gradually starve the engine of fuel.

AFM 32-10, concerned with the handling of aircraft engine fuels, sets up a number of safeguards to warrent that a clean product will be pumped into the airplane's tanks. One section serves this notice:

"At least once each week all strainers in gasoline lines and strainers in hydraulic lines of water systems will be thoroughly cleaned. Wire mesh screens will be carefully removed, to prevent dirt entering the delivery line, and cleaned by blowing compressed air over the outside of the basket."

If required, strainers should be serviced more than once a week. Strainers should be removed, rinsed in clean kerosene or other high flash point solvent and accumulations trapped in the screen blown out with the compressed air. AMC Manual 91-1 suggests that a second set of strainers be kept on hand, making it possible to replace each screen as it is removed, after which all dirty strainers can be cleaned at one time and be ready for use the following week.

But there is no shortcut to clean fuel. Problems arise almost constantly. Just a few months ago, AMC warned that particular attention must be paid to hose and nozzle assemblies on the F-6 fuel servicing semi-trailer.

Failure to remove sealing and preservative compounds from hose couplings at the time of installation, said AMC, "is causing fuel to become contaminated." It directed that preservative compound be removed by use of Stoddard Solvent, sealing compound be scraped off and nozzle screens be cleaned.

Hoses and nozzles require careful handling. Hoses, which are made of rubber and heavy woven fabric, should not be subjected to undue strains when being removed from trucks or pits. Ends of the hose should not be permitted to touch the ground but if this does happen, the end that made contact must be cleaned. An old chamois should be used for this task—never rags or waste which may leave lint or threads on the surface. Nozzles must be kept clean and capped securely when not being used. Further, the stuffing-box nut around the valve stem should be checked occasionally to assure that it does not leak and that the valve stem operates freely.

Inspectors have traced water contamination more often than not to the tank car in which the fuel was transported from the refinery. Established procedure requires that every car be gaged to determine the thickness of the layer of water at the bottom of the tank or beneath the oil. It is worthy of mention that gasoline having a cloudy appearance or definitely off color should be suspected of water contamination.

Similarly, trucks and pipelines which deliver fuels must be checked for water contamination. In the case of the truck, the drain cock on the segregator must be inspected to assure that water and sediment have been trapped out. If the truck is not equipped with a segregator, or if it is inoperative, then the tanks must be gaged. Pipeline deliveries should be made only into designated receiving tanks where the water contamination check can be made easily.

The act of dispensing fuel has grown consistently more complex with the increased variety of equipment and aircraft engine types. The majority of air bases today are called upon to handle gasoline of various octane ratings, JP-1, JP-3, various mixtures of both with gasoline as authorized by Tech Order 06-5-1, and water alcohol mixtures for both jet and reciprocating engines. Keeping current requires almost constant references to pertinent AFR's, AFM's and Technical Order Sections 06, 12 and 19. To ease the burden on petroleum personnel, AMC has suggested that all data on fuels and lubricants be catalogued in one tech order section, with a breakdown covering general publications, operations publications and maintenance publications.

Recommendations have been made that Air Force specialties be created for officers and airmen handling fuels. These were based on inspection reports, which concluded that the danger of fuel contamination increased the direct ratio to the number of unqualified persons handling fuels. A recent study commented tersely on this point:

"Personnel assigned are unqualified, not stable in assignment and are inadequate in number."

One step in the direction of petroleum specialization already has been taken with the establishment of the Petroleum Section under supervision of the Base Accountable Supply Officer. This section gathers up responsibilities previously distributed among these sections. Headquarters USAF has taken action to support the new organizational structure and, meantime, has announced it will use the Navy Petroleum Training Course to school the number of officers required Air Force-wide to support the program.

Attention to detail will eliminate the bugbear of contamination. Rust, sediment, water, corrosion—all will vanish if the SOP's are followed to the letter. But it must be remembered that all petroleum fuels are dangerous and require strict observance of safety rules to prevent fires and explosions. Additional caution will be required now in handling JP-4 fuel, which Air Force presently is procuring as its only jet fuel.

Gasoline and JP-3 vaporize readily, a fact that adds to their safety in storing and handling. These form so much vapor in a tank that air is driven out and the resulting mixture in the vapor space usually is too rich to burn. At the opposite end of the scale is JP-1, which has a low vapor pressure and a lean explosive limit.

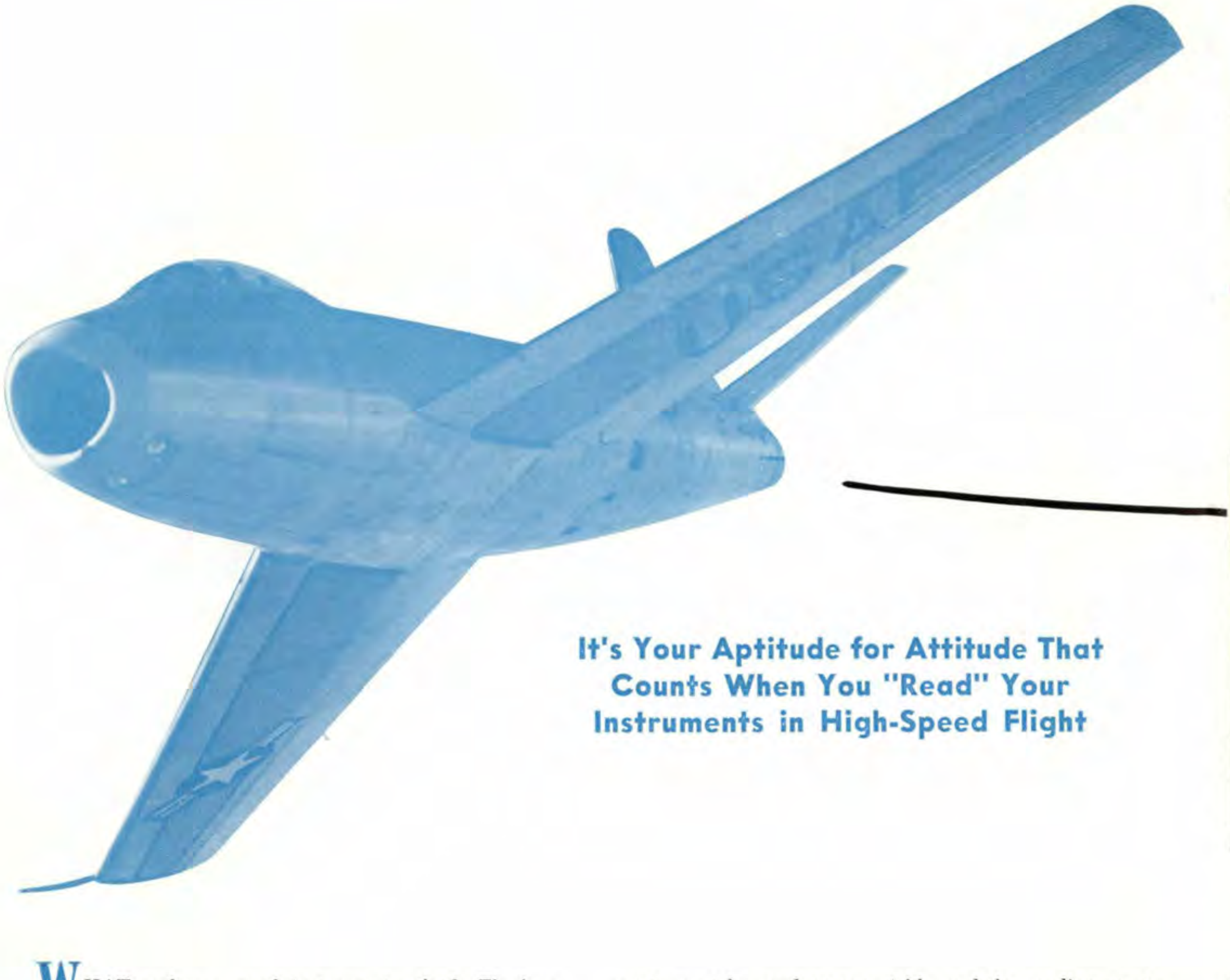
But JP-4 has an intermediate or medium vapor pressure. The temperature range in which explosive vapors are formed runs from −10°F., to plus 80°F. This range, obviously, includes most of the temperatures at which JP-4 will be stored or handled. Hence, the need for additional caution. If all safety regulations are followed and ignition sources are excluded from the vicinity of the fuel, however, petroleum experts declare that JP-4 will be no more dangerous than other fuels handled previously.

It is to guarantee safety that Air Force requires pumping units on fuel servicing trucks to be operated once each week in the dark and a careful inspection made of the ignition system of the gasoline engine, including all electrical connections and spark plugs for faulty wiring. Safety also dictates the monthly requirement for a check on all electrical equipment, electrical grounds, insulated joints, bonding cables and clips and fire protection equipment.

No one will question that those charged with handling, storing and dispensing aviation fuels shoulder a grave responsibility. In the light of an expanding Air Force, involving constantly increasing flying time with more fuel being handled, stored and dispensed, the tendency to become more casual in the approach to the job is natural. But it is pertinent to observe that one of the first things checked after a plane crashes is the condition of the fuel. It is pertinent to observe, too, that there need never be a crash because of contaminated fuel.

If established procedures are followed to the letter, the probability that such a crash will occur is extremely remote.

There is a 100-mesh strainer in the nozzle of the truck fill-stand hose line, above, which should be inspected according to T. O. 12-1-10. Note these trailers are parked in an open area, away from aircraft, and extinguisher is handy.



It's Your Aptitude for Attitude That Counts When You "Read" Your Instruments in High-Speed Flight

WHAT makes a good instrument pilot? That's a good question in anybody's book, or school of thought. It is also a question that involves not one or a few, but hundreds of answers. And like a jigsaw puzzle, one answer leads into another until the picture is complete. This picture had to have a name, so they called it Attitude Instrument flying.

For further and more complete definitions the title given the big picture was divided into three sub-titles called (1) instrument coverage or cross-checking, (2) instrument interpretation, and (3) aircraft control. The "cross-check" means looking just long enough at the right instrument at the right time. After this the pilot must "interpret" what he sees for proper "aircraft control." And it's this "interpretation" component that is the most difficult for the pilot to learn.

The high speeds of jets place a premium on quick reaction time. The pilot does many of the same things in flying a jet job that he does in flying other types of aircraft—but, he has less time in which to do it. Instruments must be read more quickly and the reading must rapidly be translated into control action.

To aid the pilot in interpreting the instruments and applying proper control action, the instruments may be considered in two categories which denote their functions. These are pitch and bank.

PITCH CONTROL

Precision pitch control at high airspeeds and high altitudes demands close attention and smooth control technique. Most high speed aircraft are particularly sensitive in the pitching plane and can easily be overcontrolled, especially at high altitudes.

The instruments that are used for pitch control are the Attitude Gyro, Altimeter, Vertical Speed Indicator, and to a lesser degree in high speed aircraft, the Air Speed Indicator.

THE ATTITUDE GYRO

In instrument flight, the Attitude Gyro replaces the true horizon and exactly the same procedures are fol-

"PITCH AND BANK"

lowed by raising or lowering the dot in the miniature aircraft on the horizon bar. The Attitude Gyro gives a direct indication of the pitch attitude of the aircraft.

By using the Attitude Gyro to control pitch attitude, the pilot can quickly place the nose of the aircraft in approximately the correct position for any condition of flight. After this is done the remainder of the pitch instruments must be checked to determine if the attitude is correct, since the attitude gyro is subject to error as a result of precession. The precession error is more noticeable while in a bank or immediately after rolling out of a bank. This error is a minor problem if the attitude gyro is used with the other flight instruments and small corrections are made as necessary.

When using the Attitude Gyro to make pitch corrections, control pressures should be light, but positive corrections must be made. The normal movement of the miniature aircraft when making corrections in pitch at true airspeeds up to 300 mph should not exceed one width of the horizon bar. The Vertical Speed Indicator is used to determine when the pitch attitude is being overcontrolled. Any movement of more than 200-300 feet per minute from the desired vertical speed indicates overcontrolling. As the true airspeed increases, pitch corrections must be smaller. At true airspeeds in excess of 300 mph, corrections normally should not exceed one-half of the width of the horizon bar and at true airspeeds of over 400 mph corrections should not exceed one-fourth of the width of the horizon bar. It can easily be seen that the pilot must observe the Attitude Gyro very closely at high airspeeds to prevent overcontrolling.

There are times, of course, when corrections of the magnitude described will not be sufficient. The best technique will always be to make a small correction and then observe other pitch instruments to determine if the correction is adequate.

THE ALTIMETER

The Altimeter gives an indirect indication of the pitch attitude of the aircraft in level flight. The altitude should remain constant, and any deviation from the desired altitude shows the necessity for a change in pitch. The rate of departure from the desired altitude is an indication of the amount of deviation from level flight pitch attitude.

Corrective action should always be taken promptly with light pressures on the controls, thus avoiding the necessity for larger corrections which will be required if action is delayed. Although there is a very slight lag in the indications of the Altimeter, at low altitudes it may be considered to give an immediate indication of a change, or the necessity for a change in pitch attitude. At high altitudes the Altimeter may appear to lag occasionally and the other pitch instruments must be cross-checked carefully to control the pitch attitude properly.

In aircraft with a flush static source there will be a reversal of the Altimeter indications when the pilot overcontrols. In the T-33 for example, if the nose is raised or lowered abruptly the Altimeter will momentarily indicate a change of altitude in the opposite direction. This will not occur if proper control technique is used.

THE VERTICAL SPEED INDICATOR

The correct use of the Vertical Speed Indicator is essential for precision control of pitch attitude in high speed aircraft. Although it gives an indirect rather than a positive indication of the pitch attitude, when smooth control technique is used it will show any change from the desired pitch attitude. When light control pressures are used, the initial movement indicates the trend of the vertical movement of the aircraft.

The amount that the Altimeter has moved from the desired altitude governs the rate at which the aircraft should be returned to that altitude. If the deviation is 100 feet or less, the rate of return should be no more than 200-300 feet per minute. A higher vertical speed will require too much of the pilot's attention to avoid overshooting an altitude, thus sacrificing the pilot's cross-check of his bank and power instruments.

If the change from the desired altitude is over 100 feet, the rate of return should be doubled, 400-600 feet per minute. A deviation of more than 300 feet per minute from the desired rate of return can be considered as overcontrolling. If the pilot is attempting to regain lost altitude at a rate of 200 feet per minute, a rate of over 500 feet per minute indicates overcontrolling.

The Vertical Speed Indicator is a sensitive instrument. Like the Altimeter, it has a reversal error when the pitch attitude is changed abruptly. Also, several seconds are required for the instrument to indicate the exact rate of change of altitude when a large pitch correction is made because of the weight and inertia of the actuating mechanism of this instrument. If the nose is lowered abruptly from a level flight attitude to an attitude that will give a 500 feet per minute rate of descent, the immediate vertical speed indication will be a climb and there will be a noticeable lag before the needle indicates 500 feet per minute descent. To overcome the tendency to chase the needle, corrections should always be made by reference to the Attitude Gyro, and any correction made should be held long enough to allow the needle to stabilize. A further correction can then be made, if required.

Occasionally, the Vertical Speed Indicator may be slightly out of calibration and indicate a climb or descent when the aircraft is actually in level flight. If this cannot be adjusted, this error must be taken into consideration when using the Vertical Speed Indicator for pitch control. If the needle indicates a descent of 100 feet per minute when the aircraft is in level flight, this indication is used as the zero position, and any deviation from that position indicates a change from level flight attitude.

THE AIRSPEED INDICATOR

The Airspeed Indicator gives an indirect indication of the pitch attitude of the aircraft. For any power setting there is one pitch attitude that will hold the altitude and airspeed constant.

The value of the Airspeed as a pitch instrument decreases with higher airspeeds. In low speed aircraft a change of 10 mph means a gain or loss of altitude of approximately 100 feet. At high airspeeds a 10 mph change in airspeed means a gain or loss of 500 feet or more of altitude. In addition to this factor the Airspeed Indicator in high speed aircraft must cover a greater airspeed range and the needle moves only a short distance to indicate a change in airspeed of 10 mph. This means that the Airspeed Indicator is of very little value as a pitch instrument at high airspeeds and is used primarily in level flight for the control of power.

BANK CONTROL

The instruments used for bank control are the Attitude Gyro, the Turn and Bank Indicator and the Slave Gyro.

The bank attitude of the aircraft can be determined in two ways on the Attitude Gyro: by the position of the wings on the horizon bar or by noting the position of the bank index or pointer in relation to the zero mark on the banking scale. Either of these methods may be used, but when turning, the bank index and the banking scale are easily read in degrees of bank, while any reading taken from the wings of the aircraft is more of an estimate. In straight flight, since the wings of the miniature aircraft are in close proximity to the horizon bar, they give a sufficiently accurate indication of bank attitude and allow the pitch attitude to be observed simultaneously.

SLAVE GYRO

The Slave Gyro gives an immediate indication that the wings have moved from the level position by moving from the desired heading.

For straight flight, as soon as a change in heading is noticed, corrective action must be applied using the Attitude Gyro in conjunction with the Turn Needle.

In some aircraft, the Slave Gyro is so designed that the face of the instrument can be rotated to place any desired heading under the index at the top of the instrument. The pilot should decide for himself whether it is best to place each heading under the index and fly the pointer at the top, or to place zero degrees under the index and fly each heading at its relative position on the dial. It is good technique for the heading to be placed at the top of the scale when making an instrument takeoff, or when on a GCA or ILAS final approach.

In using the Slave Gyro the pilot should visualize his position as being in the center of the instrument, with the tip of the azimuth needle as the nose of the aircraft. In this way the Slave Gyro can be used for bank control exactly as the nose of the aircraft and the true horizon are used in visual flight.

TURN AND BANK INDICATOR

Accurate interpretation of the Turn Needle requires close observation. Any deviation of the needle from center must be quickly corrected to maintain straight and level flight. In turbulent air the needle oscillates quickly from side to side and accurate interpolation of fluctuations must be made to detect actual turning of the aircraft.

In most high-speed aircraft the turn needle may be the only bank instrument in operation if both inverters fail since some turn indicators operate on DC power. Consequently, it assumes the same importance that it has always had in suction type installations. The pilot must be able to use it for bank control in emergencies. It must also be used with the Attitude Gyro, as the Attitude Gyro tends to precess in the banking plane during turns.

The Ball Instrument must be used at all times to determine whether the aircraft is in coordinated flight. If the ball is not centered, rudder is being used or the plane is trimmed improperly.

TRIM IMPORTANT

Proper trim in high speed flight is of major importance. Due to the control sensitivity of fast aircraft, any out of trim condition will make it very difficult to maintain desired flight conditions. Trim tabs are convenient and easy to use—but the pilot should not fly the plane with the tabs alone. The aircraft should be placed in the desired pitch attitude and the control pressures relieved with the trim tabs. Any attempt to trim the plane to a new pitch attitude will usually result in overtrimming.

For the best interpretation of flight instruments, the speed of instrument coverage and the corrections made must be practiced continually so that instrument flying becomes more or less automatic. Attitude instrument flying is directly related to other types of military flying. When a pilot has mastered the instrument techniques, he is better qualified to handle his airplane on a bomb run, gunnery, formation, and night flying because he has learned precision flying.

What's Your Attitude?

The type J-8 attitude indicator provides the pilot with a constant visual indication of the flight attitude of the aircraft in pitch and roll. The J-8 has complete freedom through 360 degrees of rotation about the roll axis and effective freedom of 360 degrees about the pitch axis. The pitch attitude of the aircraft is indicated within a range of 27 degrees in climb or dive. When the aircraft goes past 27 degrees in pitch, the horizon bar is held in the extreme position and the sphere becomes the new reference. When the aircraft approaches 90 degrees in pitch, as during a loop, a controlled precession of 180 degrees occurs. This precession should not be confused with tumbling of the gyro.

The following is an interpretation test on the J-8 indicator. Thirty seconds should be more than enough time to spot the correct answers which will be found on page 25.

No. 1
- a. spiral to right
- b. right turn
- c. left turn

No. 2
- a. slight dive
- b. inverted climb
- c. shallow climb

No. 3
- a. inverted climb
- b. upright climb
- c. medium angle dive

No. 4
- a. level flight
- b. level inverted flight
- c. spilled gyro

No. 5
- a. upright climb
- b. upright dive
- c. inverted climb

No. 6
- a. level flight
- b. inverted level flight
- c. spin—bail out

It's Constant and Rugged On The Job Training For the Men Who Fly the USAF's Biggest Bomber

BIG PLANE for a BIG JO

LIKE a carnival barker talking about the charms of "Little Eva," the sideshow's fat lady, it takes plenty of the large, economy-size superlatives to even begin to describe anything at all about the world's largest bombing and/or reconnaissance plane—the B-36.

And considering the fact that this $3,500,000 big bomber has one of the lowest accident rates established since the B-36 made its first flight in 1946, this is one of the most outstanding safety records ever made with a new military aircraft. This record is made more significant when you consider that the largest operational plane ever built by man went straight into production without even the usual months of flight evaluation and testing.

The lion's share of the credit for this safety success story, of course, goes to the crews whose skills and judgment keep 'em flying. Unlike the average jet fly-boy, the B-36 pilot and crewmember are mostly men in their thirties, settled and married. They are mature men with

B...the B-36

plenty of experience. To qualify as an aircraft commander in the biggest bomber, a pilot must have a minimum of 2000 hours in four-engined aircraft such as the B-29 and B-50.

As for the crews, like the maintenance men for the B-36, they take part in a never-ending on-the-job training plan. The crews are trained as units and generally consist of three pilots, two engineers, four observers, two radio operators and four scanners or gunners. Under normal conditions each group would consist of three squadrons each, and each of these squadrons would have six airplanes, or a total of 36 aircraft.

This around-the-clock training program is necessary because the B-36 is not only a new plane but is also a plane that is constantly undergoing modification and changes. A part in stock today may be outmoded tomorrow. B-36 maintenance has posed special problems that have and are being overcome. Standard equipment used

Above: The crew of a B-36 are ready for a long, tough training flight. Below: Crew facilities on the big bomber include high-altitude ovens to heat frozen meals.

to service the B-29 and B-50 was too small, so special equipment had to be devised for B-36 service. Work on the B-36 tail section alone required construction of a platform higher than a four-story building. During bad weather, men working on the wings were always faced with a fall of forty feet if they slipped and fell. Special hoists had to be built to lift the 3,500 horsepower P&W pusher-type engines from the plane for engine change.

The dock-type maintenance setup was found to be the easiest and most practical for the big bomber. Something like 30 men are required to maintain just one B-36, and all major maintenance is the responsibility of the base unit maintenance officer, who assigns work on a schedule basis. The dock chief, a master sergeant, is responsible to the maintenance officer. With all of these men available, a period of from three to nine days is still required to pull a major inspection on the plane.

This major inspection includes checking out more than twenty-seven miles of electrical wiring; anti-icing equipment that could heat a 600-room hotel or 120 five-room houses; sixteen 20 mm. cannon mounted in turrets, and wing tanks that hold 31,648 gallons of high-octane gasoline. The inspection also includes all the rivets in a wing 230 feet long.

Training flights in the B-36 may range from a few miles in distance to more than 10,000-mile jaunts, and on occasions, B-36's have flown at an altitude of 40,000 feet for more than 12 hours. For a current general "picture" of present and future operational aspects of the world's largest bomber, you have to review some of the facts and figures about the B-36.

To begin, it can carry a heavier load of bombs for a greater distance at a higher altitude than any other aircraft. Specifically, it has a range of 10,000 miles carrying a 10,000-pound bombload halfway; and at reduced range it can carry a maximum bombload of 84,000 pounds.

B-36s have been ordered in quantity by USAF and all of them will be assigned to SAC. Current plans include the activation of several B-36 bomb groups and two RB-36 reconnaissance groups. B-36 bomb groups are already operating from Carswell AFB, Fort Worth, Texas, Travis AFB, Fairchild AFB, Rapid City AFB, and another B-36 group is being fully activated at Walker AFB.

Now in production is the B-36F, with other later models of the Big Bomber planned for the near future. These planes are being equipped with four J-47 jet engines in addition to six 3500 plus horsepower pusher-type engines. The four jet units provide more power for takeoff, raise the service ceiling and increase the plane's speed. Maximum speed of the D models is over 400 mph and the service ceiling is over 45,000 feet. Maximum gross weight is around 358,000 pounds.

Some of the earlier model B-36's were returned to Convair for modification and B-36A's were being transformed into RB-36E's. The B-36B's, equipped with six 3,500 horsepower engines, are converted into B-36D bombers.

Externally, the RB-36 plane looks like the B-36 bomber; but internally, in place of bombs, the RB-36 carries the large cameras and other special equipment needed in long-range and high-altitude reconnaissance. In the RB-36 forward bomb bay, for instance, are 14 different cameras, including one with a 42-inch focal length lens.

The armament is the same for both the bomber and recon planes. They are protected by eight remotely controlled turrets with a total of sixteen 20 mm. cannon—more firepower than any other bomber. All of the turrets, except those in the nose and tail, are retractable.

The six reciprocating engines drive 19-foot-diameter reversible pitch propellers. These three-bladed, hollow steel props have a built-in thermal anti-icing system for all-weather operation. Leading edges of the wing and tail are double-skinned for a flow of heated air for anti-icing. Heated air also defrosts the pilots' and bombardiers' windshields.

The central portion of the 230-foot wing, which is mounted slightly forward of the midpoint of the fuselage, is seven and a half feet thick—high enough for the installation of a catwalk to enable the crewmembers to climb into the wing for access to the nacelles during flight. Eight wingtanks hold more than 31,000 gallons of gasoline and 1200 gallons of oil.

In performance, the B-36 has exceeded its design range of 10,000 miles, dropping a 10,000-pound bomb load midway in the flight. A B-36 has dropped two 42,000-pound dummy bombs—84,000 pounds—the heaviest load of bombs ever carried by one airplane.

All B-36's have four-wheel main landing gears and a steerable nose gear. These eight 56-inch main wheels distribute the plane's weight over a large area of the runway, enabling the plane to operate from almost any airfield that can support the average large bomber plane.

Flexibility of the B-36 has been increased by the development of bomb bay fuel tanks; cargo carriers for the bomb bay, and an engine nacelle carrier which is suspended externally from the bomb bay. The cargo carriers enable the bomber to operate as a transport with a capacity of 80,000 pounds of cargo.

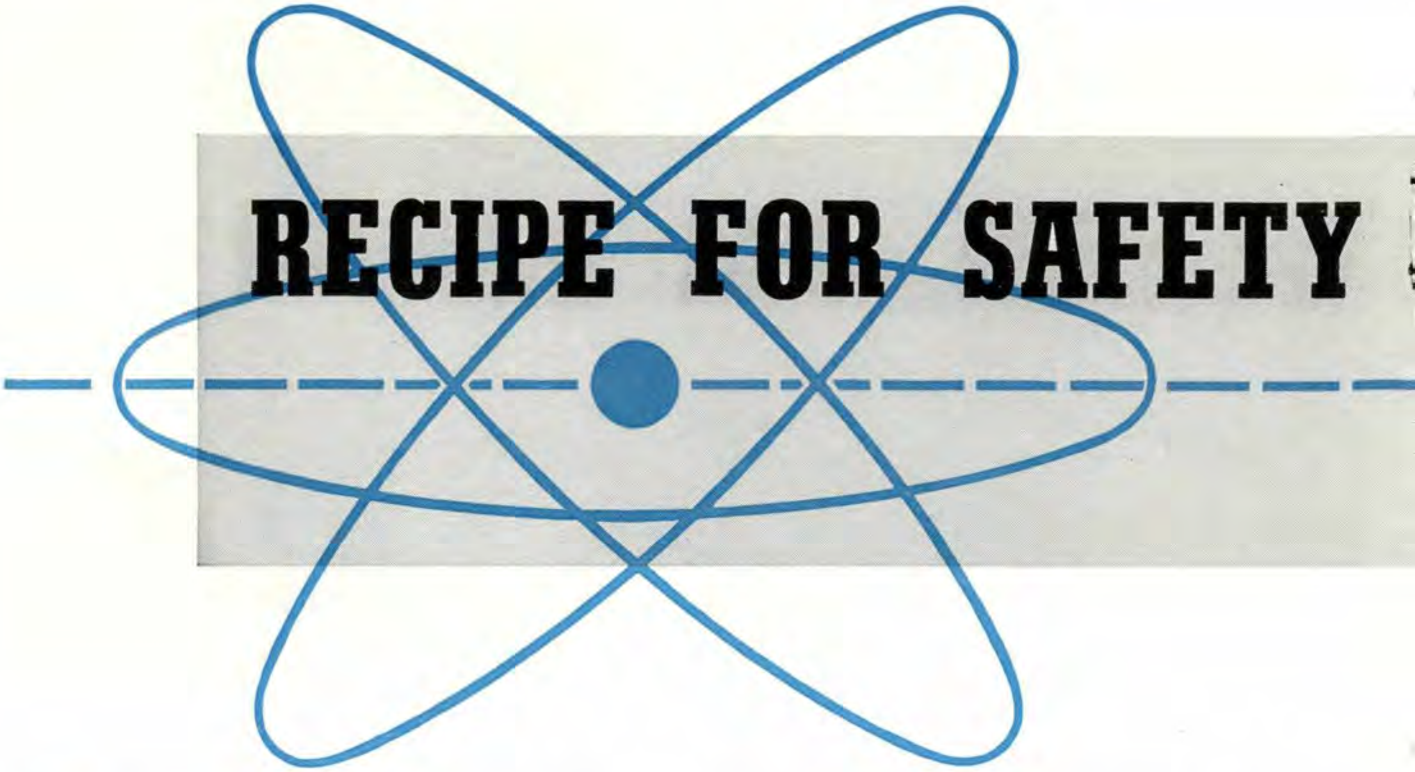
An aircraft as large as the B-36 has to be electrically grounded from at least four points when on the ramps. The span is so large that air blowing over the wings creates large amounts of static electricity which might increase fire and other hazards if the planes were not grounded.

From the standpoint of crew operations in flight, it's eating and sleeping at 30,000 and 40,000 feet altitude. For long flights, the biggest bomber has facilities for heating and serving frozen meals en route and boasts oven and ice boxes for meal storage. Accommodations in the B-36 will never equal the comforts of home—but the newest models have sleeping quarters equal to those in an eight-man rooming house.

Translate these major B-36 facts into the operational and flying safety records and it goes without saying that the maintenance men and B-36 flight crews are doing the biggest job yet with largest military plane.

Above: The huge "skate" gear of the B-36 spreads the plane's weight over a larger area.

Below: It takes a mobile scaffolding rig to work on a rudder four stories high.



RECIPE FOR SAFETY

THE United States Air Force major aircraft accident rate for 1951 expressed in accidents per 100,000 hours was the lowest in Air Force history. From a peak of approximately 500 accidents per 100,000 flying hours in 1921, the major accident rate has declined to a new 1951 low of 33. This represents a further improvement over the rate of 36 established in 1950 in spite of the fact that in 1951 the Air Force increased its flying time by almost 40 per cent over 1950 and underwent an expansion program from 48 wings toward its 95 wing objective.

During 1951, the Air Force introduced in service many new high-performance jet aircraft, activated new units manned by many reserve pilots called to active service, and transitioned these units from reciprocating-engine to jet type aircraft. This transition program demanded new pilot concepts, requiring knowledge of electronics, entirely new systems, high altitude flying, greater speeds, and many other new skills and procedures.

The enviable low accident rate achieved in 1951 did not result from any one single factor or effort. It was achieved through an Air Force-wide acceptance of the fact that accidents were not inevitable and that an aggressive accident prevention program would produce results.

Guiding the over-all accident prevention effort was a new concept which was brought to flight safety by Maj. Gen. Victor E. Bertrandias when he became Director of Flight Safety Research early in 1950. This concept was to achieve maximum accident prevention through the application of scientific, investigative and engineering techniques in the correction of design and maintenance deficiencies in materiel, the critical evaluation of Air Force systems and procedures, and the proper selection and education of personnel. These problems were approached through the development of research into engineering, accident investigative and analysis techniques, the psychological and physiological research into human factors involved in accidents, the analysis of aircraft accident histories, and a close observation of all Air Force operations. Particular emphasis was placed on applying these techniques to the latest items of equipment and to new training methods.

To accomplish these objectives of accident prevention, the Directorate of Flight Safety Research made progress in recruiting the necessary civilian and military talent to accomplish its mission. Military pilot engineers and investigator-analysts were assigned to perform accident investigation and evaluation duties. Officers, airmen, and civilians talented in editorial and graphic arts were procured to produce educational media and accident prevention presentations. Highly qualified civilian specialists were obtained to perform duties requiring professional talent in the fields of physiological and psychological research, and engineering and statistical analysis.

From this nucleus of specialized talent, the Directorate of Flight Safety Research developed its organization to provide for its exhaustive engineering investigations of accidents, the scientific evaluation of aircraft accidents reported from Air Force units, specialized research into human factors involved in accidents, the production of improved educational media, and the development of records and statistical systems designed to produce realistic cause factor information.

In view of the fact that design, materiel, supply and maintenance played such a large part in the accident picture, a liaison office was established at Headquarters,

A REPORT TO THE AIR FORCE ON FLIGHT SAFETY RESEARCH— THE NEW CONCEPT OF ACCIDENT PREVENTION

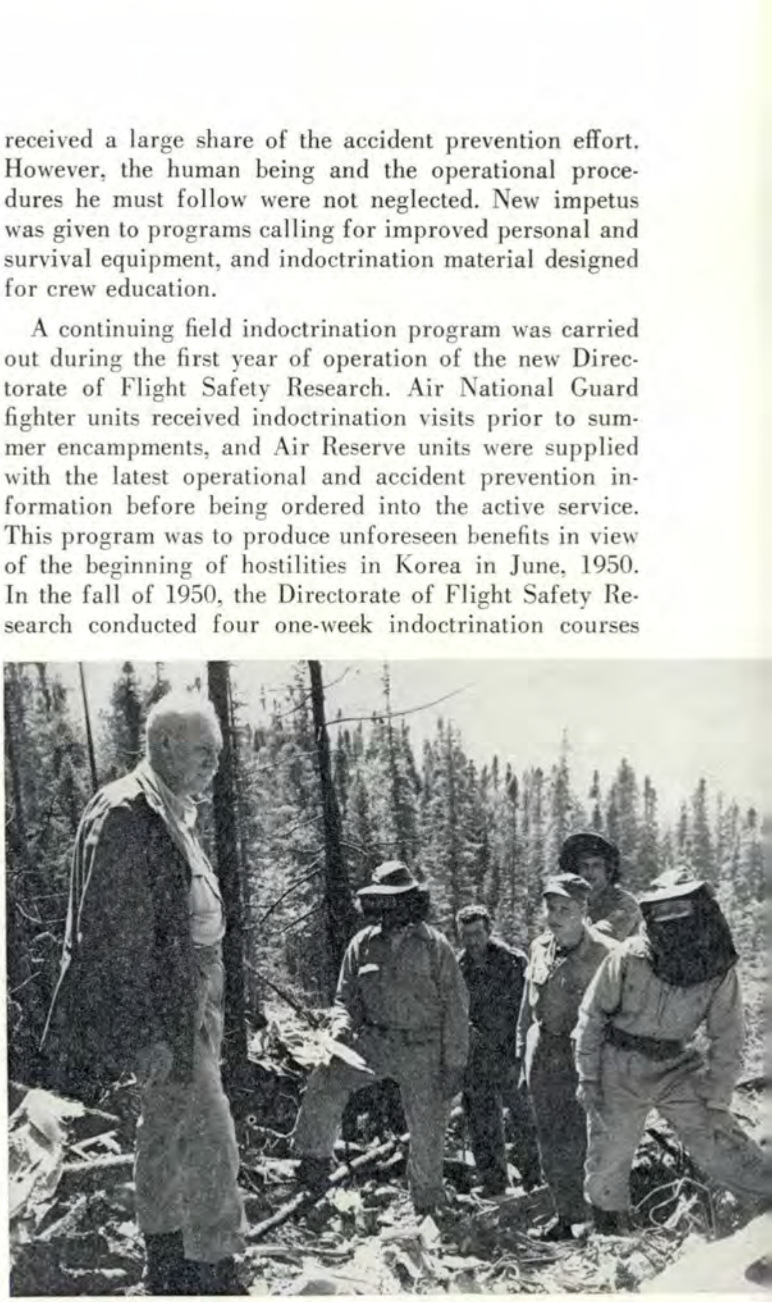
Tech representatives work with Flight Safety. Here, Mr. H. P. Hogue of Boeing Aircraft Co., watches work on B-17 engine.

Air Materiel Command. This office has returned large dividends through its ability to follow-up on recommendations and to keep the Office of The Inspector General informed on developments affecting the accident prevention program and to assist in bringing the impact of aircraft accidents closer to aircraft, power plant and equipment agencies responsible for design, supply and maintenance of the Air Force.

While improved techniques of accident investigation and evaluation were being developed, the Directorate was also endeavoring to influence long-range accident prevention thinking. The Inspector General, represented by the Directorate of Flight Safety Research, was authorized a voting membership on engineering evaluation and rock-up inspection boards for the purpose of evaluating new design configurations in an effort to uncover hazardous features. Through the wealth of experience gained in aircraft accident investigations and the analysis of accident reports, safety board members were in a position to point out past deficiencies which could affect the safety of the new design when placed in service.

Design and materiel factors affecting safety in flight received a large share of the accident prevention effort. However, the human being and the operational procedures he must follow were not neglected. New impetus was given to programs calling for improved personal and survival equipment, and indoctrination material designed for crew education.

A continuing field indoctrination program was carried out during the first year of operation of the new Directorate of Flight Safety Research. Air National Guard fighter units received indoctrination visits prior to summer encampments, and Air Reserve units were supplied with the latest operational and accident prevention information before being ordered into the active service. This program was to produce unforeseen benefits in view of the beginning of hostilities in Korea in June, 1950. In the fall of 1950, the Directorate of Flight Safety Research conducted four one-week indoctrination courses



In the field, a flight safety investigating team reconstructs a jet bomber accident to find the cause.

for Flight Safety Officers which covered an attendance of more than 280 officers from stations throughout the Air Force. The course was repeated in 1951 for more than 70 officers.

Another program launched in 1950 which had considerable influence on the accident prevention program, was a plan which established a procedure for the mutual exchange of service experience and information between the Air Force and the aircraft industry. Originally, service engineers from five (now twelve) aircraft and engine manufacturers were placed in the Directorate of Flight Safety Research as contract consultants. These contractor representatives were integrated into Directorate operations and were placed in a position to exchange information on various products and problems, then transmit such information back to their companies. The program has proved highly successful.

Concurrent with the revitalization and reorganization of the Flight Safety Program, a new concept of technical inspection of aircraft and associated equipment was being developed.

DTI ACTIVATED

During October, 1950, the Directorate of Technical Inspection was activated in the Office of The Inspector General, USAF, and was chartered to "conduct inspections to determine maintenance capabilities for aircraft and related equipment; inspect and evaluate maintenance techniques to eliminate adverse conditions and recommend improvements in maintenance practices and systems; and to evaluate command maintenance inspection systems."

The role of the Directorate of Technical Inspection in accident prevention is very definite and its contribution to the new record was substantial. The Directorate of Technical Inspection supports the program of the Directorate of Flight Safety Research by conducting studies which isolate areas of maintenance weaknesses and deficiencies that are potential accident producing factors. The two Directorates naturally complement each other.

The inspection activities of the Directorate of Technical Inspection have had direct influence on maintenance personnel as well as the accident rate within the Air Force.

While it is readily apparent that Inspector General activities were not solely responsible for the improved 1951 accident rate, it is believed that they contributed substantially to the all-time low accident record. New concepts of accident prevention, the development of engineering investigations and scientific analysis of accidents, the recognition of human and operational factors as contributing to accidents, an intensified technical inspection system, and a modernized and expanded education and indoctrination system cannot be ignored as having played a major part in revitalizing the Air Force accident prevention program.

It is obvious that IG activities of education, orientation, and a forceful program of disclosing accident-producing factors has greatly influenced the consciousness of major commanders of the accident problem. The strategic Air Command has unequivocally recognized the efforts of The Inspector General in the conservation of personnel and aircraft and has introduced an excellent accident prevention program that follows the concepts of The Inspector General. The result has been very gratifying in the steady reduction of aircraft accident rates over the past year within SAC.

MATS FOLLOW LEAD

The Military Air Transport Service has also felt the influence of the accident prevention program and has whole-heartedly followed the lead of The Inspector General in strengthening its program to insure a low accident rate and accomplishment of its mission with a small loss of life. The Air Training Command has recently established a "Fly Safe" project which, it is believed, will obtain the results already achieved in SAC and MATS.

The Air Materiel Command, in coordination with The Inspector General's Office, has established a flying safety organization under The Inspector General of the command to expedite corrective action related to aircraft accidents within AMC responsibility. The Inspector General Liaison Officer works very closely with the Air Materiel Command office and the results justify the effort expended. Air Proving Ground has also established a flight safety organization in accomplishing the aircraft suitability test mission and also works in close harmony with the liaison officers assigned from the Office of The Inspector General.

As a result of the new concept and its associated developments, The Inspector General was placed in a position to make many hundreds of recommendations designed to eliminate aircraft accidents. Such recommendations—other than those developed in technical inspections—usually stemmed from the four major sources of investigations, special projects, special studies and aircraft engineering evaluation boards. These activities were complemented by indoctrination programs and Flight Safety publications.

As pointed out previously, the achievement of an all-time low aircraft accident rate in 1951 was the result of a combined and vigorous application of effort by the entire Air Force. The wide acceptance of new accident prevention practices by major commanders represented typical progressive thinking evident in all echelons of command.

We must not now sit back and relax. The fact that in each of the past few years, the accident rate has been steadily reduced will make further reductions difficult. The full cooperation of every person in the Air Force will be required if the 1952 accident prevention record is to be even better than the one for the past year. But it can be done; doing it will pay off in lives, equipment, money and, even more important, increased combat potential to accomplish the USAF mission.

HANG ONTO YOUR HAT!

Proper adjustment means more comfort and safety

By Capt. Smith W. Ames

MUCH engineering effort has gone into the design of a protective helmet, oxygen mask, and the attached hardware so that the combination will stay on your head when you bail out. Laboratory windblast tests and flight tests show that this equipment will remain on a man's head at windblast velocities higher than are likely to be encountered in present day jet aircraft above 20,000 feet.

Nevertheless, reports on ejection seat use show that the helmet and oxygen mask are lost in about 80 per cent of the ejection seat bailouts.

Why? One very important reason is that pilots don't know how to hang onto their hats! The equipment doesn't fit, either because it's the wrong size or because it's improperly adjusted. After visits to operational bases, research and development experts return to their offices tearing what little hair they have left because carefully developed equipment is being worn in such a haphazard way that it can't possibly give the protection for which it was intended.

The necessity for keeping the helmet and mask on the pilot's head in high altitude bailout is obvious. The H-2 bailout bottle (the 10-minute oxygen supply) is connected to the oxygen mask hose, and the mask is held on the face by attachment to the helmet. The emergency oxygen supply is sufficient to keep a man conscious during an open parachute descent from as high an altitude as 40,000 feet. However, if during the bailout from an altitude above 30,000 feet the pilot loses his helmet with attached oxygen supply it is almost certain that he will become unconscious even if he free-falls. If his parachute is opened at an altitude above 30,000 feet and he is without oxygen, he will suffer severe and possibly fatal hypoxia.

To give pilots the word on how to fit their helmets properly Tech Order No. 13-1-37 was published 18 October 1951. Although this T. O. is titled, "Use and Maintenance of Type P-3 Flying Helmet," this 18-page Technical Order presents a step by step fitting procedure applicable to the P-1, P-1A and P-3 helmets. By following this prescribed procedure, with the assistance of the Survival Training and Equipment Officer, a proper helmet fit is assured.

The pilot should be sure that his oxygen mask has been modified in accordance with T. O. 03-50B-23 for positive attachment of the mask to the helmet, too. This Tech Order requires the replacement of cotton webbing harness with nylon harness, the permanent attachment of the hardware on the left side of the mask to the helmet by means of brass screws, and the replacement of the hook on the right side of the mask by a locking spring clip. All these features are necessary for retention of the mask and helmet upon ejection or high speed bailout.

The pilot can't select his protective helmet in the same manner he would select a fedora. A comfortable fit is not enough. The necessity of using all windblast modifications available and a thorough acquaintance with what constitutes a good helmet-mask fit cannot be over-emphasized. Emergencies do arise and this present gear, properly worn, has been proved able to do its job in the emergency.

The indifference of many pilots concerning the proper fit and adjustment of protective equipment is reminiscent of the early days when elaborate headgear was designed for Roman warriors principally for the purpose of decoration and unit identification.

When the helmet and mask are adjusted properly, they not only function as the designer intended, but they also give you the most comfortable fit.

The helmet won't do any good if it isn't around when it's needed. Know how it should fit and make sure it fits the way it should. Make certain that it has been properly modified.

Don't lose your hat—for if you do, you might also lose your head.

With Two Engines Out, Over 400 Miles From Land, the Crew of this SB-29 Was Faced With a Real

OVERWATER EMERGENCY!

THE crew of the SB-29 had completed its part of the overwater search mission for a missing airplane. The plane had been refueled at Lages AFB in the Azores, and the next stop was to be Bermuda, almost 1800 miles away, with nothing but the ocean beneath for that entire distance. The crew relaxed and settled back for the ride home, knowing that they had done their job well.

The plane was more than 400 miles out of the Azores, cruising at 8,000 feet, when trouble in big packages struck.

First, the Number 3 engine began running rough. Retarding the power did not help, and as the roughness increased, the pilot decided to feather the propeller. The feathering operation was watched carefully by the copilot, who was actually the commander of the rescue flight. As he glanced out the window to check the propeller, he was rather amazed, not happily so, to see the prop on Number 3 go flying off. It struck the Number 4 propeller in its flight, which with the severe vibration which followed, made it necessary to feather No. 4.

Now, the situation was serious. In a matter of only a couple of minutes, what had been a serene, uneventful flight had turned into a real emergency. Two engines had been lost, both from the right side of the plane. The B-29 still had a large gas load, and in addition, was carrying an A-3 lifeboat slung under the fuselage. It very soon became apparent that it would be impossible to maintain altitude if something were not done to lighten the load.

By this time, the pilot had turned the plane around and headed back for the Azores, which, though over 400 miles away, was still the closest land. Also, other Air Rescue planes flying in the vicinity were alerted by radio to the predicament and they were converging to give aid in case a ditching became necessary.

After Number 4 prop was feathered, the decision was made to jettison fuel. The flight engineer was instructed to pump fuel overboard, and soon gasoline was being lost at the rate of about 150 pounds per minute. Altitude was gradually lost and when the plane had descended to about

1500 feet, the lifeboat was dropped in anticipation of a ditching.

So far, everything was being done in accordance with the unit SOP for such emergencies. The procedure was to lose altitude as slowly as possible consistent with safety, turn into the wind, drop the boat and ditch into the wind. Those aboard the plane could then drift and paddle back to the boat. Dropping the lifeboat at higher altitude would have meant that the most valuable survival aid would have been lost.

However, the decrease in drag which accompanied the release of the 3200-pound externally mounted boat, together with the loss in weight when fuel was pumped overboard made it unnecessary to ditch. Altitude could be maintained in a mushing attitude at low airspeed.

Other things which influenced the decision to attempt the flight back to the Azores on two engines were the fact that other rescue planes were converging for an interception and that still more weight could be lost through fuel jettisoning. Eventually, sufficient fuel was lost overboard to make it possible to climb the airplane back up to 3,000 feet altitude without overheating the engines. As the B-29 neared the Azores, it was possible to reduce power slightly because so much fuel had been jettisoned.

It took outstanding pilot technique, excellent judgment, and real familiarity with the airplane to get the SB-29 safely back to Lages AFB for a landing. But, between the pilot, who had the technique and the judgment though not much experience in the airplane, and the copilot, who supplied experience as well as plenty of judgment, all the necessary qualities were present in the cockpit. The SB-29 was babied and fought in to a successful landing.

The pilot on this flight was Captain W. C. Pensinger. His total pilot time in the B-29 was under 100 hours at the time of the emergency. He had recently completed a 40-hour transition course which is routine for new B-29 pilots in Flight C, 5th Air Rescue Squadron, to which he and the crew belonged. The transition course included very great attention to emergency procedures, with particular emphasis on two and three engine flight, and fires in flight. His exemplary handling of this emergency in spite of his low experience level in the airplane, indicates that he made the most of the training which was offered, and that the training itself must have been of the highest quality.

Captain W. C. Pensinger, who flew a long flight to safety.

With the lifeboat resembling a huge bomb slung under the bomb bay, this SB-29 is the same type as flown by Captain W. C. Pensinger.

The copilot was Major Edward C. Lass, the Commanding Officer of Flight "C". He was flying as a supervisory check pilot on this flight and was very experienced in the airplane. He supplied much of the know-how which went into bringing the airplane back to fly again. It was he who recognized immediately that fuel would have to be pumped overboard if there was to be any hope for maintaining flight on the two engines.

M/Sgt. Maurice B. Simpson, the Flight Engineer, was the man who actually carried out the business of dumping fuel overboard. To do this, he transferred gasoline to the right outboard tanks, reasoning that there would be less danger of fire on that side since both engines were dead, and forced the fuel out the overflow vents. A total of about 2800 gallons of fuel was thus disposed of, which lightened the plane by nearly 17000 pounds.

Other members of the crew were: Capt. D. J. Glenn and Lt. R. E. Brodt, navigators; S/Sgt. R. O. Pitchford, second engineer; S/Sgt. O. J. Seabolt, and Pfc. Max L. Riddle, radio operators; and S/Sgt. B. Baker, Sgt. R. E. Miller and Cpl. Jesse Williams, scanners. The entire crew of this SB-29 are to be congratulated and commended for their parts in this flight.

In accident prevention, there is no substitute for the teamwork which these men displayed so effectively.

☆ CROSS FEED ☆

IFR CHECK LISTS—From reading innumerable accident reviews, I have gotten the impression that there are approximately 3,173 items which should be checked by a pilot before, during, and after a normal IFR cross-country flight or else he is derelict in his duty. Check lists in airplanes serve to remind him of many important items and are a big help—when they're used.

How about attaching a "Throw-away Check List" to all DD Forms 175, "Aircraft Clearance." (This would fulfill the first requirement.) Strictly an aid to the pilot, it is not to be signed by the pilot.

Capt. Carleton B. Latimer
Asst. Chief,
Electronic Repair Br.
AF Flight Test Center
Edwards AFB, California

CHUTE SABOTAGE?—Here is a photograph of a parachute which was turned in to Personal Equipment at this field in an unsafe condition. The potential hazard—had it been necessary to use it in that condition—is evident. Fortunately, the danger was noted during inspection, and remedied. This is a graphic indication of the critical importance of methodical inspection.

Maj. Peter E. Pompetti
Flying Safety Officer
Tyndall AFB, Florida

JET FLIGHT PLANNING — The feature article "Jet Flight Planning" in the January issue of FLYING SAFETY, was read and greatly appreciated for its contents and information. The mission of the 2103rd Air Weather Group and its assigned units, is to furnish the type of weather information required for fulfilling the Air Defense Command Mission.

Such articles go a long way in assisting this headquarters in indoctrinating our weather personnel on the information and value of the "right forecast."

Capt. Robert E. Finley
2103rd Air Weather Grp.
Ent. Air Force Base, Colo.

MORE ON ADIZ's—I am writing in regard to an item by Capt. Charles C. Posey in "Crossfeed" in your February issue, in an attempt to solve his dilemma regarding the ADIZ regulations.

The 4,000 ft. space was written into Part 620, Regulations of the Administrator, CAA, to allow civilian aircraft without two-way radio to enter and operate within the various ADIZ's. Since the only military aircraft without two-way radios are Gliders, the 4,000 ft. level was not mentioned in AFR 60-22.

Capt. Charles C. Putman Jr.
27th Air Div. (Def.)
Norton AFB, California

RADIO FACILITIES CHARTS—We'd like to register a complaint on the new format of the Radio Facility Charts. It is believed the new Chart is a definite hazard to flying safety. Some of the mistakes and complaints brought to our attention by pilots here at Scott AFB are as follows:

- No planning chart.
- It is extremely difficult to differentiate between the blue and black lines and letters under a fluorescent light.
- It is very difficult to determine actual intersections and terminations of airways, especially in congested areas such as New York, Chicago, Detroit, Washington, etc.
- On the map on page 41 of the December 18 issue, both Detroit radio and Selfridge radio are listed as transmitting on 388 Kc.

Would like to suggest that since this book is published every two weeks and most corrections are minor and limited to a few pages that this publication be made up as a loose leaf book similar to the East-West Pilot's Handbook.

Maj. Wm. G. Ehart
Wing Flying Safety Officer
Scott AFB, Illinois

Ed. Note—The Aeronautical Chart and Information Service is aware of and working on these deficiencies.

NYLON AND HEAT—At the request of the Equipment Laboratory, Weapons Components Div., WADC, the following data concerning the effect of heat on nylon webbing are given for your information:

a. Nylon will turn yellow after exposure for five hours at 300°F. Nylon will melt at 482°F., and will burn at 887°F.

b. When heated for five minutes at 390°F., the breaking strength of nylon webbing used in the present all-nylon personnel parachute harness is not appreciably changed; however, when heated for thirty minutes at 390°F., the same webbing will lose approximately 50 per cent of its strength.

At present, this Headquarters is in the process of obtaining basic data on the effect of high temperatures (up to the disintegration point) on all materials now used in USAF parachutes.

Lt. Col. M. E. Sorte
Chief, Materials Lab.
Research Div., WADC.

Ed. Note—The information concerning parachute materials will appear in a future issue of FLYING SAFETY.

PITOT ICE—I recently had an experience that might be worthy of publication to avert a possible accident. The culprit in this incident was

Wiring the D-ring to the harness may save the 'chute but it won't save a life in an emergency.

the "bootee" or "sock" type of pitot cover.

As you know, a good pitot cover material is water-tight, and herein lies the danger. Rain can get into the cover through the neck (consider a C-47 or a C-45, for example, where the open end of the cover faces upward) and can, in fact, fill the pitot cover, since it is water-tight.

Subsequent freezing temperatures can freeze this water and, when you remove the ice-filled pitot cover, you may find the pitot head filled with ICE. (Then, again you may not find it—even though it's there.)

I noticed this condition the other day at a "P" field. I had put this cover on myself and would have felt that surely the pitot head was clean.

About a teaspoonful of ice had to be picked out of the pitot head with a piece of stiff wire.

The "fix" for this would be to punch drain holes in the bottom of all pitot covers of this type, since some water is bound to get into them at times.

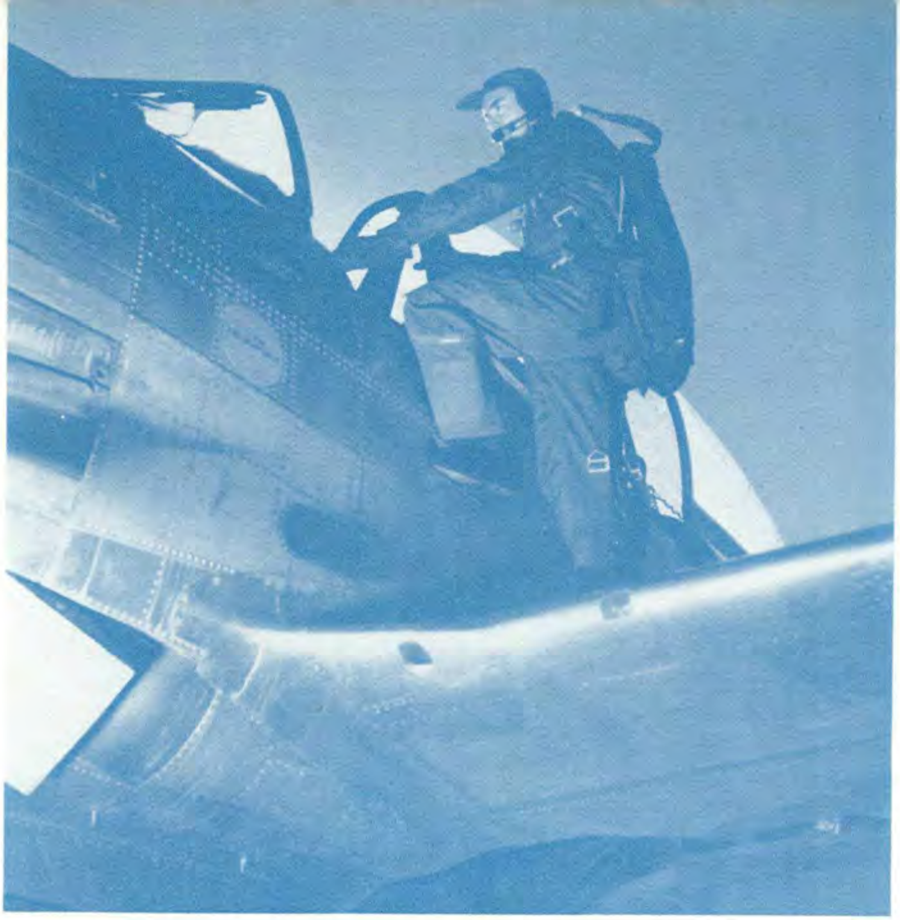
Capt. George P. Arns
Flight Safety Officer
Hq. 47th Bomb. Wing (L)
Langley AFB, Virginia

STANDARDIZATION—We would like to suggest that all instrument procedures and publications, both military and civilian, be standardized. Standardization of procedures would enable all pilots to employ the same methods. Standardization of military and civilian publications would provide all pilots with a wider selection of emergency fields with known letdowns. It has been our observation that military pilots are purchasing civilian publications to supplement the present inadequate Pilots Handbooks, after experiencing emergency letdowns at stations not published.

M/Sgt. Merle R. Mortensen
S/Sgt. Ben J. Owens
Base Ops 403d TCW (M)
Portland Int. Arpt., Ore.

Answers to quiz, page 13.

1. c	*4. b*
2. c	*5. b*
3. a	*6. a*



THE

By Dave Holladay, Flight Instructor
Columbus AFB, Miss.

SAFETY in flight, particularly in training, can not be overemphasized. There are many factors involved in flying, and the overall safety level is dependent upon the understanding and observance of all of these factors.

The final product is dependent upon the initial ideas, trends and patterns of thought. That old line, "As the twig is bent, so grows the branch," is still very true, even in modern, up-to-date flight training.

The student's psychological outlook toward all phases of flight training, the pictures he forms of certain basic maneuvers, result in a mental attitude toward flight which might be termed his PS or "psychological safety" factor. If the outlook or mental pictures are logical, clear, concise in reasoning and conducive to confidence, then this PS factor is high and will stand him in good stead throughout his flying career.

When mention is made of anything dealing with the psyche, thoughts generally run in terms of a psychiatrist or a psychologist and some mysterious malady of the mind. Nothing could be any further from the desired intentions in this case, because the PS factor begins with the pilot. Each is his own psychologist!

The influences through the realm of the mind which tend to form mental patterns either conscious or subconscious cause the increase or decrease in the potential safety factor. Therefore it is important that the student pilot form the proper, clear, concise and logical mental approach early in his flight training career. It not only will give him a higher PS factor; it will increase his level of precision and proficiency! Let's look at a few instances where the PS factor has an influence.

The PS Factor in Simulated Forced Landings —

During his pre-solo phase of flight training each student pilot made many, many patterns and approaches to the runway for landings. He was able after practice to attain a degree of proficiency and land safely somewhere on the runway. What about those simulated forced landings? They are very similar to approaches for regular landings, yet the student may have experienced difficulty simply because he allowed even the simulation of

The mental attitude in training means psychological safety.

An Instructor Levels His Guns At Some Of The Intangibles Which Cause Student Accidents

PS FACTOR

an emergency situation to confuse, disrupt and destroy his clear concise thought patterns.

There are many instances of actual forced landings, with student pilots at the controls, which were well planned for good fields only to end with such consequences as a spin-in on final, overshooting or undershooting, stalling out too high, or depressing the panic button.

What caused these things to happen? Why didn't they occur on a normal approach at the home field? How does the PS factor enter the picture?

Some of the PS factors which come into the picture here are lack of confidence, fear of an accident, misconceptions of procedures and conditions, and erroneous ideas of dangers involved. None of the errors in mental judgment mentioned above would occur at the home field to the average student because they are associated with the normal. Only when these factors become associated with the abnormal do they become a source of danger. The lack of confidence plays a large part in the forced landing, either simulated or actual, because it influences the mind and clouds that mental picture in the mind's eye. This robs the student of the efficiency and proficiency in planning which otherwise could be his. Lack of con-

Runup, takeoff, or landing, the student must be confident and keep his mind clear of needless and useless ideas.

fidence in his own ability deprives him of that clear concise pattern of thought, which in a few words is the "I can do it" attitude.

When he is confronted with an emergency condition, either simulated or actual, the student must remember that he has certain functions to perform, and that he must execute them rapidly and concisely, making the wisest choices and using excellent judgment with cool clear thought patterns. It looks and sounds very simple in print, and in reality can be almost as simple in practice.

In most cases when the words "Forced Landing" are heard in flight, the blood pressure and heartbeat of the occupant of the front seat reaches the maximum peak, and thoughts leap to things like, "What will I do now?" . . . "I can't do this." . . . "I know I'll foul this one up." . . . "Most of these end in flames and disaster anyway." . . .

Thereby hang a great many unsatisfactory grades on forced landings. How can the student perform procedures and make accurate judgments of a situation and its conditions when his mind is already over-burdened with fear, anxiety, erroneous ideas, false conceptions, and useless apprehensions? The important thing is that an emergency has developed and he must show his ability to handle it.

The student must perform the required procedures, keep flying the airplane, choose the best field, continue flying the airplane, plan the best approach, continue flying the airplane, remember those last minute procedures, and continue flying the airplane until the dust has settled and he has climbed out and completed the Form One! In a simulated emergency, the instructor will take over after the final commitment.

The PS Factor in Ground Handling —

How do you feel about landings? What about the roundout, the touchdown, and then the landing roll? Are you confident that you can control the aircraft on the landing roll? The wonderful truth of the matter is: You most certainly CAN!

During his pre-solo training, the student receives much material concerning the prevention of groundloops and good directional control on landings. From this he forms opinions and fixes ideas in his mind about what he should do to protect himself and the airplane. He may or may not have formed the most logical mental outlook toward the situation. If not, it's due perhaps to a misconception or apprehension.

There is a saying among educators which goes something like this: "Much of learning is accomplished in terms of past associations." It's very true in flying training. If you've ever driven a car or ridden a bicycle, you know what is important in its handling. Put wings on your bicycle or automobile and you have practically the same situation.

What happens to an automobile when the driver swerves quickly or starts around a corner to fast? What happens to a bicycle if the rider attempts to displace the center of gravity too rapidly in either direction? With those wings attached he'd be dragging the wingtips, would he not? Those same principles of directional control can be applied to an aircraft during the landing roll. Just drive it down the runway with the rudder pedals keeping the wings level with the stick. Fear a groundloop? Never! Just keep a healthy respect for the situation on every landing.

The same principles can apply in a very simple manner to the takeoff. If the pilot is busy worrying about a groundloop and being afraid of one on every landing, the chances are that he'll be less able to prevent one once it begins. The mind must be kept clear of needless and useless ideas.

The mental outlook must constantly be improved to build that PS factor which makes better pilots because they're safe!

The PS Factor Under Emotional Stress —

Anger, hate, fear and day-dreaming are all dangerous emotions to carry in an airplane. Judgment, when affected by these dangers is impeded or affected at times to such an extent that the pilot becomes little more than a helpless idiot!

No one would choose for himself what he knowingly considers a dangerous element in flight, yet there are times when these things, like straws on the proverbial camel's back, become too much of a load. Perhaps the pilot has been sent around by runway control what he thinks must be two or three dozen times and he is slightly worn around the edges. Under those conditions could he handle any situation which might arise?

Emergency situations are not respectors of persons! Every time one is influenced by fear, anger, hate or even this so-called exasperation, his PS factor goes down.

What about progress in learning? It can easily be influenced if not slowed completely by outside emotional disturbances. Perhaps the girl friend gave a student the gate, or maybe there are family troubles! If he carries them along in the airplane and loads his mind with them, there's little room for anything else!

Fear is perhaps one of the greatest detriments to clear thinking that exists. The human body is so designed that when frightened, a man becomes capable of things he might not otherwise be able to do. That condition of mind which lends itself most conducively to confidence is the personal PS factor. Use it . . . build it . . . and profit by it!

Everyone Is Pilot Material —

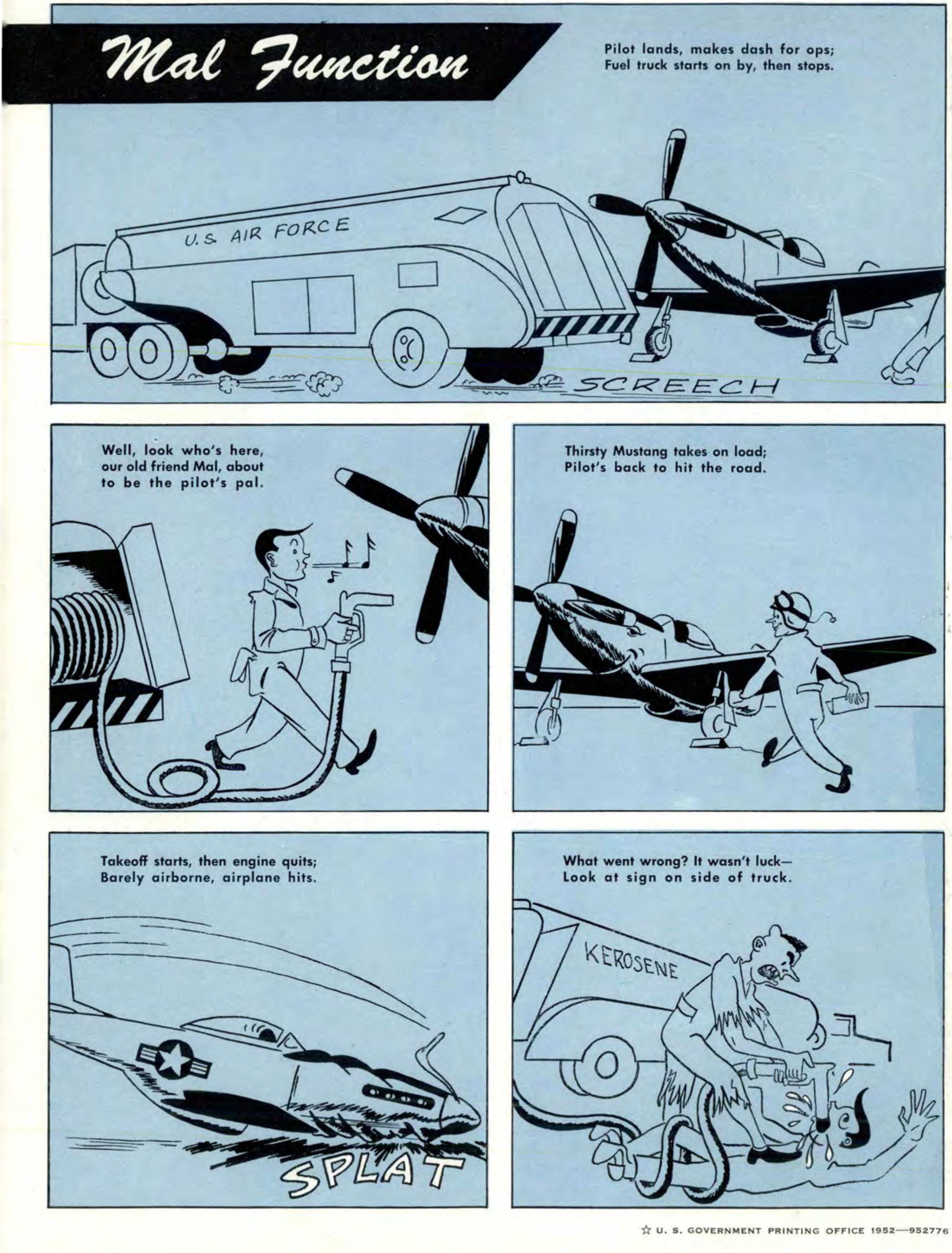
In the final analysis, a man should not become misled by any such hocus-pocus as "You either have it or you don't," for this is not true. Some are more readily and easily adapted to military flying than others, and as a result there are those who cannot win those coveted wings. That doesn't mean that those unfortunate few are doomed to be "groundlubbers," for they are most certainly pilot material in most cases. They merely are not military pilot material.

The ideas expressed here have a bearing directly upon safety, yet they may have a greater bearing on other factors more important to the final accomplishment of the mission, whether it be in war or peace. If the mind controls the body, then it certainly is an important factor in everything including safety in flight. It's up to each one to build his mind in the proper "Psychological Safety" realm, and be a safer pilot.

Don't Lie Down On The Jo

So 1951 was a record flying safety year for the Air Force. So it's something to be proud of. So now can we relax? You know the answer, of course. There is always room for improvement. Which is another way of saying that this can be an even better year for safety. But we all have to work at it . . . nobody can loaf on the job. Nobody, that is, who flies or works around airplanes. Other people? Sure . . . let them relax.

Corrine Calvet, 20th Century Fox



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