FLYING SAFETY

INSPECTOR GENERAL · U. S. AIR FORCE · RESTRICTED

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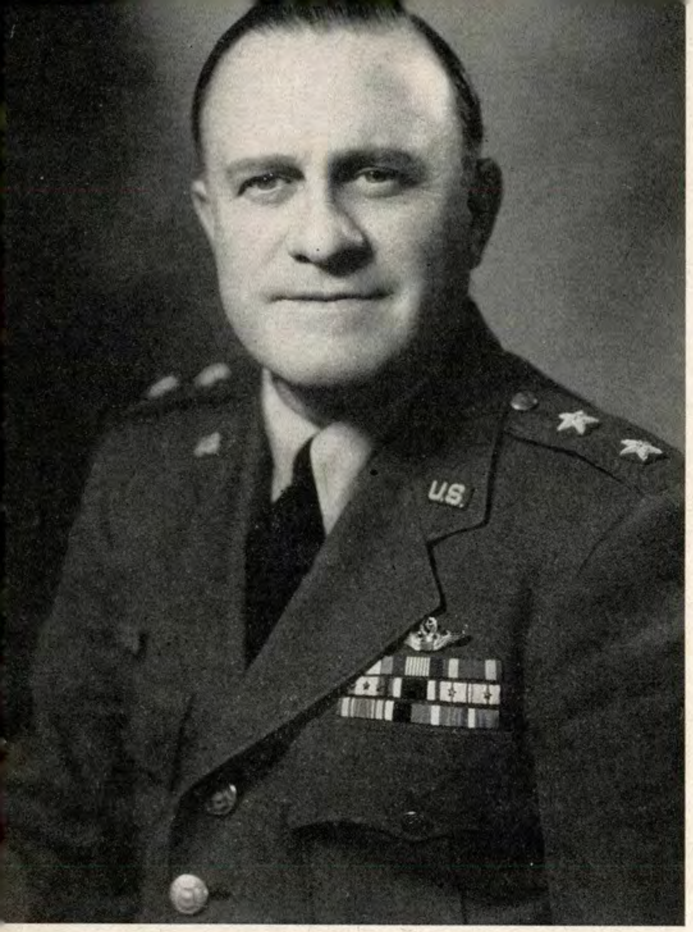
RESTRICTED

Don't Be a
Charlie McCarthy
Page 14



FLYING SAFETY
And Our
EXPANDING AIR FORCE

WE ARE AT PRESENT GOING through the growing pains accompanying the large expansion of Air Force activity to meet the requirements of the 95 wing program. We are acquiring more planes, more personnel; we are doing more flying and consequently having more accidents. However, it is gratifying to note that the Air Force is not experiencing the same alarming upswing in rates as expressed in accidents per 100,000 flying hours as was the case during the period immediately prior to and during the early part of World War II. At the present time, we are holding our own.

Nevertheless, the overall accident situation in the Air Force as we find it today represents a substantial loss of fighting power. The sum total of our accident losses in men and materiel is tremendous. The yearly dollar loss from accidents is increasing due primarily to the larger unit investment in equipment. But the losses today do not only represent higher dollar values. Our present day aircraft also represent a higher investment in time and effort necessary to train crewmen and maintenance personnel. Besides the personal tragedies, loss of pilots and crewmembers to accidents means loss of fighting power. This is of great concern to our Air Force.

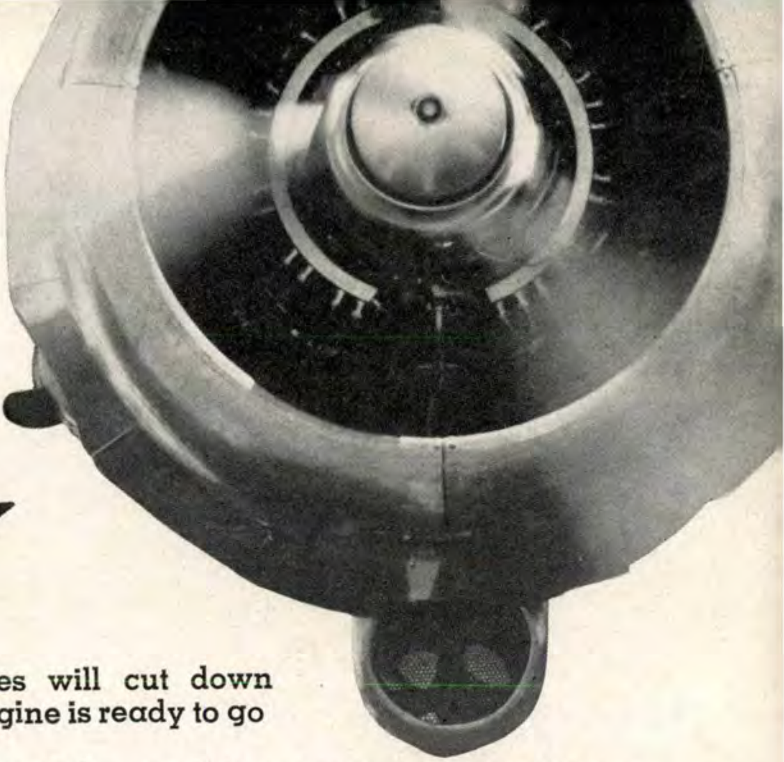
Admittedly, the jobs of flying crews are much more complicated and demanding than in the past. It is in maintenance work, however, that the skills and knowledge required for successful operation have grown all out of proportions. Modern airplanes present maintenance problems which were undreamed of a few years ago. The challenge of meeting those problems must be accepted by our maintenance people, because the increased in-commission rates which accompany good maintenance mean improved combat effectiveness. Also, quality maintenance means fewer accidents.

It is most commendable and most encouraging that accident rates have not taken a jump with the Air Force expansion. It would be much better, of course, if the rates could actually be lowered. And that is the goal toward which we all must work.

The prevention of aircraft accidents promotes the combat readiness of our Air Force. This, in turn, represents a great contribution to the preservation of our national resources and security.

Victor E. Bertrandias

VICTOR E. BERTRANDIAS
Major General, USAF
Deputy Inspector General



how to check an engine

these starting and engine check procedures will cut down on engine failures and assure you that your engine is ready to go

THE IP WAS COMPLETELY SATISFIED with the check-out job he had given the new pilot. His ex-student, who had never been in a C-47 before he arrived in the squadron, now knew everything the instructor did. And the instructor had logged almost 2,000 hours in the airplane.

It was a wonderful system the Air Force had for passing on experience from its older pilots to the new ones. In only ten hours of flying, a man with hundreds of hours and years of flying service could give the benefit of all that experience and knowledge to a man with two or three hundred hours and a few months rated service. Now the newcomer was a full-fledged C-47 driver. The IP knew he had done a good job and it made him feel good.

But a few days later, the new pilot came back to ask a question which made the IP a bit uneasy. In spite of all his experience he was unable to supply a suitable answer. The question involved something that the IP had vaguely recognized before but had never taken the time to investigate. The new pilot said, "You taught me to make my pre-flight power check at regular takeoff manifold pressure. This gives me 2,700 RPM and therefore the engine is operating properly. Right? Well, I've noticed that I can get 2,700 RPM at power settings considerably less than takeoff manifold pressure. What's the deal?"

The IP was the conscientious tpye so he dug up an answer for the boy. And after he supplied it, he changed his own ways, too. He found that through all his hours of flying the C-47, he had never really obtained a true power check—operation check, yes, but not power.

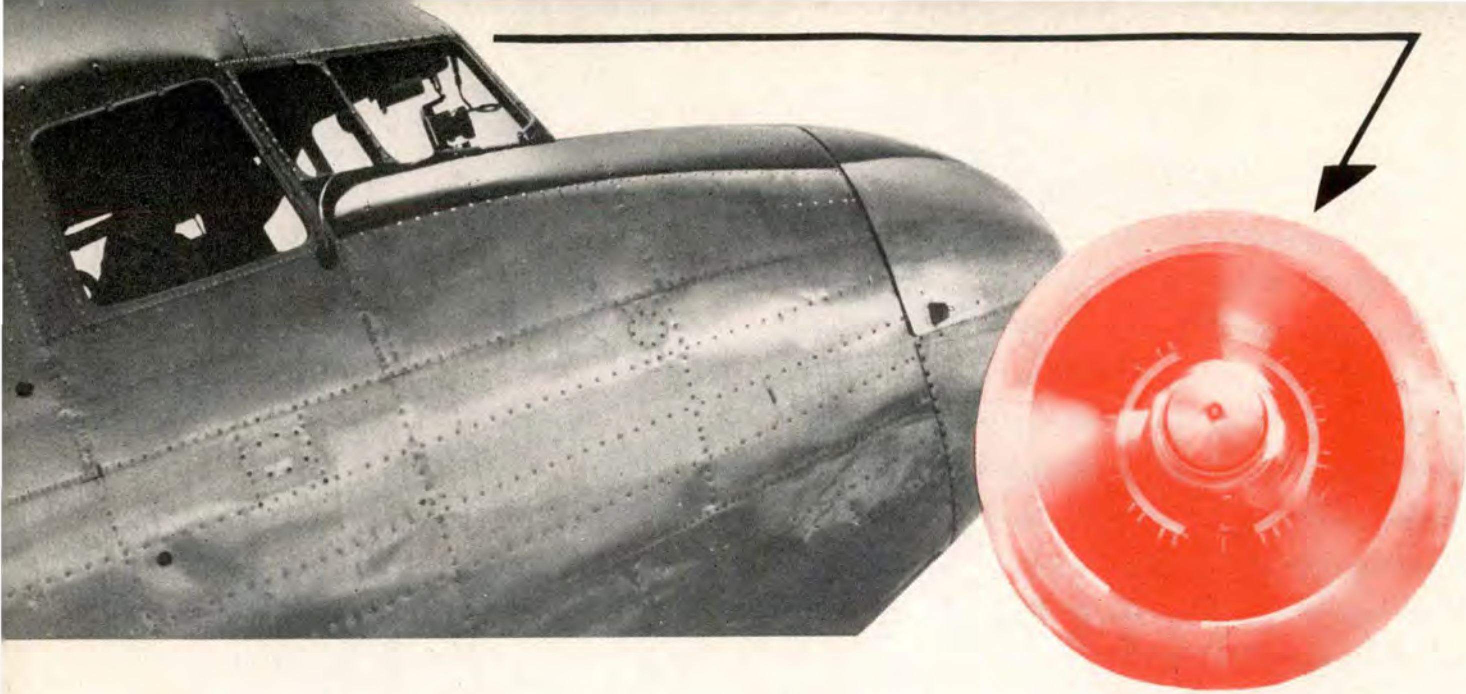
Why this was so is explained in the following standardized procedures which were developed in Alaskan Air Command as an attempt to reduce engine failures and to make possible the quicker discovery of incipient failures or malfunctions. The SOP includes a starting procedure, pre-flight engine checks and post-flight engine checks. At the time it was written, it disagreed in several ways with the methods given in pertinent Tech Orders. Since that time the T. O.'s have been revised. An Air Materiel Command representative states that Flight Handbooks are currently being revised and that the next revision of T. O. 02A-1-29 will contain additional information to make possible even more specific check procedures for reciprocating engines.

The following SOP was developed for C-47's and wherever figures are quoted, they apply only to C-47's. With minor revisions, however, the procedures given can be made applicable to practically any reciprocating engine. Concise instructions are given first to avoid confusion and make the procedures easy to follow. Detailed explanations of hydraulic lock, power check and ignition check follow under the heading of Discussion.

STARTING PROCEDURE

(Before starting, note the manifold pressure reading with the engines at rest. This setting will be used in accomplishing certain checks later.)

Start the engines as specified in T. O. 01-40 ND-1, page 21. With adequate electrical power it is preferred to turn the engine continuously with the starter for six propeller blades before turning on the ignition switch and priming. This procedure will provide an extra safety factor against hydraulic lock in cold weather as all intake valves will have been actuated before the engine fires, thus assuring protection from any liquid which may have been trapped in the intake pipes from where it could be drawn into the cylinders. After the engine fires, move mixture control from the "IDLE CUT OFF" to the "AUTO RICH" position and continue priming if required. In cold weather, if the engine will not fire on priming alone, the mixture control may be moved out of the "Cut Off" position momentarily



then back to "CUT OFF," while continually rotating the engine with the starter, in order to provide more fuel to start combustion. Do not leave the mixture control out of the "Cut Off" position more than one or two seconds unless the engine starts to fire, because hydraulic lock is apt to occur with resulting engine failure.

In cold weather, the carburetor heat control may be moved to "full hot" position as soon as the engine starts firing. This will aid in vaporization of fuel and prevent over-loading cylinders with liquid fuel. Use carburetor heat as required during all ground operation to stay within the 15 to 40° C. range. Operation above 40°C. may result in detonation.

PRE-FLIGHT CHECKS

Throttles should be set to provide 1,700 RPM for exercising props and other preflighting where applicable; props should be exercised four or more times to insure complete warming of prop oil and scavenging of diluted oil out of the governor system, so there will be no possibility of the governor losing control during take-off. If the take-off is delayed for an extended period of time the props should be exercised again. If the feathering button will not reduce the RPM on the first attempt, pull the button out and depress it again. Do not allow the button to remain in over 90 seconds, as damage can result to the feathering motor.

A power check should be made using the same MP as that which the manifold pressure gage showed when the engine was at rest before starting (this is field barometric or pre-start MP). The propeller governor control should be in the "High RPM" position and the carburetor pre-heat control in "Full Cold." Unless there is some engine malfunction this will give the same RPM, ±50 RPM, on a given engine and propeller combination regardless of the outside air temperature, field elevation, or field barometric reading. Tap the instrument lightly during the power check to eliminate instrument sticking errors. Normally, the RPM obtained in the C-47 will be approximately 2,450, but this may vary with some airplanes because of a variation in the type of propeller used or the propeller low pitch stop setting. A head wind will cause a higher RPM than normal. While making the power check, note the engine instrument readings to make certain they are within the limits shown on the instrument face.

Make the ignition check at the field barometric MP just after the Power Check, with the prop governor still in the "High RPM" position. Use "Auto Rich" mixture position. Allowable engine drop is 65 RPM. Tap the tachometer lightly during the ignition check to eliminate instrument sticking errors. Allow four or more seconds at each single mag position. Record both the fast (or initial) and the total mag drops. Watch the engine for roughness in addition to recording the RPM drop.

It is permissible, but not a requirement, to make a 2,700 RPM run-up to 45″ MP in order to check propeller governing and smooth engine operation at this high power condition. It is important to understand, however, that this does not constitute a power check because the propeller is not riding on the mechanical low pitch stop. This check merely indicates that the governor is governing properly and the engine is operating smoothly, as determined by watching for engine roughness from the cockpit window. This high power condition should be held only a few seconds as it has a detrimental effect on engine life. It is pointed out that this type of check is not made by the commercial airlines because the power check outlined above is considered sufficient for their operation. Propeller governing at take-off RPM can be checked adequately during the first part of the take-off run. For military operation under certain circumstances such as icy runways, night take-offs in unfavorable weather conditions, the first flight that an airplane has made in several days or after considerable maintenance has been performed on the airplane, a high RPM runup can be justified. It is not necessary, however, to make such a runup before each leg of a multi-leg trip during the same day. For such a trip numerous high power runups are apt to make the flights less safe rather than safer because of the accumulation of high power operating time on the engine. In general, high power ground operation at 2,700 RPM should be discouraged.

POST-FLIGHT CHECKS

A post-flight check before the engines are stopped after the last flight of the day is required by T. O. 02A-1-29. On some fields it may be necessary to stop on a taxi strip to complete this check because of limited apron space. In any case, a runup on the taxi strip is not a bad idea as taxiing at low RPM back to the apron will cause oil and cylinder head temperatures to drop low enough to accomplish suitable oil dilution if it is required.

Make a power check by running the engines up to field barometric MP with the propeller set in the high RPM position. This should give the same RPM as in the pre-flight power check, plus or minus 50 RPM, unless there is some engine malfunction. You can obtain the MP gage reading for field barometric manifold pressure even though the engines are running by momentarily opening the MP gage drain valve and observing the gage reading while the valve is open.

Check the mags at field barometric MP. Use the same procedure as for the preflight check.

Set the RPM at 1700 and move mixture control from auto-rich to auto-lean and record RPM and MP change. An increase of over 25 RPM or a decrease of more than 75 RPM as a result of the mixture change indicates an excessively rich or lean carburetor.

Pull throttles back to the idle stop and record idle RPM. After the engine speed has stabilized, move the mixture control slowly toward "idle cutoff" and note change in RPM and MP. An increase of more than 10 RPM or a decrease of more than 1/4" MP indicates an excessively rich mixture. When the RPM drops to 300, return the mixture control to "auto rich" position.

With the mixture in auto-rich, check acceleration and deceleration of engines.

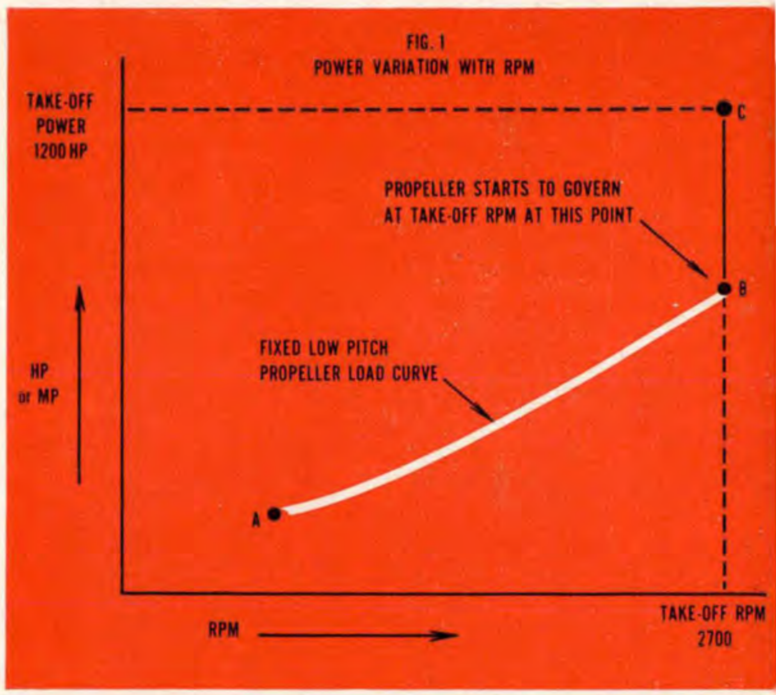
At 600-700 RPM, make an ignition switch check by momentarily turning the switch to the "off" position and then back to "both."

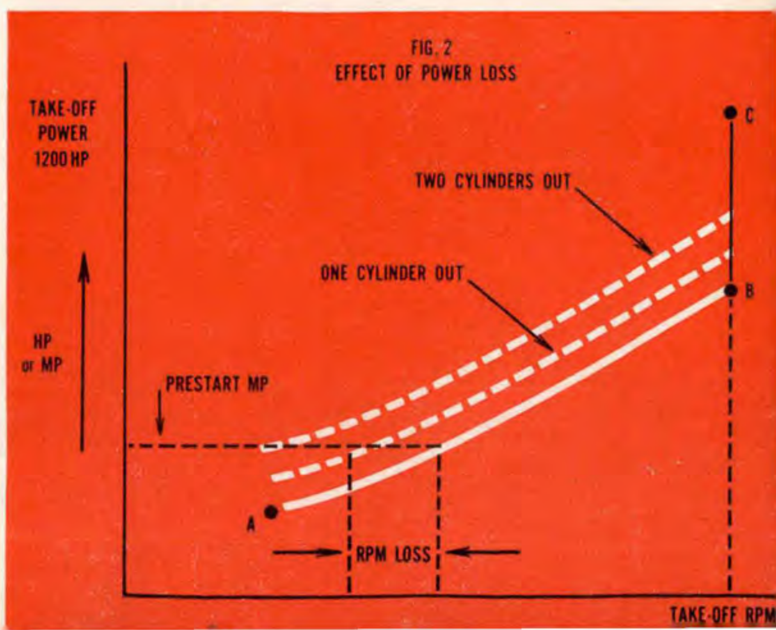
In cold weather operations, proper oil dilution is the main factor in being able to start aircraft engines for the next mission. The table on the cockpit check sheet should be used to accomplish this dilution. Oil dilution should not be accomplished with an oil temperature above 50°C. To obtain satisfactory dilution, if the oil temperature is above 50°C, shut down engine and allow oil to cool to below 40°C, then restart and dilute.

DISCUSSION

HYDRAULIC LOCK—Hydraulic lock is caused by the piston contacting a combustion chamber full of liquid fuel or oil. It is not likely to cause damage provided the engine is being turned by the starter only and has not fired at the time the lock occurs. However, if the engine fires and experiences sudden stoppage due to the piston striking the liquid, damage is quite likely to occur, although it may not be apparent for some time, and even though only one or two cylinders have fired. Cracked cylinder heads or bent or broken connecting rods are the most usual types of resultant damage. A bent rod may operate for many hours before completely breaking in two, but when it does break, almost complete destruction of the engine and possible fire may result. Because of this delay, the rod breakage may occur in a critical flight condition when it is least expected and therefore may be extremely dangerous.

Rotation of the engine for six blades or two propeller





revolutions before priming and turning the ignition switch "on" gives reasonable assurance that all the combustion chambers are clear and that excessive fuel is not trapped in the intake pipes before the engine starts to fire. In the event hydraulic lock is experienced while cranking the engine with the starter before the engine has fired, the lower spark plugs should be removed and the fuel or oil allowed to drain out.

Pulling the engine through backward will not satisfactorily eliminate the lock as the liquid will be pushed into the intake pipes. The liquid is then likely to be sucked into the cylinder again when the engine fires, causing severe damage to the engine.

Hydraulic lock resulting in sudden stoppage after one or more cylinders have fired is just cause for engine removal.

POWER CHECK—A pilot will sometimes make a "power check" consisting of a part throttle runup to near takeoff manifold pressure through which he secures an intuitive assurance of power output without running the engine long enough at a stabilized setting to achieve an interpretable relationship between RPM and MP. If he does run the engines to a stabilized setting, he usually does so in an attempt to check one engine against another. This constitutes a poor basis for judgment in that both engines may be in equally poor condition. Running the engine to a part throttle, high power, setting only assures that the engine may be expected to attain the same relationship again—but does not necessarily measure its mechanical condition or horsepower output reliability.

Any standard engine propeller installation in good condition, started, warmed up, and run in full low pitch up to a manifold pressure equivalent to atmospheric (prestart MP) for the operating field elevation will attain a given RPM or "norm" from day to day and time to time providing the carburetor pre-heat control is in the "full cold" position. Any resulting RPM lower than the norm is a proportional measure of horsepower loss. This constitutes an accurate power check.

The basic source of horsepower losses can often be pinpointed by comparison with accurately run mag check data or manipulation in the cockpit such as changing the fuel mixture strength momentarily to determine the effect on attainable RPM.

It is anticipated the average pilot will detect an apparent fallacy in this recommended power-check system by pointing to the fact that as inducted air temperatures vary with summer and winter, horsepower output will vary at atmospheric manifold pressure, thus upsetting the validity of the proposed procedure—also, barometric pressure variations from day to day—also, inaccuracies in manifold pressure instruments. Fortunately, all these factors are self-compensating. That is, the lower free air temperatures of cold days which boost horsepower also boost drag properties of the propeller turning in denser air. The same self-correction is evident in barometric changes from day to day which effect equally air density inducted by the engine (at atmospheric MP) and propeller drag. Variations in field elevations at which the check is performed will be equally self-compensating. Further, errors in engine MP instruments are self-correcting in that each engine is run to its pre-start MP reading.

The effect of wind cannot be accurately accounted for in any type of ground power check without using special equipment. A power check made with the airplane headed into the wind will result in a higher RPM than normal. An engine should never be run-up with a tailwind because of the detrimental effect on engine cooling. A headwind or crosswind should never result in a low RPM reading during a power check and therefore the wind effect should not be confused with any malfunction which would result in an RPM loss.

The curve on Fig. 1 shows the variation of RPM with horsepower (or MP) while the engine is being operated with the propeller governor control in the "Full Increase RPM" or "Takeoff" position.

From a relatively low power represented by point "A" to the point where the propeller starts to govern at 2,700 RPM as indicated by point "B," the RPM increases with an increase in manifold pressure or horsepower (HP). This portion of the curve between "A" and "B" is known as a "Propeller Load Curve" because the propeller is in a fixed pitch against the mechanical low pitch stop causing the RPM to vary as an exact function of power. After point "B" is reached, a further increase in MP (or HP) no longer results in an increase in RPM because the propeller governor increases the propeller pitch to hold a constant 2,700 RPM. Therefore, any determination of power as a function of RPM cannot be made in the 2,700 RPM portion of the curve from "B" to "C." It must be made in the "propeller load" portion of the curve from "A" to "B." A power check at pre-start MP falls well within the portion of the curve between "A" and "B." Engine operation at 40″ MP (or any other high MP resulting in governing at 2,700 RPM) does not constitute a power check.

Figure 2 shows how a higher manifold pressure is required throughout the whole "propeller load" range to obtain a given RPM if one or more cylinders are not firing. A partial loss of power from several cylinders, because of loss of compression or for any other reason, would show up in a similar manner but no power loss would be evident once "takeoff" RPM was reached. In other words, when operating at 2,700 RPM which is the takeoff RPM for the C-47 airplane equipped with R-1830 engines, it would not be possible to tell whether 40″ MP was giving 1,000 HP or 800 HP. The 200 HP difference would result in a different propeller pitch setting as provided by the governor but there would be no difference in the instrument readings as long as the propeller was governing at 2,700 RPM. Again, operation of the engine in the takeoff RPM range does not provide a true power check.

IGNITION CHECKS—One of the basic fallacies evidenced from time to time is the belief that a standard mag check with RPM drop within tolerances is an accurate measure of overall engine dependability. RPM drop alone is not a reliable criterion to identify some troubles which may make their presence known only by the engine roughness discernible by observation of the engine while running in the mag check condition. A satisfactory ignition check must show that the engine is operating smoothly in the single mag position as well as show that RPM drop is within allowable limits. Lack of any RPM drop in the single mag position may be an indication of faulty grounding of one side of the ignition system. Complete cutting out when switching to one magneto is definite evidence that its side of the ignition system is not functioning.

For these reasons, a more thorough mag check procedure is suggested employing standard techniques, but inviting that more detailed information be secured and tabulated. Time at each single mag position should be at least four seconds with special attention devoted to estimating fast or initial drop as well as the total drop. The fast or initial RPM drop is generally indicative of the condition of the spark plugs and ignition harness. The slow RPM drop following the fast drop indicates possible inaccuracy in distributor finger or magneto timing. This sensitive mag check, if properly employed in combination with an accurate power check, will give an accurate indication of engine condition.

PROJECT *Flameout*

The Experts Find Out How to Simulate Jet Engine Failure

Suddenly the wingman had to retard his power to idle and open the speed brakes to maintain formation. The leader had a flame-out. Grinning across the narrow air space separating the two F-84's, the leader hit the B-channel button and called: "X-ray Sugar Dog, this is 656, flamed out at 17,000 feet, 185 mph air speed over the southwest edge of the lake." Yes, the pilot of this flamed out F-84 actually had a grin on his face. Might sound a bit zany but there was no sweat, for directly below him was Muroc Dry Lake and the runway with the mark he was shooting for was approximately eight miles long.

The flame-out was intentional as a part of *Project Flame-Out*." Every move throughout the forced landing which followed was charted and readings were listed by a sun-baked group at the mobile control truck on the dry lake bed. The information was analyzed by engineers to provide every jet fighter pilot with a long awaited story—the story of how each fighter performs under actual flame-out conditions and how to simulate jet fighter flame-out landings accurately.

Pilots assigned to the project are briefed on procedures to be followed during letdown and landing after intentional flame-outs. Landings were made on eight mile natural runway of Muroc Dry Lake.

The project was formulated and monitored by the Directorate of Flight Safety Research and was successfully executed and implemented by the Experimental Flight Test Engineering groups at Edwards AFB.

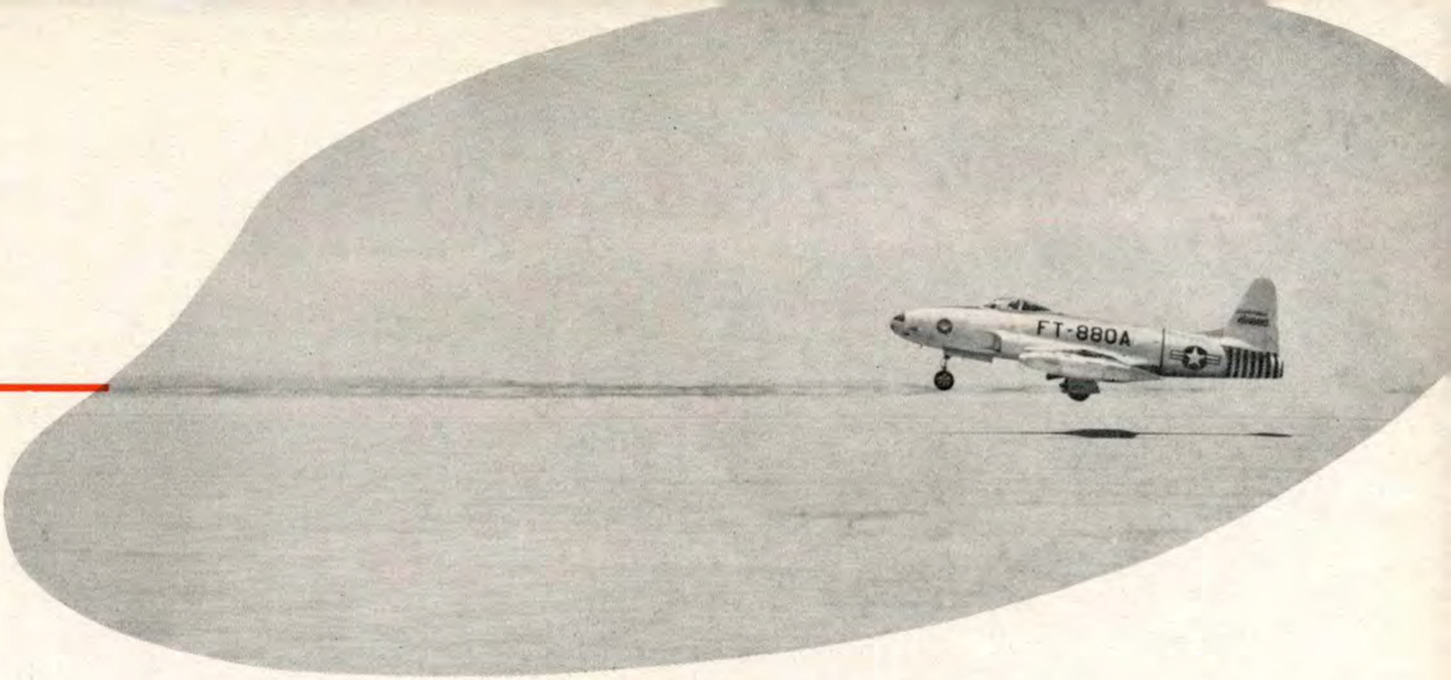
Weather at the time was adverse as far as peak efficiency jet operation was concerned, due to the extremely high temperatures of 136° on the first day and a cooler 125° on the second day of the tests. Clear sunny skies with typical 50-mile visibility prevailed which made it quite easy to track the "flameouts."

The fighters were flown by highly qualified pilots from tactical outfits, with the 78th fighter group at Hamilton AFB, furnishing the F-84's. The 94th Fighter-Interceptor Squadron sent two 86's from George AFB. The 80's were from Nellis AFB's 3597th CCTS, and the F-94's were dispatched from the 325th Fighter All-Weather Wing, McChord AFB.

These self-imposed flame-outs were flown by clean aircraft with tiptanks installed but only internal fuel loads. No external test equipment was carried. The weight of each test fighter was identical to the normal takeoff gross weight as listed in the applicable tech order. Pilot comments common to all models stated that the amount of internal fuel load had no noticeable effect on aircraft handling characteristics or approach speeds.

Other conditions of the tests were that aileron and elevator hydraulic boost systems were turned off. Landing gear was down and locked prior to stopping the engine, and landing flaps were not used by any of the fighters except in the pattern for landing. Chase planes flew close formation with the dead engine fighter throughout the letdown. They used full open dive flaps to induce drag for simulating a dead, windmilling jet engine at the power settings used.

Actual flame-out approach data obtained for each fighter is as follows:



Type	Best Glide Speed	Rate of Descent	Final Approach Airspeed
F-80	180 mph	2350 fpm	170 mph
F-84	180 mph	2250 "	170-180 mph
F-86	175 knots	2350 "	150 knots
F-94	170 knots	2650 "	140 knots

Gliding distances were determined by applying the chase plane data to test fighters coming in from a distant known fix using an idle power straight-in letdown (for power and dive flap settings, see Fig. 1.).

The F-80 can glide a distance of 100 statute miles from 40,000 feet. This is on a straight letdown. The altitude found best for lowering the gear is 10,000 feet above the terrain. No landing flaps were used until base leg and final approach.

The F-84 showed very favorable results in rates of descent and gliding distances. Contrary to many present rumors that the Thunderjet has an abnormally high rate of descent with power off, it was found that the 84 has a slightly better gliding distance than the F-80 or F-86. It will glide 100 miles starting at an altitude of 38,000 feet.

Glide distance of the F-86 was comparable to that of the F-80 and the rate of descent, both with gear up and down, closely followed the "Shooting Star" figures.

The F-94 was found to have the highest rate of descent and the shortest gliding distance of all the fighter models tested. Approximately 80 miles can be covered from an altitude of 40,000 feet. It was determined that due to this fast sink rate it is better to put the gear down and locked at an altitude of about 12,000 feet. This is roughly 2,000 feet higher than the other test fighters. The pilot is able to devote more time to his approach planning using this procedure.

All of the four types, F-80, F-84, F-86 and F-94, exhibited good flight handling characteristics, with control boosters off and power unit flamed out. The F-80 and 84 were maneuvered at better than two needle width turns without placing undue strain on the pilots. The F-84 is very easy to handle with boost off and the pilots commented that slight slips and skids could be accomplished without jeopardizing the pilot's control over the aircraft.

The F-86 was the least comfortable to fly without boosts and the comments of the pilot, Captain D. C. Buchanan, rather specifically stated that no turn greater than one and one-half needle widths should be made close to the ground unless it's absolutely necessary. It might be well to note that the 86 model with the short chord aileron is much easier to control laterally with the boost off than the models with the long chord aileron. However, if turns are made at the pattern altitudes specified at normal rates of turn, complete control of the aircraft is assured. Buchanan also stated that without the use of landing flaps, the aircraft's touchdown speed was slightly higher.

There was considerable debate over the tech order data of the 86 which stipulates that landing flaps should not be used on a flame-out landing. The purpose of the tech order restriction is presumably to prevent loss of aileron effectiveness because of disturbed air wash off the outer end of the flaps. Another reason is to prevent the out-of-trim condition which would result if only one flap lowered. The Sabre does not have inter-connecting flaps and there was an inverted ejection bailout some months ago due to the flap lowering on one side only, causing a series of uncontrollable rolls. It was decided that the restriction against use of flaps was a good one and should be continued.

The F-94 was reported to have good flame-out handling characteristics at lower indicated airspeeds. This aircraft usually made a higher and larger pattern due to its greater sink rate.

Once the flamed out plane is maneuvered over a landing field, the pilot should use the basic circular descent from which downwind, base and final approach legs can easily be established. This pattern has two key points. The first is the "Hi-Key" point which is the altitude above and slightly to one side of the landing end of the runway from where the pilot can visualize his touchdown spot. It should be reached flying in the approximate direction of intended landing, then a turn of approximately 270° onto the base leg is executed.

The position that would normally be considered the turn onto base from downwind leg is referred to as the "Low Key" point. Here the pilot is in a good position to judge his correct angle and distance to the touchdown point. He may play his turns onto base leg and final approach as the situation requires.

The comments of the pilots who flew the test planes, regarding handling techniques throughout the landing pattern, are interesting. First Lt. D. C. Carlson, who flew the F-80, used a drop-nose technique over the low key when he found he was too high, until correct altitude was attained. He used an airspeed slightly slower than tech order recommended glidespeed and was then able to drop the nose without danger of overshooting. Probably this should not be recommended to all pilots, however. The 80 can be slipped or fishtailed on final approach with good handling characteristics.

During the F-80 tests, several stalled out touchdowns just short of the intended runway were made. This should suggest a slightly high approach, shooting for a point about one-third down the runway.

Captain P. R. Henderson, who flew F-84 tests, stated the importance of pattern work cannot be overemphasized. If the maneuvering necessary to arrive over the end of the runway at the "Hi-Key" point (6,000′) fails to position the aircraft properly, then the pilot can rectify this judgment error by making a larger or smaller final pattern. In the case of a wheels-up landing the rate of descent will be close to a thousand feet per minute *less* than with gear down.

The other Thunderjet driver, Capt. W. O. Belton, commented that the J-35 engine, when flamed out, will windmill at approximately 10 per cent rpm and supply sufficient hydraulic pressure for landing flaps. However, the flaps come down slower with a flame-out than with simulated power settings. All turns were made at approximately one and one-half needle width and the F-84 pilots made consistently accurate spot landings using a pattern of approximately one and one-half miles radius from the point of touchdown. This is close to 8,000 feet, the average runway length. The pilot can judge his distance out from the spot by visualizing an 8,000-foot runway length as a radius of turn over the ground.

Another comment pertaining to visibility was that the nose of the F-84 was almost as difficult to see "through" as an F-51 and that the pilot should keep the field in sight slightly off the side of the nose at all times during his approach. Aileron control is good with boost off if positive control pressures are used.

Some observations of Captain Buchanan, the F-86 pilot, have been given. He also said that the "Hi-Key" point should be placed a thousand feet higher than for the other planes to allow easier maneuvering of the F-86 with boost off. Also, there was sufficient hydraulic pressure in the accumulator to drive the speed brakes to full out position when the pilot needed them.

In the F-94, 1st Lt. W. A. Cato noted that the rate of descent is noticeably higher when the power unit is cold than for the other planes. The high and low key points were placed higher than any other model in the test project to compensate for this high sink rate. It should be stated quite emphatically that the greater sink rate had no effect whatsoever on the ability of the pilot to spot land. Control was in no way affected but more careful pattern planning was necessary to prevent undershooting. Landing flaps can be used at any desired

time throughout the final 360° and although the dive flaps have little effect in inducing drag, they will affect the rate of descent on the downwind or base leg.

Basically all the information derived from the actual flame-out forced landings should be applied to simulated forced landing practice. A pilot who has conscientiously followed correct simulated procedure will be far better able to cope with this type of emergency than one who does not practice this technique.

In order to achieve a true simulation of a windmilling unit, the power settings as specified in the charts should be attained at the earliest practicable time during descent. Power settings noted in the chart as "Idle" indicate that it is impossible to reach the recommended settings at altitudes above 15,000 feet due to regulator controls. However, this difference is not sufficient to cause any appreciable change in gliding distance or rates of descent. The power figures shown from 15,000 down to sea level are accurate to one per cent and will afford the pilot an extremely accurate simulation of a "cold" unit using the dive flaps and power settings as suggested.

Fuel consumed in the different types was tabulated for operational planning. Time allotted for each aircraft making a simulated pattern from 25,000 feet should be about 20 minutes.

Project "Flame-out" showed that practice simulation can be done with safety and accuracy using the test data. This accuracy can be attained with relatively little practice. Of course it should be remembered that the pilots on the project were the best qualified of their units. Every actual flame-out landing during these tests could have been confined to a 6,000-foot runway with a 2,000-foot elevation.

Flying Safety congratulates and thanks the pilots and other personnel who took part in these experiments. The results may save lives and valuable Air Force equipment.

CONDITIONS • *Simulated* FLAMEOUT • FOR PRACTICE PURPOSES

ALL CURRENT JET FIGHTERS

BOOST OFF--NO FLAPS, EXCEPT ON FINAL APPROACH

AIRCRAFT	Recommended Glide Speed	Dive Flaps	POWER SETTINGS 25-15 M	15M-SL	Recommended Alt. Lower Gear (Above Terrain)	RATE OF DESCENT Above 12000 No Gear	Below 12000 Gear Down	Fuel Consumed 25000 Ft to S L
F-80	♦ 185 mph IAS	Down	Idle-54%	52%	10,000 Ft	1570 Ft/Min	2350 Ft/Min	28 Gal
F-84	■ 185 mph IAS	Down	Idle-56%	55%	10,000 Ft	1450 Ft/Min	2250 Ft/Min	30 Gal
F-86	⊙ 175 Kts IAS	Full Out	Idle-71%	70%	10,000 Ft	1600 Ft/Min	2350 Ft/Min	37 Gal
F-94	⊙ 170 Kts IAS	Down	Idle-47%	45%	12,000 Ft	2000 Ft/Min	2650 Ft/Min	22 Gal

CONDITIONS • *Actual* FLAMEOUT • FOR FORCED LANDING

ALL CURRENT JET FIGHTERS

BOOST OFF--NO FLAPS, EXCEPT ON FINAL APPROACH

AIRCRAFT	Best Glide Speed	R/D=Ft/Min Alt. 25000—12000 Ft, Gear Up	R/D=Ft/Min Alt. 12000 to S.L. Gear Down	Best Rate of Turn 4-Min. Turn	High Key Point Altitude	Low Key Point Altitude	Best Final Approach Speed - IAS	A/c Touch Down Speed IAS
F-80	♦ 185 mph	1570	2350	2^{o}/Sec.	6000 Ft	4000 Ft	170 mph	110 mph
F-84	■ 185 mph	1450	2250	2^{o}/Sec.	6000 Ft	4000 Ft	180 mph	145 mph at 14,600# 135 mph at 13,000#
F-86	⊙ 175 kts	1600	2350	1.5^{o}/Sec.	7000 Ft	5000 Ft	150 kts	110 kts
F-94	⊙ 170 kts	2000	2650	1.5^{o}/Sec.	8000 Ft	4000 Ft	140 kts	100 kts

♦— GEAR DOWN 175 MPH ■— GEAR DOWN 180 MPH ⊙— GEAR DOWN OR UP

watch the red line

—A simplified explanation of compressibilty—

By Major General GEORGE W. MUNDY, Director of Supply and Maintenance Hq., Air Materiel Command

IF ALL PILOTS WHO FLY FIGHTERS, jet bombers or even cargo aircraft that can approach the speed of sound, understood the ærodynamics of compressibility, many accidents that are happening today would not occur. Design engineers understand the mathematics of compressibility at the supersonic barrier, but most of them are unable to explain it in terms readily understood by the average pilot. This article is written in the hope that readers may gain a better understanding of the subject and that those pilots who frequently, or on occasion, exceed the red line will be made aware of the deadly aspects of such practice.

Most pilots wonder:

- Why the speed of sound is important (why not just any high speed?)
- What kind of compressibility barrier it creates.
- Why faster speeds do not create even stronger barriers.

The answers may be simplified.

This basic fact must be kept in mind to arrive at a proper understanding of compressibility—shock waves travel at the speed of sound. In an ordinary conversation between two people, one does not normally feel the breath of the other on his face, yet he hears the words spoken. This is due to the fact that a shock or sound wave is transmitted from molecule to molecule without necessarily transporting the air used to create the shock wave. A little illustration will suffice to depict how these molecules transmit the shock waves. Place two coins side by side on a hard surface. Holding one coin firmly with the finger, strike this coin a blow with a third coin. The force will be transmitted to the coin not held and it will move several inches away. The coin held firmly by the finger, of course, does not move. In this same manner, each molecule of the air transfers from molecule to molecule the shock or sound wave.

So far so good. Now, for a little ærodynamics.

A wing as thin as a razor blade would have the least amount of drag, yet would provide no lift at zero angle of attack. If it went through the air with a small angle of attack, some lift would be provided but structurally it is impossible to build a razor-thin wing. Most pilots have had sufficient ærodynamics to know that a wing cross-section is designed in a manner which causes the air moving across the top to increase in speed, thereby decreasing in pressure. This causes a negative pressure area and creates the lift. (Example 1.)

Now, let's assume that Example 1 depicts the wing cross-section of one of our standard jet fighters today, and let's also assume that the pilot, through ignorance of the danger, is approaching the speed of sound (say, for this particular wing, .9 Mach.). Let us further assume that, as the air goes across the top of this wing at this airplane speed, it increases in speed and reaches the speed of sound (Point 'a', Example 2) for a short distance, then slows down to under the speed of sound again (Point 'b', Example 2) before fully passing over the wing. Under these conditions, let's trace the shock waves.

Up until the point the air first reaches the speed of sound, the direction of the shock wave, in relation to the airfoil, is forward and up as well. At the point where the air reaches the speed of sound, the *relative* motion of the shock wave can only be to the rear and up, following the direction of airflow. At the point where the air slows to under the speed of sound (Point 'b', Example 2), again the shock waves can be forward and up. At this point, there are two shock waves impinging on each other. So, under the conditions described, there is a small wall of compressed air created (Point 'b' on the wing cross-section, Example 2), although the airplane itself has not reached the speed of sound.

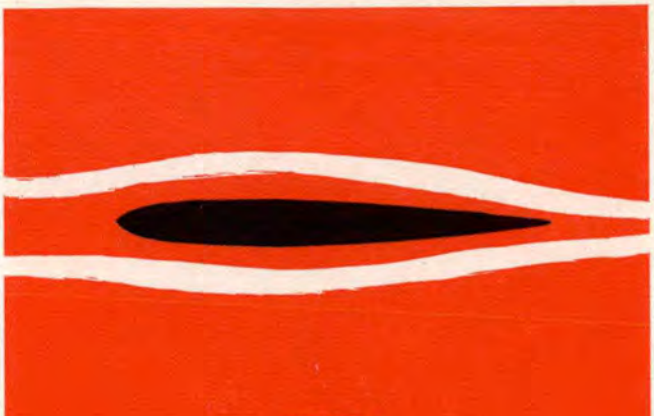
The airflow across the top of the wing seeks the course of least resistance and at the point of this wall, rises above it. Depending upon the design of the particular wing cross-section, this can have one of two effects. It could render useless the lift from that portion of the wing from Point 'b' to the rear, thus moving the center of pressure forward on the wing chord. Under this set of conditions, the pilot would have a nose high reaction, requiring forward stick. On the other hand, if the wing were so designed, this compressibility wall would cause a flow of air in such a manner as to strike underneath the wing, causing the airplane to pitch nose down. This, of course, would call for back stick.

As most of our present fighters are not supersonic fighters, their strength factors are not designed to cope with these forces, which are tremendous. It is obvious, therefore, that the control forces must be sufficiently strong to counteract this nose-up or nose-down tendency or else the airfoil will be thrown at a tremendous speed to the airflow and disintegrate. If this control force is sufficient, then the structural strength of the airplane must be able to take these forces. If the controls or the design strength are insufficient, then the pilot has had it!

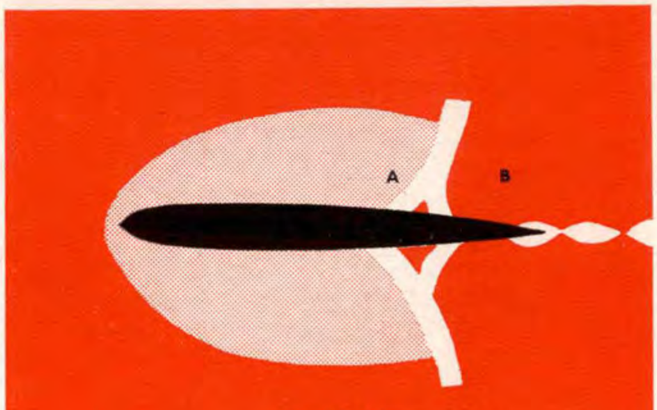
After an airplane has passed through the speed of sound, the relative motion of the shock wave along the wing is to the rear, across the entire wing (Example 3). This, in effect, reduces drag and also removes the reason for the wall of the compressed air. It is true that the ærodynamic forces increase with increased speeds after passing through the sonic barrier, but they are increased in a manner which does not upset the design flow and, consequently, the control of the airplane.

The foregoing explanation of compressibility is, of course, over-simplified and does not include all aspects of the subject which must be considered by a designer of airplanes, but should be sufficient to explain to a pilot why our present fighter aircraft such as the F-80's, F-84's and T-33's, etc., should be flown within the limiting Mach numbers. No sane pilot would fly a wing with the cross-section shown in Example 4, and yet that is the type of wing a jet pilot is flying when he exceeds the red line.

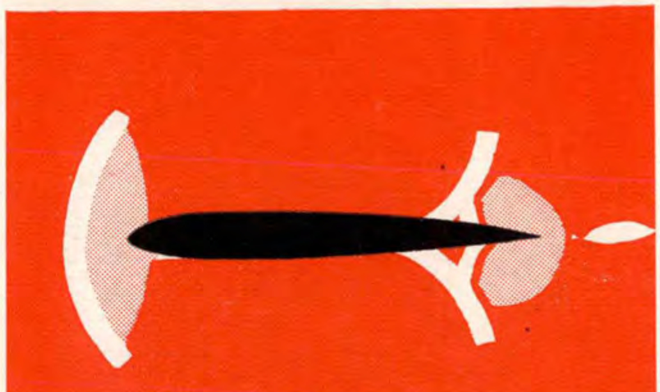
There's a good reason for that red line to be on your airspeed indicator. You can help to keep yourself out of trouble by staying on the right side of it.



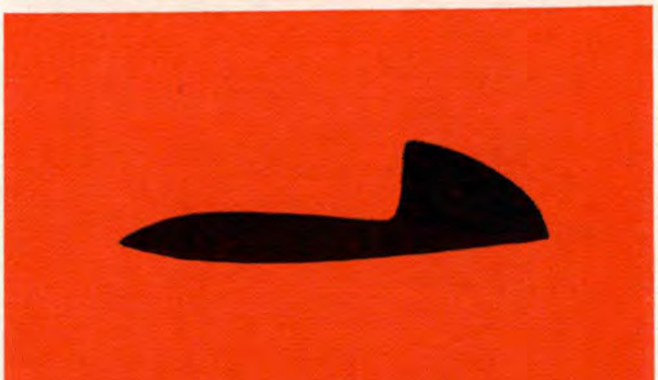
EXAMPLE 1



EXAMPLE 2



EXAMPLE 3



EXAMPLE 4

FLIGHT PLANNING

A Way to Safer Flying

USAF cadets are learning that the fastest and safest way to get there is to plan a good flight and fly a good plan.

"AIR FORCE 3354, YOU WILL HOLD on the northeast leg of the range at 7,000. Expect approach time at three-zero . . .," droned the voice of the instructor-controller over the intercom system. He was a busy man as he simultaneously instructed 10 cadets who were each making a three-hour advanced single engine flight from Craig AFB, Alabama.

Nearby, two other instructor-controllers were also busy as they gave the good words to their individual groups of fledgling cadet pilots of the 3615th Pilot Training Wing. The instruction was a major training phase of the 60-hour flight planning course given each class of USAF cadets coming into this advanced single-engine school.

All of these flights were being made with perfect safety because the students were seated at their desks proceeding on simulated missions from information on a navigation log. In this particular phase of flight planning instruction, the accuracy and clarity of radio calls were stressed from the simple takeoff instructions to a complete change of flight plan. By using a clock with a speed four times the normal operation, the cadets were taking three-hour flights in a 50-minute period.

Using an interphone-intercom hookup from desks the students making the flights were being "controlled" from takeoff to landing by an unseen instructor in a nearby communications room and all the chatter of position and weather reports, changes of flight plans, was heard by all. It was close work for the teachers, especially when a lot of the calls came in only seconds apart.

Largely, this newly organized flight planning course at Craig was established after it had long been apparent that graduate pilots, while proficient in flying, had been sadly lacking in flight planning ability. Set up under the direction of Maj. Louis Renaud, the course at Craig consists of 60 hours of instruction devoted to the broad subject of flight planning which is broken down into flying regulations, publications, radio communications, meteorology, navigation and the E-6B, cruise control, and R/T procedure.

Designed to effect maximum student learning, the program is presented through a "learning-by-doing" approach. The cadets, at their first class attendance of flight planning, are told that they are to take a flight from one point to another under IFR conditions. Then, in order to prepare for this flight, they are given all of the facilities and information necessary to do a safe job of flight planning.

Interest is kept up throughout the course by keeping the students aware that all of the apparently miscellaneous information is directly related to the problems of flying from point to point.

Three principal, experienced instructors, Captains John Ray, Maynard Bjorgo and C. M. Cronk, guide the students into the course. In a mock-up operations room, the cadets take their initial step in planning a flight. They are told to "begin with the clearance form," then at the dispatch desk they get their form 175's and go through the publications. Each classroom allows for closer supervision where small groups can be taught.

From here they progress in small groups to a chart room mock-up to prepare their maps. "Watch this danger area," says an instructor pointing to a red area on a huge wall map. A chart table and other planning facilities give the students privacy and completes the flight operations mock-up.

Following their flight planning work in operations, they go to another mock-up for the all important weather picture. Here they study past weather as an instructor explains the relationship to present conditions, and pore over the latest teletype for a proposed flight. At the end of the course, the students are expected to prepare their own forecasts.

With the completion of their flight planning, the cadets are now ready for a flight and they are given instructions and briefings along these lines:

"You have been directed to make a flight from Charleston, S. C., to Nashville, Tenn. You have been furnished an F-51 type aircraft for this flight which will be carried out under IFR conditions. The following information is given:

Gross weight: 9,230 pounds.

Gasoline per gallon: six pounds.

Winds: 250 degrees, 20 mph, Charleston to Atlanta
230 degrees, 25 mph, Atlanta to Nashville.

Total fuel: 269 gallons."

This information is followed by the routes and altitudes and the flights get underway. The students are graded by the instructor-controllers who further test them by closing the destination or alternate, making the "fliers" change their flight plans.

"During the early part of the flight planning course the students are more or less confused by all of the various steps of properly planning a mission," said Captain Cronk. "But when they start understanding how it all fits together they become plenty sharp on making and carrying out a good flight plan."

It has only been in the last few years that any specific attempts have been made to focus training on the problems confronting both the young and old pilots. For the young pilot just beginning to stretch his wings, good flight planning is something more that was learned in the classroom. But for the older, experienced flier, "planning a flight" is a technique that was mostly picked up on his own. And this latter class of older fliers would do well to "bone up" on flight preparations.

BEFORE YOU TAKE OFF

Get charts covering your flight and number in the order you'll use them.

Check **NOTAMS** and note changes on charts.

Note elevations of highest points along and near your route. Pick a safe altitude.

Plan the legs of your flight. Make all turns over check point when possible.

Note location, frequency, and call letters of radio ranges along your course.

Mark course line in short segments to help you check distance traveled.

Mark all check points plainly and boldly.

Get all necessary weather information. Study winds-aloft charts carefully.

Figure total elapsed time to destination. Compute fuel consumption and range.

Note and check all emergency landing fields on each side of your course.

Check compass and radio before takeoff.

Get temperature at cruising altitude—then correct IAS for temperature and altitude.

Remember to take a flashlight if the mission is at night.

WIND

Wind drift should be computed for each leg of a flight. The difference between the ETA and actual time of arrival is a variable influenced mainly by wind. The airspeed can be controlled but not the effect of the wind, so in addition to getting winds-aloft information before takeoff, the pilot should check winds continually during a flight and each time he lands during a cross-country.

Here, cadet pilots of the 3615th Training Wing figure the air miles for one of their desk-borne "missions."

The "operations" officer helps in planning a flight. Below, hidden controller-instructor grades a student.

DON'T BE A Charlie McCarthy

Upper left: While Bergen studies the weather, hot pilot Charlie studies a comic book in between taking care of his social obligations.

Left: Bergen can check ranges, identification zones and flight distances; Charlie McCarthy has more important things to occupy his time.

Below: "Edgar, she thinks I'm kinda cute," says Charlie, "Wonder why she won't do any long distance planning with me." Bergen knows.

ON THESE PAGES, MR. EDGAR BERGEN and an unidentified little friend give their impressions of Air Force pilots getting ready for a flight. It appears that Mr. Bergen has a considerably higher opinion of the Air Force than does his friend. Bergen, who is a private flyer and a very good one, appears rather horrified at the procedure used by the wooden-headed pilot in these photographs.

Actually, the business of getting ready for a flight is no laughing matter. Many pilots have been killed or injured and many airplanes have made the junk heap because of poor flight planning and preparation. It's a matter which cannot be skipped over lightly.

A thorough weather briefing, good route planning and a proper visual inspection of the airplane are essential to a safe flight. Perhaps you don't flirt with the girls when you're supposed to be studying the weather. But do you always ask about winds and icing levels? Perhaps you don't take a nap or look at pinups in place of planning your route for a trip. But do you check NOTAMS? And maybe you don't hold hands with a WAF or light a match to check your fuel supply when you're supposed to be checking the airplane. But do you always look at the Form 1 and remove the pitot cover? No element of your preflight preparation can safely be left undone.

The word just came in that the name of Mr. Bergen's little friend is Charlie McCarthy. Charlie's WAF friend is really movie actress Margia Dean. The girl waving through the window is Kay Mason.

Charlie is all set to take Margia Dean for a ride, regulations or no. Who but Bergen would scream about the pitot tube cover?

"Just off to buzz that WAF a bit and drop her some posies," says the hot shot. Bergen seems to know a better use for the daisies.

The paper dolls did it. Just after this photo was snapped, Charlie finally got into the air—Edgar's toe is still sore from the sendoff.

FLYING the FLIGHT PLAN

ONE OF THE MOST IMPORTANT PARTS of any flight is adequate flight planning. If the pilot knows what to expect on his route, he can plan in advance how he will handle any situation which might arise.

To plan a flight, the pilot must know how to use all the facilities available to him before he takes off. Yet, because he often fails to use plain, common sense and discipline his thoughts well enough to plan a flight intelligently, many a USAF mission has ended in disaster. For instance, accident statistics for a 12-month period ending last October totaled up to dozens of lives lost and many aircraft destroyed or damaged as a result of poor flight planning.

The greatest offenders in this accident picture have been fighter pilots with 31 per cent of the accidents stemming from poor flight planning. Trainer type aircraft ran a close second in accounting for 25 per cent of the total. These accidents occurred during the various phases of flight—but each was an "accident about to happen" simply because the pilots failed to prepare adequately for their intended flights.

Where, then, does the pilot slip up on his flight planning and why? What can and is being done about better flight planning? There were many ramifications to the answers of these questions and to understand the why of the accidents, an analysis was made of each of the accidents that involved poor flight planning.

The evidence turned up was surprising. It was found that pilots made more errors while making the preflight inspection than at any other period prior to flight. To further answer the question and to locate the greatest area for error this problem of visual examination was divided into two fields: aircraft exterior and aircraft interior inspection. After an analysis of this breakdown the answer was that pilots made a total of 36 errors which contributed to a total of 32 accidents. Twenty-two of these mistakes were made during the interior inspection of an airplane.

Both fighter and trainer pilots committed nearly the same number of errors during the interior inspections. It was also found that the pilot's failure to check the fuel supply with relation to the length of flight was a major error in both inspection areas. From the statistical evidence uncovered it was apparent that the tendency of these pilots was to check the outside and then assume that everything inside the plane was satisfactory.

Of other errors brought out it was found that poor weather analysis by pilots contributed to 18 per cent of the total accidents brought about through bad flight planning. These accidents involving weather were evenly distributed among all types of aircraft. They show that none of the pilots involved was fully prepared to complete his intended mission successfully.

Here are some of the Flight Safety Research recommendations for reducing and eliminating those accidents brought about as a result of poor flight preparation by pilots:

- That IP's thoroughly teach visual inspection techniques before qualifying a pilot to fly.
- That IP's teach their students the functions of each item inspected.
- That the aircraft interior inspection be made part of the regular visual inspection.
- That visual inspections by pilots be standardized for each aircraft type.
- More comprehensive weather briefing by weather officers.
- Greater emphasis be placed on wind analysis by pilots; indicate to inexperienced pilots how wind affects navigation, fuel consumption and landing conditions.
- Strict compliance with requirements for adequate fuel reserve for the distance to be flown.
- Pilots be thoroughly instructed on use of any new equipment added to aircraft.
- Closer supervision by clearing authorities.

The preparation for a flight requires as much thought by pilots as does the actual technique of handling the controls. From the past record of accidents it is beginning to appear that many pilots are of the opinion that flight planning begins and ends with the preflight inspection and weather analysis. As important as these two factors are to safe and sane flight, there are many other items that must be understood. These things include a complete knowledge of the facilities at the point of departure, destination or alternate, weight and balance, weather, and the terrain to be encountered along the route of flight. Only by taking the time to do the job right can the sharp pilot plan his flight carefully; then he can be sure—and be safe.

ETA's AND CHECK POINTS

The distance between important check points should be measured so the time can be noted when each point is passed. It then becomes a simple matter to figure groundspeed and ETA to the next point.

Don't compute groundspeed, however, on the time it takes to fly from the point of takeoff to the first checkpoint. Climbing airspeed is used to cover part of this distance and the plane passes through regions of varying wind direction and velocity to reach cruising altitude. Ordinarily, by the time the first check point is reached so is cruising altitude and airspeed.

The time over the first checkpoint should be marked down and the time computed to the second check point and so on throughout the flight.

Failure to recognize the relationship of time and distance to groundspeed is a common error—the pilot cannot compute his ETA correctly without first having correctly figured his groundspeed. If the distance between position checks is great, some pilots begin worrying too soon about the next check point. Then they begin to circle around aimlessly, and get lost. In considering an ETA over a check point the pilot should not confuse true airspeed with groundspeed. When the ETA over a turning point is up and the point is not yet in sight, the flight should be continued for a reasonable length of time. Then if it is not sighted the flight should return to the last positive check point.

Here are some good checkpoints for flying over various types of terrain:

Mountainous Areas

Prominent peaks, cuts, passes, gorges. General profile of ranges, railroads, bridges, power lines. Clearings and Valleys.

Coastal Areas

Coastlines with unusual features. Lighthouses, marker buoys, towns and cities.

Seasonal Changes

Unusually shaped wooded areas in winter. Dry river beds if they contrast with terrain.

Populated Areas

Large cities with a definite shape. Small cities with an outstanding check point. Prominent structures, rail yards, rivers and lakes.

Open Areas

Towns or villages with identifying structures or prominent terrain features. Prominent paved highways, large railroads, race tracks, factories.

Forested Areas

Transmission lines, lookout towers, farms, rivers. Ridges, clearings, open valleys.

In General

Some general features, often as far as 40 or 50 miles away, may make good check points in flat country. Abrupt changes in physical appearance; mountainous to flat areas, forest to farms, land to water.

Flight planning instructor warns students of a danger area as they prepare their maps in a "chart" room.

Above, a group of cadets look over the latest weather. Below, students learn about the new clearance form 175.

CARBON MONOXIDE

THIS HAZARD TO FLIGHT PERSONNEL COULD BE THE CAUSE OF SOME UNEXPLAINED CRASHES

CARBON MONOXIDE is one of the oldest known health hazards in industry. It is encountered in mines, caves, swamps and all places where there is incomplete oxidation of carbon, which also means coal and fuels. Aircraft reciprocating engines long have been known to produce their share of this deadly gas.

Carbon monoxide from the exhaust gases enters the body through the lungs and combines with the hemoglobin in the red blood cells to form carboxyhemoglobin. The affinity of hemoglobin for carbon monoxide is 210 times as great as its affinity for oxygen. The hemoglobin which is thus combined with carbon monoxide is not available to carry oxygen to the tissues of the body.

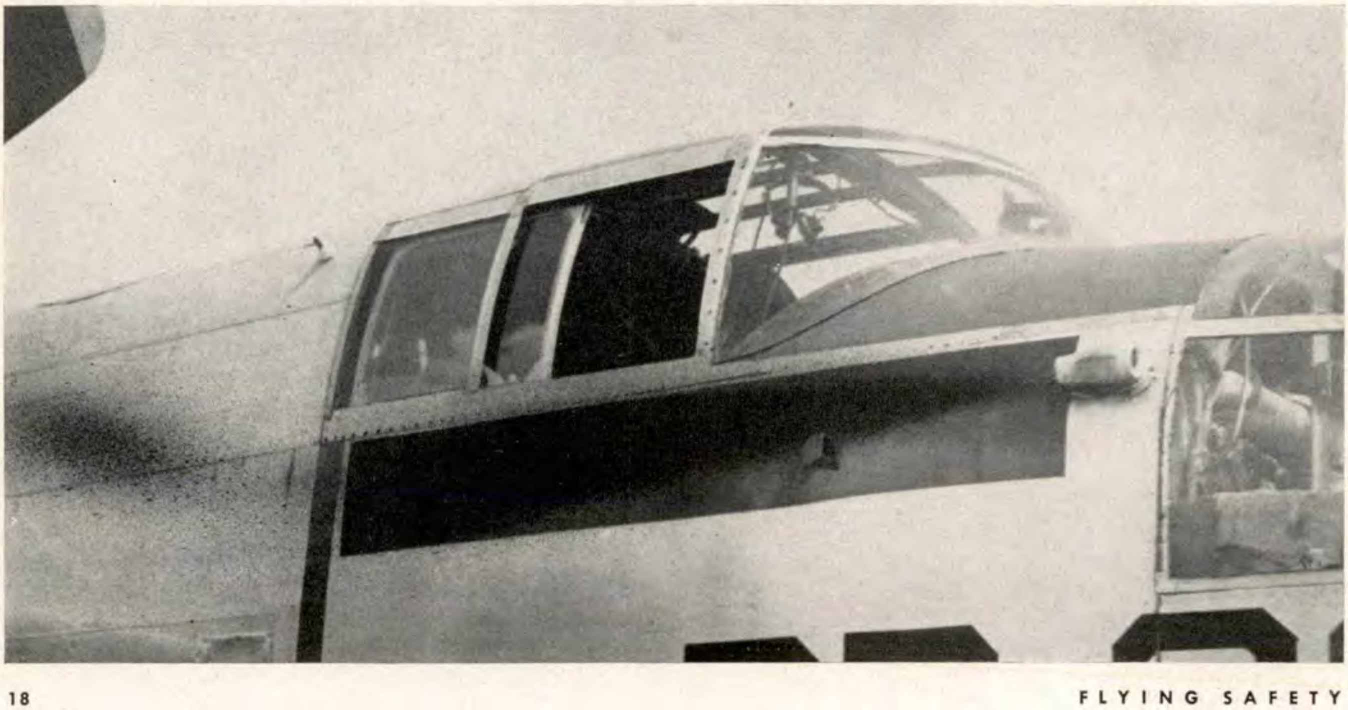
Breathing air containing very small amounts of carbon monoxide for several hours will result in an accumulation of carbon monoxide to such an extent that a large portion of the blood is useless for oxygen transportation. As little as one-tenth of one per cent of carbon monoxide in the inspired air will cause 20 per cent of the blood to be saturated in 30 to 40 minutes. Higher concentrations cause the blood to become saturated more rapidly.

Carbon monoxide is slowly eliminated from the body. While resting and breathing air at sea level, the average time for the percentage of carboxyhemoglobin to fall to half its value is about four hours. Thus, if the blood was 30 per cent saturated, four hours later it would be 15 per cent saturated and four hours after that, it would be seven and one-half per cent saturated. If 100 per cent oxygen is substituted for air, at sea level, the time required to eliminate half the carbon monoxide from the body is reduced to 40 minutes rather than four hours.

Carbon monoxide is especially dangerous to aircrew personnel. As the barometric pressure is lowered with increasing altitude during flight, simultaneously the degree of saturation of hemoglobin with oxygen is decreased. If both carbon monoxide and altitude lower the oxygen carried by the hemoglobin, there may be an inadequate supply of oxygen for the tissues of the body. Certain tissue, especially brain cells, have a high rate of metabolism and use oxygen rapidly. When the oxygen supply to the brain is lowered, some of the cells cease to function. This may cause lapse of memory, inability to reason, incoordination, etc. Many accidents attributed to personnel factors may have been caused by carbon monoxide poisoning.

Poisoning with carbon monoxide is so insidious that an air crewman can be in a dangerous physical and mental state without knowing it. Lowered mental and physical efficiency on the part of any air crewman in any part of the operation of aircraft means "an accident looking for a place and time to happen." Some of the symptoms of carbon monoxide poisoning are, in increasing degree:

During a cross-country flight, the pilots of a B-25 developed severe headaches and dizziness. They called on the flight surgeon who found high concentrations of carbon monoxide in their blood. Investigation revealed that the cabin heater exhaust outlet was feeding the gas into the cockpit through the fresh air vent. Corrective action consisted of closing off the air vent.



- tightness across the forehead with slight headache,
- headache with throbbing in the temples,
- severe headache with dizziness, weakness, poor vision, nausea, vomiting and collapse,
- more severe symptoms ending in death.

These symptoms are present in many types of illness but when they arise in flight they should arouse suspicion of carbon monoxide poisoning. Breathing 100 per cent oxygen will be most beneficial since it will reduce the hypoxia caused by both the altitude and the carbon monoxide; it will prevent more carbon monoxide from entering the body, and it will effect a more rapid elimination of the carbon monoxide already in the body.

A pilot and student pilot, in a T-28, were recently tested for blood saturation by carbon monoxide. One used tobacco, the other abstained. Tests showed a 10 per cent saturation of hemoglobin in the smoker and five per cent in the non-smoker. The following day, another pilot and student operated the same aircraft. Again, one smoked and the other abstained. The test results were identical with those of the previous day. It would appear that five per cent saturation came from the tobacco and five per cent came from the aircraft. These low saturation levels become significant when we realize that 10 per cent saturation with carbon monoxide leaves only enough hemoglobin for about 85 per cent saturation with oxygen even at sea level breathing air. This is equivalent to breathing air at 10,000 to 12,000 feet. However, if there is 10 per cent saturation of the blood with carbon monoxide and the individual is breathing air at 10,000 feet, the oxygen available to his tissue is equivalent to breathing air at 15,000 feet or higher. It is evident that air crewmen would be considerably handicapped under these conditions.

Evidence has been accumulated which indicates that in the operation of some aircraft, the atmosphere in the crew compartments may become dangerously contaminated with carbon monoxide, especially during engine runup, taxiing, takeoff and climb. The permissible limit of carbon monoxide in crew compartments is 0.005 per cent (AMC Manual No. 80-1, paragraph 12.410, revised October 1949). During practice landings where there are a considerable number of the above maneuvers in a relatively short period of time, exposure to carbon monoxide in high concentrations is highly possible.

Numerous unexplained fatal accidents have occurred which are characterized by the aircraft going out of control with power on and crashing. Review of these accident reports shows a trend indicating that the pilot became semi-conscious or unconscious and lost control of the airrcaft. Assuming the pilot was in good health prior to flight, one or more of the various stresses incident to that particular flight must have exceeded his compensatory ability, the resultant strain being manifested by the loss of control of the aircraft. Of the various stresses, hypoxia and the presence of carbon monoxide appear to be worthy of great consideration.

Pilots and crewmembers should exercise caution about smoking prior to and during flight. Smoking, like other things, is best in moderation. Be careful about too long an exposure to excessive carbon monoxide during taxiing, engine runup, takeoff and climb. A partially opened canopy produces high concentrations in the cockpits of T-6 and T-28 aircraft and probably is evident in other aircraft of similar configuration.

AIRCREW EFFICIENCY WITH ALTITUDE AND CARBON MONOXIDE

TRAINING FOR IFR

Realistic training in instrument procedures without ever leaving the ground is provided for Sewart AFB's Troop Carrier pilots

By S/Sgt. Frederick J. Nelson
Sewart AFB, Tennessee

"I DON'T CARE WHAT THE WEATHER IS . . . these supplies have got to be delivered! The men up front need them!"

These words echoing down the chain of command, send several Troop Carrier aircraft slipping down ghostly, fog-hidden runways, tucking in their landing gear, to disappear into the murk.

Hours slip by. The aircraft roar through fog and night, finally to touch down on a forward airstrip. The needed supplies have been delivered.

This would seem strictly an "old hat" mission with modern GCA, radar, range stations and other navigational aids for the pilots of these vital transports. Yes, GCA, radar, range stations are marvelous, but no item of mechanical or electronic equipment is better than the training and experience of the pilots who use them. Fear, like the fog, can close about an inexperienced pilot and give him Death for a copilot.

To assure plenty of IFR practice for pilots of Sewart's 314th Troop Carrier Wing is the job assigned to the Instrument Training Section of that Tennessee Air Base, by Col. Hoyt L. Prindle, Wing Commander.

"Instrument training operation, just as flying itself, has progressed as various improvements in navigation aids have been adopted," says Capt. William F. Brannian, Officer in Charge of Sewart's Instrument Training Section. "As changes such as GCA come along, our training equipment and training procedure must be varied to fully cover these developments."

Several additions to training equipment, in Captain Brannian's section, have been made with resulting change of procedure. Not the least of these is a simulated CAA Approach Control unit installed in the Link Trainer Department.

This unit is a duplication of a CAA installation, composed of a two-way communication system between the Link students and approach control operator, plus a modern plotting board. Both the Link trainer operator and approach controller are in communication with any or all of the Links.

The Link operator gives the student a CAA-type clearance with instructions to fly at a specified altitude to a radio fix. At this point, the Link pilot's transmission is channeled over to the approach controller. Receiving contact from the student, the controller enters the trainer position on his plotting board. The board, using the peg system, can position the seven trainers within the Sewart unit at 1,000-foot vertical separations, up to 10,000 feet, stacking on all radio fixes of the Nashville range, Nashville ILS and Sewart Radio.

Clearances are then given by the controller to the trainer. These contain data such as clearance to another fix for holding, changes of altitude, station weather, expected approach clearance times and final approach clearances.

As the clearances are given, the trainers report vacating the altitudes, pegs are replaced, indicating newly assigned altitude and position. In this manner, the trainer is brought down to the approach altitude for the requested facility and given final clearance for landing at either Nashville's Berry Field or Sewart AFB.

The approach control procedure allows the Link students to practice procedure which can normally be accomplished only through flight under actual instrument conditions. Thus, each student becomes acquainted with the language of the "talker" and through repetition, gains confidence in "feeling the way down."

According to Lt. J. A. Wooten, who worked on the device, "this unit takes all operator error from radio compass corrections, which must be registered with the pilot's radio compass indicator as the 'crab' travels across the plotting chart. Formerly, the corrections were made manually, allowing a chance of slip-up if the instructor failed to correct the indicator reading continuously. This device adds definitely to the accuracy and reliability of radio compass homing and tracking."

The unit itself consists of a small telemotor to which is affixed a slotted arm. This arrangement is then fastened directly on the "crab." The "station," a small pointer which slides in the slotted arm, activates the telemotor on the crab, which in turn relays the information to the telemotor driving the indicating needle in the trainer's radio compass indicator.

The station pointer, mounted on a swivel arm, may be changed to any desired location on the Link plotting chart, by placing the pointer over the "fix" to be used, such as an outer fan marker, range station, or non-directional homing beacon.

Instrument training aircraft come in for their share of changes, to meet current training needs. The radio jack boxes on C-47 and T-11 type aircraft were found to be unsatisfactory in that only a single receiving channel could be monitored at one time. This made dual instruction all but impossible, since a student could not monitor radio range signals, approach control frequencies nor listen to the instructor on the plane's interphone.

Captain U. G. Weatherby, Instrument Flight Instructor, and Mr. R. R. Saylor, Philco Radio technical representative, tackled the problem, coming up with a modification on the jack boxes which, though minor in nature, enables multichannel monitoring to be realized.

Toggle switches and a call button were installed on a standard jack box, thus causing no changes in wiring outside of the actual jack box unit. Included among the toggle switches were selectors for radio compass, liaison, VHF command, and interphone—all these for reception. A selector switch was also included for VHF command, interphone or liaison transmitting.

The new jack box has served well, not only in training, but it has proved invaluable in flying under actual weather conditions, where the pilot must monitor both radio range and approach directions.

With accelerated training, Captain Brannian and his staff found improper IFR voice procedure to be a common weakness with Air Force pilots. This was particularly true of those who had not been on active duty for some time.

A wire recorder has proved quite effective in helping to overcome this difficulty. In the Link department, the recorder monitors both student and operator for their voice procedure. In listening to the playback, a pilot receives a lasting impression of his voice procedure.

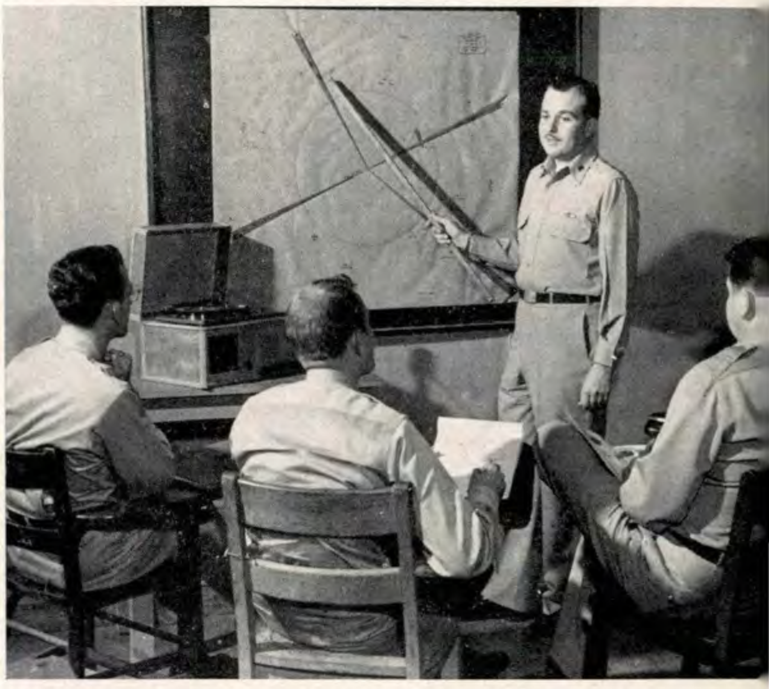
In the classroom, the recorder allows an instructor delivering a lecture on radio range or GCA to utilize actual sounds and signals, which the students will encounter later in the flight phase of this training. These transcriptions are made in the Link department prior to the lecture, then played back before the class in connection with visual aids such as radio range mockups and diagrams and GCA approach diagrams.

Captain Brannian plans to take the recorder into the control tower at Sewart during instrument-weather conditions to transcribe actual approach and departure instructions. This recording will be used in further flight training.

Regardless of how complicated navigation equipment for instrument flight becomes, 314th Troop Carrier Wing pilots will find their Instrument Training section complete and ready to supply any needed instruction. This instruction, coupled with ingenuity in the development of new training devices and procedure, will allow Sewart aircraft to fly in any weather wherever and whenever "the men up front need them!"

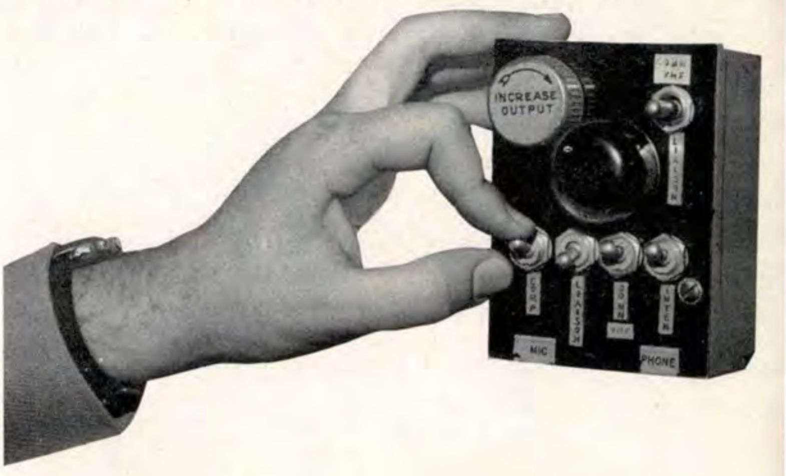
M/Sgt Sarver operates new simulated CAA Approach Control unit. Two-way communication, peg-board and chart are control tools.

Link radio compass is automatically corrected by telemotor attachment to crab of the plotter. Operator is Pfc Mary Stewart.



Capt. Brannian uses wire recorder to simulate range and homing signals during lecture. Voice procedure recordings are also made.

Standard jack box was modified with toggle switches and call button for multi-channel monitoring. Lt. R. C. Holt took these photos.



the solution to one PROBLEM

JET INTAKE SCREENS WERE REMOVED TO PREVENT ICE FORMING ON THEM

A COUPLE OF MONTHS AGO, eight F-84's either crashed or made emergency landings during a mass flight in the ZI. The resulting publicity was enormous and the effects of the investigation which followed are still being felt. The causes of the multi-accident could not be positively determined, but the symptoms, the analyses and the process of elimination pointed toward icing of the jet intake screens, resulting in air starvation of the engines.

In the December, 1950, issue, Flying Safety carried a comprehensive article entitled "Your Airplane and Icing." Mention was made of the cause and results of intake screen icing, but the subject was not gone into in much detail. Since then much has been learned about the matter.

Induction icing of jet engines can occur in summer just as easily as in winter. All it takes is a certain weather condition which can be present any time and any place. Just as for carburetor ice in reciprocating engines, visible moisture in the air is not necessary; also, ice can form on the inlet screen without showing a trace on the wings or other parts of the plane.

The ideal weather condition for induction icing would be a combination of temperature below freezing and heavy moisture in the air. This condition could exist in any cumulus cloud associated with frontal activity. Such clouds may be expected in August or January—in Georgia, North Dakota or anywhere else in the world. But air intake icing can also occur when no clouds exist. The ram air effect upon which the jet depends for its best operation can cause icing whenever the temperature and dewpoint are in proximity at or near freezing temperatures.

Jet pilots have to be always on guard and alert to the symptoms of intake icing. They must make certain that the weather briefings are complete and that the forecaster does not slight the very important item of icing possibilities. At present, a free air temperature indicator is not required equipment in jet fighters. It may soon become standard and the pilot can then readily determine for himself when he is passing through an area where icing is possible.

The initial symptoms of inlet icing are increased tailpipe temperature and accompanying loss of thrust. When ice forms, it restricts the amount of air which can enter the intake. This causes an over-rich mixture with the result that raw fuel is impinged on the turbine sections. When this fuel burns, it burns away the turbine nozzle vanes and turbine buckets. These molten portions of vanes and buckets may be thrown through the surfaces of the exhaust cone and the sides of the airplane. An air restart then is not possible and should not be attempted.

Immediately upon recognizing the indications of icing, that is loss of thrust and increased tailpipe temperature, the pilot should retard the throttle and attempt to get out of the icing area as soon as possible. The natural reaction to loss of thrust would be to increase the throttle setting. Such a procedure, if induction icing exists, could be disastrous since it would simply aggravate the situation and accelerate engine failure. As for leaving the icing area, this appears to be the only method possible at present for getting rid of the ice. Inlet icing is in some ways similar to carburetor ice, but there is no built-in way of relieving the situation such as carburetor heat provides for the boys who fly propeller-driven airplanes.

Engine anti-icing provisions and retractable air inlet screens have been developed and will be incorporated in engines and aircraft to be produced in the future, however, these developments are not standard in the majority of presently operating jet planes. As an interim measure, pending complete engine anti-icing installation, instructions have been issued requiring removal of intake screens from all axial flow turbo-jet engines except those installed in the F-89. This will be optional for overseas commands, since many planes are operated from fields and strips which it is virtually impossible to keep clean. Also, hazards of combat operations may make it inadvisable to remove screens. Cartridge cases from machine guns and debris thrown up by rocket blasts have been known to enter jet intake ducts. The presence of screens in such cases may prevent the pilot from being forced down in enemy territory.

Removal of screens will not altogether eliminate the hazards of icing for jet planes. Under certain conditions, delayed air inlet icing can occur in other parts of the induction system. Reduction of air flow to the combustion chambers would result and the same difficulties would follow as if the ice had formed on the screen. The air inlet screen has been recognized as by far the most critical place for ice formation.

has caused ANOTHER *problem*

WITHOUT THE SCREENS, OBJECTS CAN ENTER AND DAMAGE JET ENGINES

REMOVAL OF AIR INLET SCREENS from jet aircraft engines brings back the problem which the screens were designed to eliminate. That is entrance of foreign material into the engines.

How do foreign objects get into jet engines? Probably the most common is a result of the suction or vacuum effect which accompanies the operation of any jet engine. The jet engine has to suck air into the intake to keep operating. But it has no way of rejecting pieces of foreign matter which might be sucked in along with the air. As a rule, only lighter objects such as paper or small pieces of wood will be sucked up off the ramp or runway. The answer, of course, is to keep ramps, taxiways and runways clean. This has always been a must in the Air Force. With jets it is a double must. "Policing the Area" is a fundamental military chore which now takes on a new meaning.

Heavier objects such as rocks, bolts and pieces of metal are not likely to be sucked up from the ramp, but they get into the air intakes, just the same. They get there by being kicked up into the air by tires of a towing tug or by the nosewheel of the airplane. Such happenings have actually been observed. Just another argument for keeping paved areas clean.

Occasionally, a screw-driver, a pair of pliers or some other tool gets into the engine and causes its failure. These aren't sucked up or kicked up from the runway. Invariably, they were left in the air duct by maintenance personnel. The remedy is obvious.

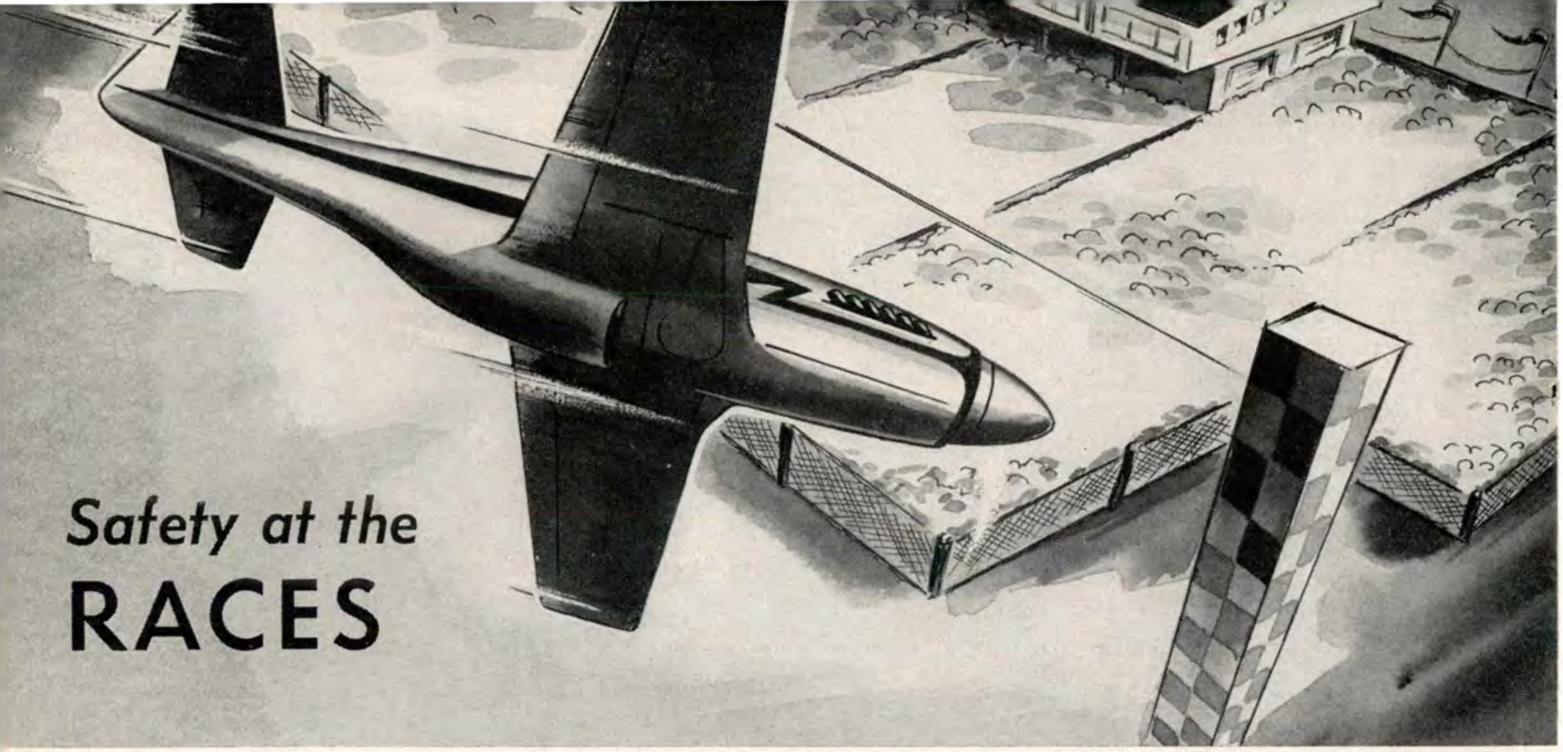
Of those ways in which foreign matter enters jet engines, the most common is that of lightweight items being "sucked" up from ramps and runways. Pieces of paper, grass, weeds, leaves, rags, gun plugs and other lighter objects are most often found on air inlet screens. The frequency with which matter is picked up varies inversely with the height of the air duct above the ground. For example: the F-84 and F-86 which have higher ducts have many more hours flown per article reported than do such low duct planes as the F-80 and F-94. This only means that the matter of keeping taxi and takeoff areas clean is more pressing the closer the intake is to the ground.

The most critical times for foreign matter to enter the jet intake ducts are during engine runups, when taxiing behind other planes or in high winds and during takeoffs, especially in formation.

The only effective way of preventing jet engine damage due to entrance of foreign objects is to keep ramps, taxiways, runways and adjacent areas clean of all foreign matter. It is the only way to prevent objects from being sucked up into air intakes or thrown into the air by vehicle and aircraft wheels so that they can enter the ducts.

Another "must" is that of making certain that articles such as tools are not left in the ducts by maintenance people. Perhaps an inspection procedure prior to flight may be necessary to accomplish this. At some bases effective results have been obtained simply through appealing to the integrity and sense of responsibility of maintenance personnel.

Jet engine damage by foreign matter could very easily take a sharp jump after intake screens are removed. It could very easily reduce the Air Force's effectiveness and ability to accomplish its mission. It will take the coordinated efforts of installations personnel, maintenance, crewmembers and supervisors to lick the problem.



Safety at the RACES

The 1951 National Air Races will be more safety-minded than ever before

THE NATIONAL AIR RACES are probably the outstanding aviation event of the country. Through the years, they have provided thrills and chills to many thousands of air-minded spectators. But at the same time, they have been the setting for a number of tragic accidents which have made the races rather notorious.

The 1951 National Air Races, to be held at Detroit this month, will undoubtedly provide their share of thrills, but serious efforts have been made to avoid the chills. Emphasis has been placed on safety.

Each airplane which participates in the races must be certified for airworthiness by CAA, or by the government concerned, if it is a foreign licensed plane. These certificates must be prominently displayed on the airplane or the plane will not be permitted to start a race. Only minor repairs or alterations which obviously do not impair airworthiness will be permitted after the plane arrives at the race site. Any plane which the Race Technical Committee considers not capable of flying with safety will be barred from closed circuit racing.

Pre-race demonstrations required of each plane before it may be entered in a race include a full-throttle takeoff without veering more than thirty feet to either side, a 6-G pull-up from straight and level flight, a dive at 1.3 times the maximum level flight speed, slow rolls each way at racing speed without excessive loss of altitude, and three full speed laps of the race course at race altitude. In addition, all planes participating in closed course pylon racing will be thoroughly tested for carbon monoxide content during qualifying trials.

Precautions for the safety of the pilots have not been neglected. Each plane must have a 270-degree field of vision in the horizontal plane, 140 degrees upward and aft from the top of the cowl and 25 degrees from the pilot's eyes down to the top of the cowl. To minimize injury from crackups, some sort of substantial overturn structure other than the fin must be provided. Parachutes, safety belts, shoulder harnesses and crash helmets also are required. Forced draft cockpit ventilation is mandatory and backs of seats and sides of cockpits must be free of obstructions which might interfere with the pilot's emergency evacuation of the plane.

Like their airplanes, pilots must be certificated by CAA and in addition must hold special licenses issued by the Contest Board of the National Aeronautics Association. They must have a minimum of 500 hours solo flying time of which 50 hours must be accumulated in the six months preceding the race. They also must have flown 10 hours and at least five takeoffs and landings in the planes they will fly in the races. Each pilot receives a thorough physical examination by a doctor appointed by the race management within six hours before any race in which he flies.

Even if he and his plane meet all the foregoing requirements, the pilot can still be disqualified at any time for violation of any of several other race rules. These include such things as flying over grandstands, unfair or reckless competition, unsportsmanlike methods in competition, and others.

These are only a few of the many rules designed for safety at the races. The point is that the accident problem has been recognized as the menace to aviation it is and that positive action has been taken to eliminate it. Air Force pilots are not the only ones who must fly by the rules for safety.

did you KNOW?

A SELF de-icing windshield whose surface can be made to give out as much heat as a griddle and yet not feel very hot to the touch, has been developed for use in commercial aircraft. The windshield has been installed in two airlines for flight testing and if it proves successful may later see service with the Air Force.

• • •

ONE - EYED depth perception is possible. The fact that pilots can land airplanes as well with one as two eyes has been proven at the Air Force School of Aviation Medicine. It all started 11 years ago at a German airfield west of Lille, in northern France. A damaged ME-109 was turning into its final approach to the landing strip. The pilot had radioed he had lost an eye in a battle with RAF fighters over the English Channel. While squadron officers looked on in grim expectation of a crackup, the 109 made a perfect three-point landing.

This gave a jolt to the long established belief about the physiology of the eye. It was taken for granted then and is widely believed now that depth perception comes mainly from the two slightly different images reported to the brain by the eyes. Since judgment of depth is one of the most essential functions of the optical nerves in landing a plane, a pilot with an eye gone would seem to be seriously handicapped.

After testing 100 air cadets at Randolph Field, the German physician who observed the ME-109 landing (he is now working for the USAF), is convinced that he has the answer to why the pilot could land with one eye. A new instrument of his own design, the motion parallax tester, proves that the pilot can estimate depth with either eye alone. The new tester not only provides a better gage of the pilot's flying ability but may also keep some pilots in the air who would otherwise be grounded. There have been capable one-eyed pilots, notably Wiley Post, but it has always been supposed that their ability to gage depth was the result of long training.

• • •

THE F-84G, now rolling off the production line, is the first operational jet fighter to be fully equipped for mid-air refueling by tanker planes. This feature of the "G" will provide greater flexibility and mobility for the plane. It will permit deeper strikes, heavier armament load, and the ability to spend more time over the target area. Fuel can be passed to the fighter at the rate of several hundred gallons per minute, with a complete refueling possible in two and one-half minutes.

• • •

A CRASH locator beacon developed for the USAF is being put through preliminary tests at Wright-Patterson AFB. The beacon is an electronic device which can be ejected manually from planes in distress or can be automatically ejected on crash impact. Immediately upon ejection, the beacon will commence to transmit distress signals for rescue planes to home in on. It should speed up the location of crashed planes and make possible early aid and rescue.

• • •

AN ENTIRE F-86 has been mounted in the 40 by 80 foot test section of the world's largest wind tunnel at NACA's Ames Laboratory. The purpose was to study airflow conditions on swept-back wings at landing speeds. Air in the tunnel can attain a speed of 250 mph in its half-mile circuit. Tufts of wool attached to the wing surfaces of the F-86 made it possible to observe and photograph airflow patterns. The results of this research should supply valuable data for the development of higher speed aircraft.

THE IN-FLIGHT fire fighting procedure for B-29 engine fires consists of nine separate steps. The most important of these is apparently feathering the propeller, according to a study by Boeing. It was found that 83 per cent of the engine fires were successfully extinguished if the propeller was feathered; only 14 per cent if the prop was allowed to continue rotating. Closing the throttle and feathering the propeller, with subsequent stopping of the engine, results in shutting off of the flow of fuel and air, allows the engine to cool, stops rotation of accessories, stops flow of oil and prevents loss or dissipation of the extinguishing agent. The nine steps of the complete fire fighting procedure are as follows:

- Feather propeller as quickly as possible.
- Close throttle.
- Shut emergency fuel and oil shut-off valves (if aircraft is so equipped).
- Turn boost pump "OFF."
- Move mixture control to "FUEL CUT-OFF."
- Turn CO_2 switch on **after** propeller has feathered.
- Open cowl flaps 10°.
- Open oil flaps.
- Open intercooler flaps.

CROSS FEED ★

FLYING SAFETY IDEA EXCHANGE

MIKE CORD HAZARD—Recently a student in the advanced single engine school here at Craig, flying a T-6F, reported to the tower that he had lost use of an aileron. It was learned, through the tower asking the pilot questions, that the left aileron was completely restricted but that the right aileron could be used. Since the student had plenty of fuel and was at 9,000 feet, supervisory personnel took off for an inflight inspection of the aircraft. This inspection revealed no discrepancies so the student was instructed to return to Craig and land.

A long, low flat final approach was used with airspeed slightly higher than normal and 10 degrees of flaps. Touchdown was made slightly wheels first (unintentionally) and the aircraft bounced slightly. As luck would have it, the right wing went down but the student controlled the aircraft perfectly with rudder and prevented the wing striking the ground.

A post flight inspection of the aircraft revealed that the rear cockpit microphone cord had wrapped itself around the rear cockpit control stick (not removable in T-6F's) in such a way as to restrict movement of the stick to from slightly right of center to full right only.

Pilots at this base have been briefed as to the hazard existing along these lines while flying T-6F's and were reminded to shorten the rear seat microphone cord by tying knots in it to prevent recurrences of this incident.

1st Lt. Burge C. Smith
Craig AFB, Alabama

NIGHT SCARE—During a VFR night flight, intermittent reflections in the haze drew the attention of the pilot of a C-54 to number two engine. As he watched, the engine appeared to have a high tension arcing in the vicinity of the forward row of cylinders.

A closer inspection of the engine by the pilot showed the engine appeared to be on fire. A thorough check of all instruments revealed no indication of fire or malfunction of the engine; however, the arcing or fire appeared to grow in intensity. All personnel aboard were alerted for an emergency. Though all instruments were normal, the engine was feathered and the fire faded away.

Routine three engine check list was completed and clearance was received to return to the takeoff airbase. Fifty miles out, the arcing again occurred in number two engine. Another routine check of the engine showed that the arcing was intermittent around the front cylinders but was not a continuous blaze. A visual check of the engine and fire warning system indicated the accessory section was not burning; however, the feathered engine frequently produced an arcing effect among the lower cylinders.

Prior to landing, an emergency was declared, and crash equipment alerted. The pattern, touchdown and after-roll were normal. All crash equipment was in place. As the C-54 was taxied off the runway, a visual inspection was again accomplished by the pilot and he noted that the engine was showing a steady flow of light, originating from the area along the lower four cylinders. At that time it was definitely decided that the engine was not on fire. The aircraft was returned to the line and parked with the engine still feathered. A close inspection of the engine by the crew revealed a flashlight wedged between the cylinders. The vibration of the running engine caused the flashlight to turn on and off intermittently.

Total cost to Uncle Sam of a 59c flashlight and a negligent groundcrew included 600 gallons of high octane gasoline, tension and anxiety to nine people aboard the C-54 during the entire procedure, the emergency alert of an entire airbase and aborting of the mission which was hauling high priority cargo for the defense effort. Eighty people were involved in a needless incident implemented by an aircraft mechanic who neglected to check his tool box for missing items and thus ruined an otherwise fine job of aircraft engine maintenance.

Wing Flying Safety Officer
Great Falls AFB, Montana

FLUID FIRE—Possibly the largest single item of carelessness that contributes to serious accidents is failure to maintain the aircraft plumbing—all fluid carrying lines—in top condition. The old-fashioned hose and clamps, still in existence, can be completely satisfactory but they require a lot of maintenance. Lines rubbing on hose, wires rubbing on lines and all of them chafing against the structure, present the very best opportunity for one of your worst enemies—fire in the air. Failure to maintain tight fire seals and firewalls makes it certain that any aircraft fire will have every opportunity to spread and do the most possible damage. These fire seals are often overlooked because they are necessarily in awkward places and a man is likely to get dirty climbing into areas to look for light shining through bulkheads that are supposed to be fume tight.

— Flight Safety —
516 TCW, Memphis

JABBER JAW—How many times have you been flying on instruments and wanted to contact an airways range station for change in flight plan, or to give a position report and found that the channels were so full that you could not make contact? Have you ever listened to the radio messages and tried to visualize how much of the time being used by some pilots in giving a position was unnecessary?

The proper voice radio procedure for position reporting is given on the last page of AN 08-15-1, the Radio Facility Chart. Every pilot knows this but since so few follow the prescribed procedure it appears that other steps may be necessary to reduce the excessive time now being used in giving position reports.

Perhaps each Air Force base should prepare mimeographed sheets on which the pilot can list the required information to be transmitted before he makes the initial call to the range station.

Lt. Col. Gilbert G. Smith, Jr.
Maxwell AFB, Alabama

EDITOR'S NOTE: This letter was written before the "A" channel crystal change. Although you can't hear the other pilot's transmissions to radio stations now, you should still make your own position reports as brief as possible. The result of two pilots talking at the same time is that the man on the ground can't understand either of them.

The Vestibular Demonstrator, all plastic model of the inner ear, was designed and constructed by M/Sgt Ciupak, T/Sgt Gilles and S/Sgt Miller, all of Chanute AFB.

SYNTHETIC EAR — Every pilot knows or has been told that he cannot trust the seat of his pants, meaning his senses, of course, for blind or instrument flying. But not every pilot knows why.

To illustrate the reason so that everyone can understand it, the 3499th Training Aids Wing at Chanute AFB has constructed an enlarged mockup of the human inner ear, or vestibule as it is known in medical terms. What this Vestibular Demonstrator does is demonstrate the working functions of the inner ear and illustrate the sensations of instrument flight.

The demonstrator resembles a slightly over-proportioned human head, made of plexiglas, which houses three circular plastic tubes representing the semi-circular canals of the human vestibule. In these tubes are acid-free kerosene and narrow strips of neoprene which simulate the endolymph, fluid in the canals of the real inner ear, and the sensory hairs which indicate balance to the brain.

When the "head" is moved to different attitudes on its swivel mount, the liquid in the tubes causes the neoprene strips to react similarly to the sensory hairs in the human inner ear. The pilot can be shown that although these hairs move when the head is in motion, after it is held in a tilted position for a short time, the hairs return to their original positions with relation to the head. The result is that the sensory hairs send a false balance message to the brain.

And the lesson is don't trust your sense of balance on IFR.

PIO, 3499th T A W
Chanute AFB, Illinois

WE "WORE 'EM" — Recently, I was a passenger on a C-47 flight from Norton AFB, Calif., to Pueblo, Colo. The other passengers represented a cross-section of AF personnel. To help pass the time during such flights, I usually carry a brief case full of reading material. On this occasion, a copy of the June, 1951, issue of Flying Safety was included in the brief case. I passed this and several other magazines around among the other passengers in the course of the flight and estimate that probably two-thirds of the passengers read the article entitled "If the Chute Fits," and the companion article, "They Wore 'Em."

On the return trip, we had come about 100 miles when an engine went out and had to be feathered. The pilot returned to Pueblo, where he landed OK.

Perhaps as a result of this experience on the return flight to Norton, Flying Safety's "If the Chute Fits" was eagerly perused by everyone on board. It was interesting to note that everyone wore his parachute! Here was certainly a case of the right information at the right time and place! I would like to suggest that in the future, copies of Flying Safety be placed on board all USAF aircraft carrying passengers.

Sidney M. Hequembourg
Base Librarian
Norton AFB, California.

Flying Safety

RESTRICTED

DEPARTMENT OF THE AIR FORCE
THE INSPECTOR GENERAL, USAF

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

DIRECTORATE OF
FLIGHT SAFETY RESEARCH
Norton Air Force Base, California

Brigadier General Richard J. O'Keefe, Director
Lt. Col. John R. Dahlstrom, Supervisor of
Flight Safety Publications

VOL. 7, No. 8 AUGUST, 1951

Cover: Edgar Bergen is horrified at Charlie McCarthy's method of checking his fuel supply. All Bergen-McCarthy photos in this issue by courtesy of Look Magazine.

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NO FLIGHT PLAN

(photo from All Year Club of Southern California)

- The flying fish gets a notion to take off—and he does, without checking route or destination. Sometimes he lands in a life raft or on the deck of a freighter and his tangy flesh ends up on the menu.
- This flying fish was rescued by a mermaid, but don't YOU count on mermaids on over-water missions.
- Plan every nautical mile of your flight and know the procedures for emergencies.

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