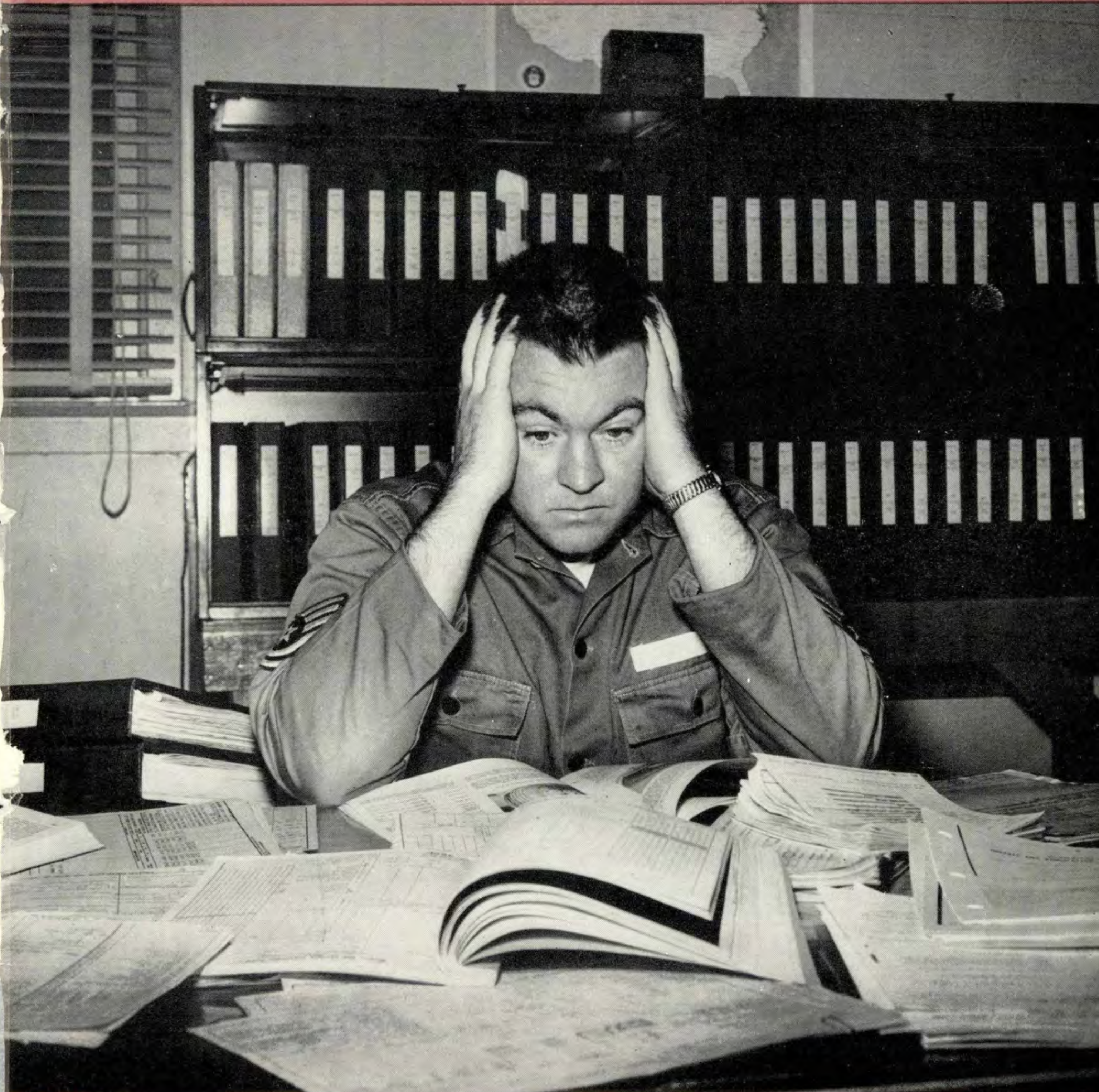
APRIL 1960

FLYING SAFETY

UNITED STATES AIR FORCE



A MATTER OF FORM . . . . Page 22

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MAINTENANCE AND MATERIEL STANDARDIZATION

THE EDITOR'S VIEW

During the Annual Worldwide USAF Flying Safety Officers Conference in September, the real spadework is done in seminars—12 in all. The themes for these study groups are decided upon at preplanning meetings held in the Directorate months prior to the scheduled conference. Each seminar has a specific subject to discuss and develop according to the safety theme of the month.

The theme for this month — April — is *Maintenance and Materiel Standardization*. True, it's a pretty broad and all-inclusive subject; yet, combined with standardization of operations, it's the basis for effective and safe mission accomplishment.

For the pilot the key statement that appears in the writeup of the April seminar reads like this: "Close cooperation between air and ground crews in performing preflight and postflight inspections is vital to the safe and successful accomplishment of the flying mission." With this opening thought, the seminar recommended "a mutual education program to foster a better understanding on the part of aircrew and maintenance personnel of their interdependence and responsibilities to each other." The seminar members further recommended that such a program, to be effective, should be conducted by qualified maintenance personnel at a joint aircrew-maintenance crew meeting. Much good can come from a program of this nature on any base and the end result will bring us closer to that happy day when we lose no more aircraft to the breakdown of communication between pilot and crewchief. Let's get with it!

Another fine recommendation concerns the base simulated crash program. Frequent dry runs can pay large dividends in safety of operations. During one such practice session at an Air Force base, no less than 7 errors were found in the maintenance paperwork of the simulated wrecked fighter. Four of these *could* have led to an emergency or crash. A very fertile field for the FSO!

About The Cover—This photo of TSgt. Edward Moynagh, C-47 Flight Chief of the 1002d IG Maintenance Section, was taken by Cliff Munkacsy, Norton Base Photographer. We think it mirrors perfectly the perplexed airman throughout the Air Force who must deal with flight forms, especially after the pilot has a go at them. A reading of "A Matter of Form" which starts on page 22 should give some clues on how to make the harassed maintenance man's job much easier.

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CROSS·FEED

LETTERS TO THE EDITOR

Simple Crosscheck

Although I have read several accounts of actual and suspected cases of accidents resulting from altimeters being misread or improperly set by 10,000 feet, I have never read any mention of a simple, obvious and quick crosscheck which could be made. This is, of course, a glance at the cabin pressure altimeter. Such elementary knowledge of the aircraft's pressurization schedule can give a good verification or contradiction of the altimeter reading.

As a more positive check to help muster the courage to descend below the indicated altitude of the local terrain, the cockpit pressure could be dumped, thus causing the cabin altimeter to read the gross ambient altitude directly.

An automatic crosscheck with the cabin pressure altimeter at frequent intervals should be an integral part of *every* penetration—visual, hooded or weather—in order to develop the habit.

Maj. C. B. Latimer
Hq WADC, W-P AFB, Ohio.

It sounds worthwhile.

★ ★ ★

Successful Pickup

I have read with great interest the article entitled "Take the Hook" in the January issue. The U. S. Navy has enjoyed considerable success and saved many aircraft by using the already installed tail hook to catch cross runway pendants for arrestment.

Although the original field arresting gear equipment was installed as early as 1949, many accidents continue to occur because the pilots either do not understand or fail to comply with certain restrictions in the use of the arresting gear.

The most important item for the pilot to consider is the maximum allowable speed at time of arrestment. Even if he makes a successful pickup, by having excess speed the chances are that either the arresting gear or the hook will fail before any appreciable deceleration occurs. If the pilot becomes confused and hurries his approach or does not control his touchdown point or speed, the arresting gear will not cure all by bringing him to a safe stop. I would suggest that early efforts be made to educate and acquaint pilots — flying aircraft with tail hooks—with the limitations and capabilities of the arresting gear. Most of the field arresting gear used in the U. S. Navy is designed for stopping a 30,000-pound aircraft traveling at 150 knots or less. In any event, good luck and welcome to the Tail Hook Club.

Capt. J. T. Lawler, USN
Aviation Safety Officer
US NAS North Island, San Diego.

★ ★ ★

Izaak Walton League

Several months ago I read a Survival article entitled "Come Home to Mama." Although I have been in the Air Force since 1938—both as an active member and a reserve—I've never bailed out so I don't consider myself an expert on the subject of survival. However, I have been an ardent fisherman, hunter and woodsman all my life and believe that I know a little about fishing. You can make up an adequate fishing kit the size of a normal correspondence envelope that will weigh only a few ounces, yet contain enough tackle to catch fish. You can carry it in your pocket without discomfort.

I would suggest a monofilament line about 20 lbs. test and two sizes of hooks—the small size 12 for small fish and the large size for the big ones. For bait you can get dried grasshoppers, small worms or flat metal flutter spoons. Care should be taken to make up the kit for the general section of the world over which you may be flying. For example, salt water fish around coral reefs require different hooks and bait than fresh water types, but you can still get the gear in a small envelope.

Let's stop advising pilots how to make fishing gear out of odds and ends and give them a simple, effective, inexpensive kit that will do them some good!

Col. Frederic G. Hoffman, USAFR
904 Crutchfield Street
Falls Church, Virginia

P.S. Be glad to help anyone if I can. F.H.

★ ★ ★

O-Bento

For those who read the "O-Bento" story in the November issue and wish to follow up on the subject, here's a suggestion:

If a small transistor radio is to be included, then the type which has a directional antenna is a wise investment. This will not only provide soothing music in the event some hapless soul scatters the pieces, or makes a nylon letdown, it will also serve as a radio compass when the "troop" starts the long trek home.

1st Lt. George W. Robinson
4510th Maint. & Supply Gp
Luke AFB, Arizona

U. S. Coast Guard

Permission is requested to reprint certain selected portions of two articles published in the January issue: One is entitled "The Commander and Flight Safety" by Major General Joseph D. Caldara, and the other is a quiz or test, called "Vague on VOR?" by A/2C James A. Stagner. This material will appear in the U.S. Coast Guard Flight Safety Bulletin.

Commandant (OAV), Hq U.S. Coast Guard
Washington 25, D. C.

Please be our guest!

★ ★ ★

The Spirited 76th

A new safety program has been inaugurated for the 76th Air Rescue Squadron, PACAF, by its Commander, Lt. Col. M. V. Fredrickson. The program calls for both ground and flying safety ideas to be submitted by squadron personnel for consideration and adoption. The originator of the winning suggestion will receive a $10 cash award, a 3-day pass, and a certificate designating him as "Safety Airman of the Month." The troops are working at it too.

Col. Fredrickson believes that his program will be an added incentive for his personnel and that the 76th will be well rewarded with many sound and outstanding safety suggestions.

The "Safety Airman of the Month," together with the Flying Safety Seminar already in effect, should lead to a safe 1960 for the "Spirited" 76th.

Office of Information
76th Air Rescue Squadron

Congratulations, Col. Fredrickson and the 76th AR Squadron! How about sending in some of the suggestions?

The 76th AR Sq. is assembled to discuss the main subject of the monthly Flying Safety Seminar.

At Upper Heyford, U.K., an aircraft commander accompanied by his B-47 crew chief carefully inspects the troublesome nose-cone latches.

Pilots and maintenance men would be wise to remember Benjamin Franklin's advice. To paraphrase, "if you would not hang separately you should . . .

HANG TOGETHER

•

Col. Kenneth W. Schultz
3918th Combat Support Group (SAC)
Upper Heyford, U. K.

Newton's third law of motion holds that for every action there must be an equal and opposite reaction. Slightly modified, this statement might well be applied to the fields of aircraft maintenance and flying safety where every act—or failure to act—contains the seed of a possibly disastrous reaction. One aircraft company, recognizing the inseparability of the mechanics and crewmember's mutual responsibility for flight safety, posted this sign in its shops: "Somebody's life depends on the way you do your work."

At an Air Force base, it is the Flying Safety Officer who must act as the conscience of the flying safety program and see that all personnel realize their responsibilities to the common effort. If he is doing his job conscientiously and aggressively, his voice will be heard, his warnings read, his advice heeded. To exert this influence, however, he must be an inspector, interrogator, teacher, mentor, coach and a bit of a showman. He must know the aircraft and its operation as well as the crew, and be as familiar with its systems and deficiencies as the Maintenance Officer *(MO)*.

As commander of one of SAC's Seventh Air Division's bases in the United Kingdom, I found a number of special reasons for insisting on the closest possible working arrangements between maintenance people and the FSO. Our maintenance and flying safety operations are geared to the demands of the B-47 bombers which arrive here regularly on either temporary duty or on a rotational basis. Our primary mission is to support them, and to

The mobile debriefing room not only saves time and energy of crew-members and support personnel—a more exacting debriefing results.

maintain the highest possible on-line commission rate commensurate with safety.

After a '47's gruelling 10-hour flight from the ZI, the maintenance problems presented to our technicians are as many and varied as the individual parts of the aircraft. The crews are in no mood for discussing discrepancies or shortcomings. They want a hot bath, a hot meal, and a soft bed. But it is our job to find the aircraft's faults, correct them, and get the plane back on the line in the fastest possible time. This is our problem. Its solution requires establishing sound, repeatedly tested procedures, meticulously followed. To this end, the aircraft MO, the technicians and the FSO must learn to work together as coefficients of each other.

I do not contend that we have introduced any startling innovations in our maintenance and flying safety programs. We have simply adapted well-known and well-tried methods to the situations and circumstances we have to cope with. Basically, we work on the assumption that there is no shortcut to safety—and that accidents will be costly. A mechanic's carelessness in forgetting a penny's worth of safety wire can be the cause of triggering off a series of events culminating in the destruction of an aircraft and its crew.

To illustrate the procedures we've adopted, let's follow a hypothetical case of a B-47 from the time it starts its penetration on arrival until its departure some days later. Everything on the ground is ready for the bird's arrival. Once landed, the follow-me jeep leads it to a predesignated hardstand where it is precisely positioned for refueling, inspection, and maintenance.

As the crew emerges, they are met by the MO and the FSO and escorted into the mobile debriefing room, a converted bus. This is the nerve center of our maintenance operations. As the crews are debriefed, teams of technicians using checklists discuss each system and component of the aircraft, eliciting information about malfunctions and discrepancies. These 7-level airmen extract every ounce of information available and then, via the hot line, get experts on the way with tools and spare parts for instant repair of the defective equipment. Not a moment is lost. In the meantime, crews are already swarming over the big birds, refueling, reservicing, and postflighting them.

The very convenience and comfort of the debriefing bus assures a thorough debriefing session. Details are fresh in the minds of the flight crews and through pantomime and gesture, they can clearly explain to maintenance personnel just what gave trouble and how. This is also an ideal time for the flight crews to make out Operational Hazard and Unsatisfactory Reports, while their memories are clear. Time and energy of the exhausted crews is saved by this mobile debriefing, and they are soon on their way to a hot tub and a clean bed. They appreciate it.

There are several examples I could cite of deficiencies disclosed by these debriefing sessions which, if left uncorrected, might have had disastrous consequences. As an illustration, on one occasion a crew reported that it took

Above, a maintenance technician relays the B-47 malfunction via the hot line to specialist after debriefing. At the same time, right, Maintenance Officer and Line Chief monitor maintenance flow chart.

...HANG TOGETHER (cont.)

4 minutes for the approach chute to blossom after it had been deployed. The FSO immediately inspected the recovered approach chute at transient alert and discovered that the deployment bag and pilot chute were missing. An English farmer found the articles in his field. When the approach chute, pilot chute, and deployment bag were examined, they revealed that improper packing had caused the failure. The FSO ordered an inspection of all similar chutes on aircraft at the base.

Our usual debriefing routine is changed, of course, to meet emergencies that arise. If a pilot has trouble in the air and alerts the tower, the MO, FSO, maintenance specialists and myself all converge on the end of the runway and meet the aircraft as it taxis off the active. In the meantime, Maintenance Control, also informed of the emergency, has specialists already on the way for immediate replacement or repair of the deficient part. Work to get the bird back into ready status begins on the spot.

A dramatic illustration of this procedure occurred recently. An incoming B-47 from the ZI lost its nose cone while turning GCA final. The tower immediately notified me, the Director of Maintenance, the FSO and the MO, as well as other maintenance specialists. We met the aircraft when it turned off the active. As soon as the pilot shut down, we examined the engine and interrogated the crew, obtaining a comprehensive debriefing and an accurate OHR.

A saving grace of the incidents described is that although they were serious in themselves, by their very manner of malfunctioning they gave a warning which allowed us to catch them short of disaster. You can imagine how many things give warnings that go unnoticed and finally end in a tragic accident. Only constant vigilance can detect such deficiencies. Constant vigilance, they say, is the price of safety. Here's an example that underscores the significance of that old saw.

An NCO technician, while performing a ring-out of the ATO *(assisted takeoff)* system on a newly arrived B-47, discovered an extremely hazardous misalignment of the electrical wiring caused by a worn insulating tube. This could have resulted in the inadvertent firing of the ATO rack with consequent injury or death to personnel and/or the destruction of the aircraft. The NCO corrected the trouble, and submitted an OHR which helped establish procedures to preclude the recurrence of the hazard in the SAC fleet.

I have dwelt on the postflight procedures because of their importance in getting the SAC bombers on-line as quickly as possible after their long flights from the States. Of equal importance to our state of readiness, however, are the daily preflight inspections and checks made by the flight crew and the crew chief. The pilot's questions get an immediate answer, and maladjustments are corrected on the spot—or specialists are called in if necessary.

In addition to comprehensive daily preflight inspections, hourly visual checks of the parked aircraft are made by the Flight Chief to spot and eliminate safety hazards. For example, fuel will spill into dangerous puddles because of expansion in the tanks from the sun's heat. These conditions are instantly corrected—and another potential accident is eliminated.

Our policy of flying safety surveillance is maintained from touchdown to wheels up. Before a departing aircraft goes onto the runway, the driver of the follow-me jeep makes a final visual inspection at what is virtually our last control point. These eyeball checks have paid off in a big way. In one case the jeep driver noticed fuel pouring from the center main tank vent just as a B-47 was preparing for takeoff. He called the pilot who cut the power immediately, thereby averting a possible fire. On another occasion, the alert driver noted excessive smoke from the mid-frame vent of a B-47's No. 5 engine, and called the pilot. After the engine was shut down, an on-the-spot investigation revealed that an engine change was required.

In both instances the consequences of these uncorrected malfunctions could have been serious. It is worthy of note that strict adherence to an established procedure and the alertness of an airman who had been properly indoctrinated in flying safety paid off again.

Let me describe another case where, despite the presence of a very real hazard, the motivation and cooperation secured through a safety education program prevented the occurrence of a single accident from foreign object damage. In revamping our base, British contractors performed over 4 million dollars' worth of construction on taxiways and runways. Vast quantities of earth were moved, and this, plus the traffic of heavy equipment, left large unseeded areas salted with stones and rocks. These stones have a way of getting onto the runways and up into engines. Re-sodding and re-seeding were a partial long-range solution, but a concentrated program of prevention was imperative.

Accordingly, the Chief of Maintenance and the FSO launched an intensive program of publicity and education to make all personnel aware of the potential danger of foreign object damage. They were requested to eliminate such hazards wherever encountered. Simultaneously, emphasis was placed on clean-ups, and it became routine to inspect runways prior to takeoffs and landings. The result? We have not had a single incident where foreign object damage was a factor.

The splendid cooperation of our maintenance and flying safety personnel is revealed in the teamwork which produced a valuable GCA addition to our flying safety program. Since 1951, GCA operations on this base have been hampered by a 23-foot runway hump which protruded into the GCA line-of-sight. This limited jet GCA coverage to 300 feet and 1 mile, and restricted us to using only one end of the main runway. Because the GCA could not readily be turned around, surveillance had to be relied upon for the other end.

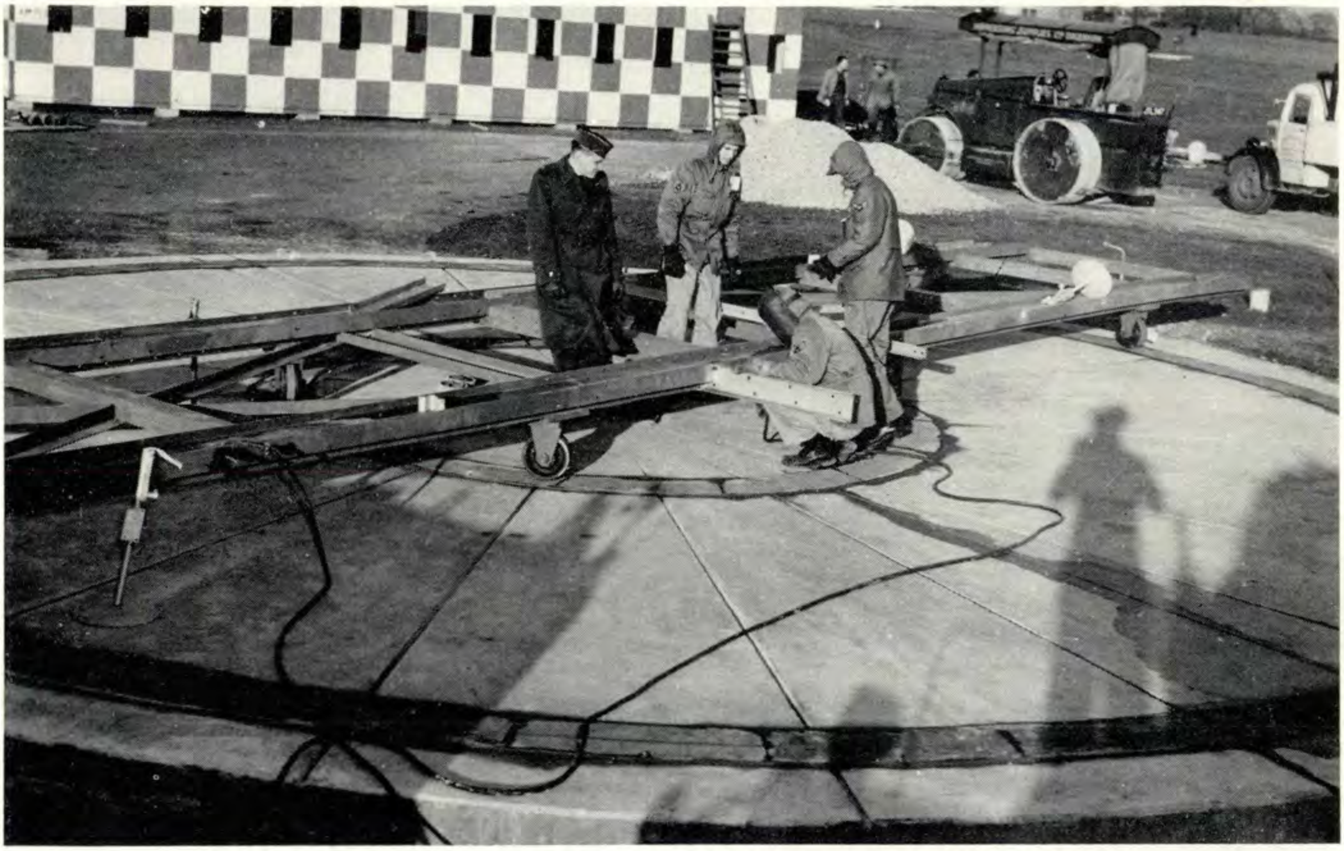
Mounting the heavy trailers on a turntable was the obvious solution. But a team of specialists told us that, because of the hump, the turntable would have to be mounted on top of a 25-foot hill. After much exploring and a great deal of effort, however, AACS and SAC personnel located a site on an abandoned pad that allowed GCA coverage to both ends of the runway.

How did the maintenance men figure in all this? They made the turntable, complete, out of a scrapped portable control tower found in the Base Salvage Yard. The flair for improvisation and invention, and the ability to produce something out of virtually nothing, which seems to characterize all Air Force maintenance technicians is a never-ending source of wonder. Someone said that meat packers use all parts of the pig but the squeal; if our maintenance technicians were meat packers, they'd find a use even for that.

As a result of the combined efforts of maintenance, the Civil Engineer's Office, the FSO, and the base AACS, we

Left, B-47 crew reports a malfunction immediately after shutdown. Below, while other discrepancies are being remedied, a brake chute is installed and inspected to insure a quick turnaround.

...HANG TOGETHER (cont.)

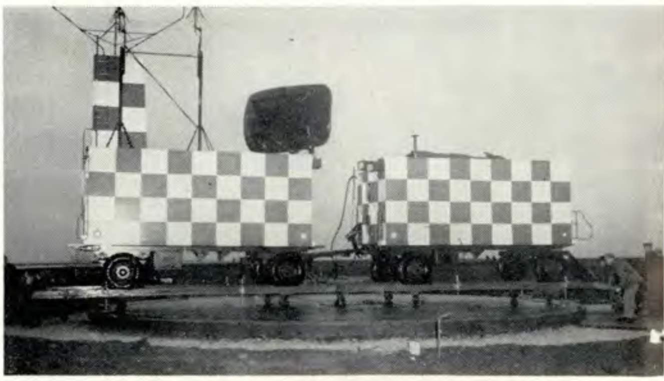


Above, the finishing touches to the GCA turntable are completed. It is made out of a scrapped portable tower and allows GCA coverage to both ends of runway. Below, final inspection is given the rig, with GCA in place.

have a completely usable GCA unit. Its potential value in increased safety of flying operations is beyond estimate. And it cost less than 2% of the figure estimated by the survey team of specialists.

It is my steadfast opinion that the FSO must constantly work with the maintenance people to impress upon them the importance of their job. He must direct his efforts towards the creation of an identity of interest and responsibility between the men who maintain and the men who fly the aircraft. His presence among the mechanics at work is itself an incentive for them to do better.

As a Base Commander I have involved myself deeply in the safety program because I am convinced that a commander of men who fly must assume a direct and personal responsibility for measures taken for their safety.



A & E technician explains gunnery malfunction to FSO.

No one segment of the Air Force effort—maintenance, safety officials, or aircrews—can achieve safety without the cooperation of the others. As Ben Franklin said, "We must all hang together, or we shall all hang separately." By hanging together, understanding each other's roles and responsibilities, and performing our individual tasks to the best of our abilities, we shall achieve our objective of total safety. ▲

Living a Century with the Hundred

Lt. Col. Waring W. Wilson, Fighter Branch, DFSMR

We haven't had the F-100 a century yet, but the signs all point to many years of use for those we have left. There are increased hazards to be faced if we don't learn to live with some of the quirks of the beast. Time was when if something began to go wrong on an old bird, a modificaiton was made which eliminated the problem—and most of them were fixed, fortunately! Nowadays, money is much harder to come by. As a consequence, if a defect isn't considered serious enough to ground or restrict the whole fleet, it requires certification by a major command as mission essential before it can be fixed. This doesn't mean you should stop all Unsatisfactory Reports; money *is* available if the problem is serious enough and the UR you send might just be the 1 out of 20 that gets results.

Every month the units in USAFE send me a copy of their Form F-4, the flying safety activities report. These reports contain a lot of little gems which can be useful to others. They also contain a summary of Operational Hazard Reports *(OHR)* called "Incidents Incorporated" which, in my opinion, might accurately be entitled "Accidents Averted." Here are a few of them, along with appropriate comment. They may be of help to you in averting or overcoming similar mishaps.

An F-100D, after takeoff at 1500 msl in weather, rolled out and the MM-2 attitude indicator showed 20° of bank when the turn needle and compass showed wings level. The pilot climbed on top using the compass and turn needle. Later in the flight the MM-2 went back to normal but would stick when rapid bank was applied. The cause was a faulty instrument.

Comment: This pilot was lucky that the error was only 20° in bank and that it occurred during climb. He did prove, however, that a cool head and proper interpretation of the remaining instruments can overcome failure of the MM-2 under some circumstances.

An F-100F, at about 155 knots during a wing takeoff, started pulling to the right. The pilot used rudder to keep the aircraft on the runway and continued his takeoff. After they were airborne, the leader confirmed "right tire failure." The wingman landed his ailing '100, at 145 knots, on the left side of the runway, and maintained directional control without any difficulty.

Comment: This might very easily have been a major accident had the pilot attempted to abort. Three accidents have occurred this year under similar circumstances. However, numerous successful landings have been made with a known flat tire. The Flight Manual procedure is the best we know; follow it.

An F-100D flew in clouds for 40 minutes with the defrost lever forward. Once on top, the defrost lever was retarded. Then, while cruising at 37,000 feet, the airspeed went to zero. The pilot put the defrost lever forward again. The airspeed remained at zero so he let down on another aircraft's wing. At 15,000 feet, the airspeed indicator began to work.

Comment: Because the proposed fixes for airspeed malfunctions are expensive and of doubtful value, this deficiency will have to be lived with. A letdown on someone's wing is usually the only solution, although we heard of one sharpie who let down by watching the slats. The best preventive for this problem is to keep the defroster on full blower when in clouds, have the anti-ice on at all times, and drain the system regularly.

F-100D/F. After engine start and while making a flight control check, a startled pilot discovered the stick moving full back without his asistance. Takeoff trim corrected this and centered the stick. He taxied out, and the same thing occurred. At this point it might have been wise to head back for the line but since the trim switch brought the stick back where it belonged again, the pilot proceeded with his takeoff. At 145 knots, the aircraft pitched up nose-high and left the ground. The pilot forced the nose down and chopped the throttle, making a successful abort with his clean aircraft. The cause of this near-accident was undetermined but it may have been inadvertent engagement of the autopilot pitch servo caused by a short in the autopilot circuitry.

Comment: This has happened in flight and has been overcome by pulling the autopilot circuit breaker. The pilot cannot always regain control this way, however, because the power may be introduced to the servos through cannon plugs downstream from the circuit breaker. A fix has been engineered for this problem but it can't be bought under the present austerity program. So, if it happens to you and you have the stamina to hold the stick against the pressure, you may be able to land the aircraft. As a last resort, and provided enough time is available, turning all the electrical power off would solve the problem. This has to be weighed against the situation, however.

The observations following would apply to any model of F-100 aircraft. In one case, the engine fire and/or aft overheat warning light came on shortly after takeoff. The pilot retarded the throttle to the minimum required for maintaining ejection altitude and then checked for other evidence of fire. Finding none, he landed. Moisture in the cannon plug had caused the overheat warning light to come on. In similar cases the causes were: safety wire in cannon plug; bare wire causing shorted fire warning circuits; evidence of fire caused by engine burnthrough; and fuel plumbing leaks.

Comment: Those last two causes are the reason that a fire warning light cannot be ignored. When such a situation arises, a properly executed heavyweight landing is better than flying around to burn off fuel. But remember, the light alone is no cause for panic and should never be the cause of ejection or stopcocking unless other evidence is observed.

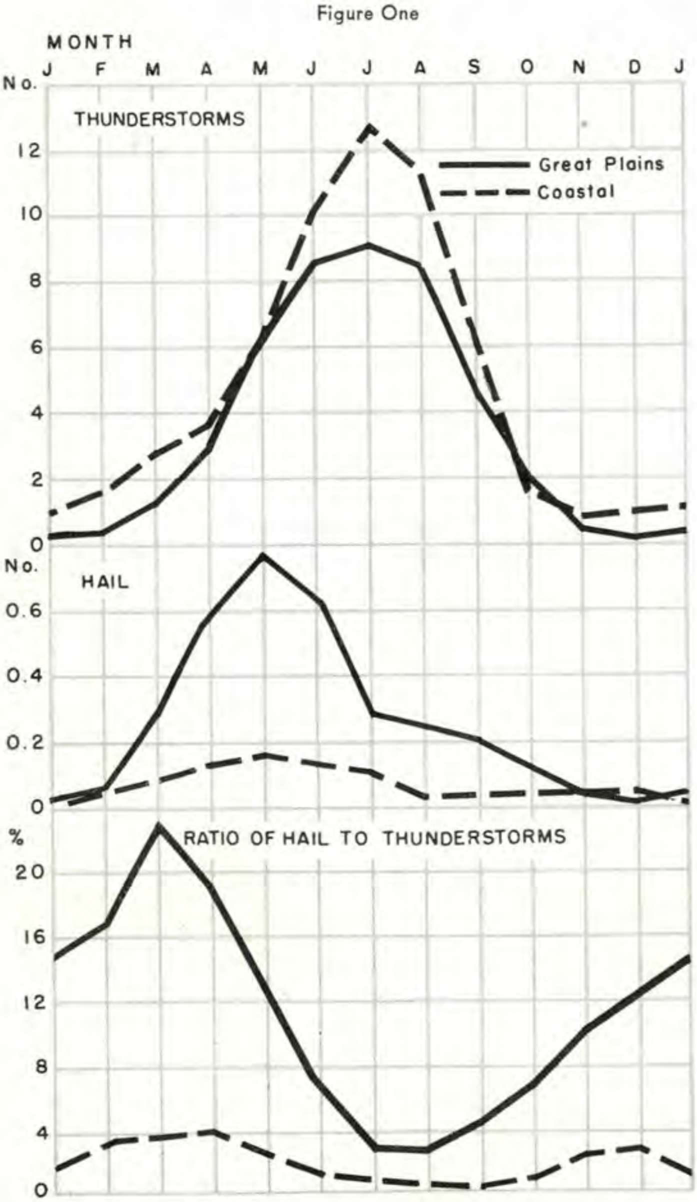
The Flight Manual has most of the answers to your problems, but the time to analyze and apply proper corrective measures is often limited. Next month we shall have more of these notes if you like 'em. Let us know. ▲

In the August 1959 issue, Lt. Col. E. J. Fawbush, of the Air Weather Service, did an outstanding job of reading us in on "The ABC's of Thunderbumpers." This is a follow-up of that article and is based on brand new studies by AWS on the thunderstorm-hail forecast problem.

The Hammer

It will come as no surprise to all throttle benders that no one knows for sure whether or not all thunderstorms are issued quotas of hailstones. Highbrow meteorologists now theorize that sometime during the life cycle of each cumulonimbus cell either hail or ice-crystal phases do exist. The not-so-highbrow weather forecasters know doggone well this is true, especially after suffering the verbal blasts of a hailstone-bruised pilot who irately brandishes the crumpled carbon copy of a Form 175 with the THUNDERSTORM block filled out with "sctd," and the HAIL block with "none."

Figure One



Conclusion? A great many thunderstorm cells generate hail, but only in the stronger updrafts *(hail columns)*. If Joe Pilot lucks through a thunderbumper without being hammered full of dents, he should congratulate himself on traversing that one without running afoul of any hail columns. He's a prize knucklehead to depend on the same thing happening during his next flight.

So when our own particular "Stormy" sets himself to solving the probability of encountering hail on one of our own flights, he has 6 variables to juggle:

- Observational records and networks.
- Geographical area.
- Seasonal variation.
- Hail outside of thunderstorms.
- Masking clouds.
- Air mass stability.

NOTE. Perhaps it would be better to say 6 additional variables. "Stormy" will also use as many of Col. Fawbush's methods as he has time for.

Observational records and networks. We can get this one started with a reverberating thud by admitting that hail certainly occurs much oftener than reports would have us believe. There are at least two reasons for this discouraging state of affairs:

- Hail from a thunderstorm is an on-again, off-again sort of thing.
- Weather observing stations are too far apart.

To prove our second point, the comparative results of a 6-year observing test of the same region—the Denver area—by 2 independent weather observing nets, one dense and one sparse, are startling. The hail-thunderstorm ratio—the percentage of thunderstorms in which hail is observed—for the dense network was 2:3. For the not-so-dense network, it was 1:7. Moreover, hail has been observed as high as 45,000 feet and ranging in size from peas to softballs. And, if one were so inclined *(perish the thought!)*, he could even find golf ball size hail above 35,000 feet.

Geographical variation. The 2 worst regions for thunderstorms in the United States—the Great Plains and the Gulf Coast—were studied to see whether or not hail exhibited any preference for one area over the other. The results show up in Figure 1. No question about it. The Great Plains thunderstorms will give you a more solid reception.

It appears there might be some sort of hail suppressor which is distinctly partial to coastal storms. This is true, but don't try to requisition one. It's all thought to be bound up in the quantity of liquid water above a cloud's base and below the freezing level. If the quantity is large,

Major
Sheppard C. Cummings
AWS Flying Safety Liaison Off., DFMSR

# of Thor

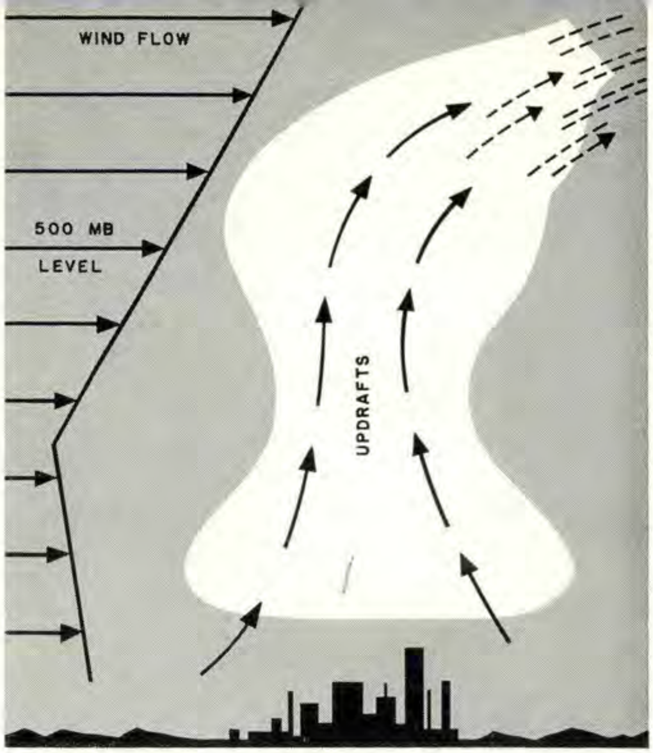


Figure Two

cloud droplets will grow to raindrop size and fall out before being carried high enough into the air to freeze into hailstones. Such are the predominating conditions along the East and Gulf Coasts, especially in summer.

The West Coast also had a quick check and showed a hail-thunderstorm ratio of almost 100% between October and May. Before refusing to fly in this area, however, you might consider this: The average number of days with thunderstorms on the West Coast is 5 per year, and the hail tends to be small and soft.

Seasonal variation. Figure 1 also shows the seasonal variation of thunderstorms, hail, and the hail-thunderstorm ratio. Omitting the West Coast, hail reaches its peak frequency in late spring and falls off to a minimum in midwinter. The hail-thunderstorm ratio, on the other hand, is greatest in early spring and smallest in late summer. Be advised, however, that this is no invitation for tigers to go roaring in and out of late summertime cumulonimbus clouds with only a 2 or 3% risk of coming down with a bad case of hailstones. Said tigers are invited to reread the foregoing paragraph on observational records and networks, with particular attention to the disheartening relationship between the observed hail-thunderstorm ratio and the density of weather observing stations. Also, evidence from several studies indicates that hailstones tend to be larger in the late summer thunderstorms than at any other time of the year.

Hail outside of thunderstorms. Right now, Joe Pilot is undoubtedly saying to himself: "All right, you've made a believer out of me. I'll just stay out of *all* cumulonimbus from now on, and my problem will be solved." Hold it, boy! Cast a look at Figure 2—lifted from Lt. Col. Fawbush's article of last August—and think again. Hail *can* be ejected from the top or sides of a thunderstorm. Listen to Colonel Fawbush:

"Ejection *(of hail)* is computed to be at the altitude where the horizontal flow overcomes the force of vertical motion. The direction of the wind flow above the 500-millibar level in conjunction with the location of the shear zone may help to identify the side where the hail fallout occurs."

So stay away from the sides of this monster and do not fly under the anvil top—especially on the downwind side—and thereby avoid being smacked in the face with those nasty airborne ice cubes.

Rule of thumb: If possible, get no closer than 2 or 3 miles in any direction of the intense thunderstorm radar echo and remain 10 miles away from the downwind side. Without radar, try to stay that far outside the cloud!

Masking clouds. It's bad enough to have a recognizable thunderstorm buildup standing in your path and glaring at you. At least it is possible to know the brute for what it is and be able to do something evasive. The nasty part comes when this sneak hides behind, under, or within other harmless clouds. We can more or less expect this sort of thing in frontal zones and squall lines—that's normal, if dismaying.

But this lethal hide-and-go-seek does not stop there. Large, isolated thunderstorms may also be concealed under enormous anvil tops or within extensive middle clouds. In fact, unintentional penetration of hail columns have taken place at altitudes as high as 45,000 feet because the anvil tops looked just like the cirrus decks not usually associated with thunderstorms.

Rule of thumb: The best help for this is "Stargazer," or remaining clear of *all* clouds in known thunderstorm regions.

Air mass stability. There is probably no argument that without thunderstorms there will be no hail And Joe Pilot nowadays is aware that without unstable air there will be no thunderstorms. Therefore, without unstable air there will be no hail. *Quod erat demonstrandum.*

To expand on this just a bit, present theories provide that hail will form if 3 conditions are met:

- The cloud must grow sufficiently far above the freezing level to produce ice particles.
- The cloud must contain sufficiently strong updrafts to allow the ice particles to grow to hail size.
- Hailstones form only when a quantity of the large cloud droplets which occur only in cumulus type clouds are carried to altitudes well above the freezing level. These large droplets freeze to form the nuclei for hailstones.

Let's sum it up with this: *Never* assume that a particular thunderstorm staring you in the face is free of hail. You'll probably not be hammered out of the sky by those murderous chunks of flying ice, but they can certainly make your big bird look—and you feel—as though you'd been through the war. ▲

REX Says . . .

After a normal takeoff roll, the pilot raised the nose of the aircraft at 120 knots. The aircraft skipped but would not begin to climb so he applied back pressure and back trim to the control stick but could not move it further aft. Because he could gain only 3 to 4 feet of altitude, he decided to abort and called for the barrier. Touchdown was at 135 knots, and in applying maximum braking, both main tires blew out. The MA-1 barrier was engaged 10 feet left of center at 110 knots. The arresting cable parted 720 feet down the overrun and the aircraft swerved left down a slope for 128 feet. The aircraft was destroyed, but the pilot was uninjured.

Investigation revealed that, because the MD-1 survival kit was placed backward in the seat, aft travel of the control stick with trim at takeoff position was limited to ½ to ¾ of an inch. The seat was in the full UP position. A cushion covering the kit concealed its improper placement. However, had the pilot checked with any care, he would have noticed that the deployment lanyard for the kit was not in its normal position in relation to the seat. Instead of being in the normal front right position, the lanyard was in the left rear.

T.O. 14S3-1-3, dated 2 August 1957, states that the MD-1 survival kit may be used in the F-86; however, the C-2A modified kit will be used in the F-86D where the upper 3 holes of seat adjustment are required. With the MD-1 kit properly installed and the seat in the top seat adjustment position, the control stick will clear the rigid portion of the top of the survival kit. The stick will also clear the top of the kit even if it is in backwards, provided the seat is adjusted below the top 3 holes. But if the MD-1 kit is in backwards, and the seat is in the full UP position, control stick movement will be restricted . . . with results that can be fatal.

(Mr. Dean L. Thorpe, D/FMSR)

REX SAYS*—Pilots should be briefed on the correct installation of the MD-1 survival kits according to T.O. 14S3-1-3, and checklists should include kit inspection. Further, only qualified personal equipment technicians should be authorized to install survival kits in aircraft.*

★ ★ ★

Not many crewmembers go around without a cigarette lighter stashed away in some pocket. As useful as a lighter is, it can be a hazardous article in any aircraft, even in one that is parked. One such little flame carrier blew a gasket during normal use on the ground recently. The elevation where this incident occurred was only 655 feet.

The liquid gas ignited and flame spewed out 3½ to 4 feet. It lasted about 15 to 25 seconds, but that's plenty of time to do some real damage. This incident points out the potential danger of carrying this type of lighter in the cockpit of an aircraft. It is possible, you know, under an explosive decompression condition to blow the gasket of a gas type lighter even when it is not in use.

REX SAYS*—Checked your gaskets lately? Along this same line. Wonder if crew chiefs are still finding cigarette butts in hard hat and oxygen mask type aircraft? Want to bet that there are still some jokers who slip off the mask and light up a cigarette? The usual answer, after being accused, is, "I've been doing it for years." Well, Buster, if you have, you've been playing around with a first-class A-Number One fire. Keep on playing around and you'll get burned real good.*

★ ★ ★

The T-Bird was on a long cross-country night flight, taking an airman to the East Coast on an emergency leave. The pilot began his trip without a supervised briefing. Because of a UHF malfunction, the flight plan was changed en route and the plane brought into Hill AFB. The radio was replaced and checked OK. The AF Form 781 was left behind at Hill *(T.O. 00-20A-1 states an aircraft will not be flown without the 781)*, but no maintenance was reported as necessary. At the next stop the pilot spent an hour carefully preparing his flight plan. Witnesses stated the pilot did not stop to rest or refresh either himself or his passenger, who seemed very fatigued. More significantly, he was ferrying his passenger in violation of AFR 50-27 governing altitude limitations for passengers not having received physiological training. Final destination was Westover AFB. The distance was 1125 NM, a mighty long haul in a "T." Weather was reported poor, with severe icing above 15,000. The pilot put "below" 15,000. No alternate weather was entered in section D of the Form 175. The pilot leaped off for Westover. One hour and 23 minutes after takeoff he gave a position report to Goshen Radio. He was 500 NM out on course, estimating Cleveland Radio 24 minutes later. He never made it. In the ensuing two dozen minutes, disaster overtook him in the night sky.

REX SAYS*—Since neither the plane nor the bodies was recovered, it is difficult to ascertain the cause of the accident, but the finger of suspicion points strongly at that old bugaboo* Hypoxia. *Because the airman-passenger had not had proper physiological training in high altitude hazards and oxygen technique, he may have exhausted the oxygen supply through overuse or dissipated it by improper handling. The pilot and passenger were tired; neither had had any nourishment. The pilot was taxing his capabilities to the utmost in flying such a long distance at night under adverse weather conditions. These fatigue factors tend to destroy good judgment. When the insidious effects of hypoxia exert themselves, there is no margin of safety left. Disaster is usually the result. In this case it seems the man failed, not the machine.*

★ ★ ★

In a recent accident, an RB-66 was destroyed and three crewmembers were killed. The aircraft was in a standard jet penetration. The pilot acknowledged completion of a procedure turn at 7000 feet and approximately two minutes later the aircraft, flying straight and level, crashed into a hillside at an altiude of 1620 feet. The published minimum for the field is 3000 feet. Conclusive evidence of malfunction or emergency was not found by the accident investigation. The weather was 1900 broken, visibility 7 miles. The primary cause is undetermined but most probably it was operator error in descending below published minimums during a penetration under instrument conditions.

REX SAYS*—One of the Board recommendations was to encourage aircraft commanders and pilots of multi-crew aircraft to designate a crewmember to call out altitudes as aircraft is descending on instrument approaches and particularly to advise when minimum altitude is reached. Sounds sensible—try it?*

★ ★ ★

Have you noticed an occasional poor fit when attaching your oxygen mask bayonet connector to the CRU-8/P manifold block assembly? Some pilots have found that the 3-pronged male adapter will either not fit into the female adapter without forcing, or will not fit at all.

Part of the explanation for this is that there are at least 2 different types of oxygen hose connectors which are used with the manifold block assemblies. To insure fit, carry your own manifold block when not using your issued chute. You may spare yourself an emergency like the following.

After flying for an hour at 31,000 feet, a T-33 pilot lost consciousness from lack of oxygen. His plane dived earthward. He came to in time to pull out at 2000 feet msl. He found the 3-pronged male adapter disconnected from the CRU-8/P mast-to-regulator connector. There had been no warning of lack of oxygen.

Investigation revealed that in certain cases when the male adapter is improperly connected, there is no warning to the pilot. The blinker indicates normal operation, and there is no hard-to-breathe disconnect warning. The bailout bottle, if used, will not supply oxygen in this case because the connection is not directly into the mask hose as on the MC-3A connector.

When issued a chute for odd flights or when your own is being repacked, use your regular manifold block. Then you'll be sure. Forewarned is forearmed.

★ ★ ★

Prior to descent for the low level portion of the mission, the crew of a B-52 contacted Phoenix Center for a 100NM radius clearance and requested the altimeter setting for Tucson, Arizona. They were cleared as requested and received an altimeter setting of 30.79. At the low level entry point, Blythe Radio was contacted to relay the position report to Phoenix Center. Blythe Radio acknowledged the position report and stated that the Tucson altimeter setting was 30.79; almost immediately the Blythe operator indicated some doubt as to the accuracy of the altimeter setting and requested the flight crew to stand by for a recheck. The B-52 had been cruising at 13,500 feet maintaining VFR on top of a cloud deck. When the cloud deck dissipated underneath, the descent was continued to 11,500 feet indicated, as briefed for that particular leg of the mission. The radar navigator reported to the pilots that he could not see over the terrain in front of the aircraft. Very shortly thereafter, Blythe Radio contacted the B-52 and stated that the previous altimeter setting was in error and that the current altimeter setting was 29.79. After resetting the altimeters, the correct altitude was discovered to be 10,500 feet instead of 11,500 feet. An immediate climb was initiated to 11,500 feet. Considering the future operation of night IFR low level missions, an error of this nature could place the aircraft at a dangerously low altitude. *(15th Air Force)*

REX SAYS*—Each 1/10 inch of altimeter setting is equal to approximately 100 feet. The alert Blythe radio operator quickly sensed the error when it was evident that the pressure change was too great over the short distance and it was quite radical from the previous setting. A bouquet of roses to Blythe Radio.*

WELL DONE

Major Willard B. Helms, Headquarters ARDC

On the night of 13 October 1959, Major Helms—on a proficiency training flight—cleared Andrews AFB, Maryland, in his T-33 and headed for Scott AFB, Illinois. He flew on the gages at 28,000; the tops were at 40. The first hint of trouble came 45 minutes after takeoff when the VOR flag went to OFF and the instrument lights dimmed. With oxygen at 100% as a precaution, he checked the battery and generator switches. They were on. This meant generator failure, although the "generator out" light, which had been checked, had not gone on. When the "gyros out" light started to glow, he shut off the VOR and radio compass, switched to Guard, and broadcast MAYDAY, stating generator failure. Then, after squawking EMERGENCY for 30 seconds, he turned all radios off, along with the gyros, and navigation and panel lights.

The Major, remembering that clear weather had been forecast north of his line of flight, used turn-and-bank and the magnetic compass to steer a course of 300 towards good weather. He hoped to miss the Great Lakes.

With the "generator out" light now winking on, any use of electrical current would weaken the battery rapidly. The Major decided to climb out into the clear. Although he had no horizontal reference, the overcast was thin enough so that he could see the hazy outline of the moon. His northwest course placed the moon about 3 o'clock, 20-30° above level flight attitude.

With course and climb established, he turned the battery off to conserve all electricity for the transfer of fuel.

Then more troubles: after a 2-minute climb he lost his moon reference and fell off into a high speed spiral. The aircraft approached its maximum mach of .8 and began buffeting. The Major raised the left armrest to be ready for ejection if the aircraft became completely uncontrollable, and at the same time turned on the battery for lights and needle-ball. The moon came into view again, so he rolled out and pulled up, using it as an aiming point.

But the pullup was too steep and required a sharp pushover to avoid stall conditions. After re-establishing his northwest climb he turned the battery off again and continued by moon reference. Although disorientation and loss of moon reference occurred 3 or 4 more times during the climb, he recovered by rolling out on the moon each time.

Major Helms reached on top at 40,000 and set course to 310° by using a group of 3 stars as a reference with a crosscheck against his mag compass. He switched the battery on to transfer fuel whenever the fuselage tank read 70 gallons. Cruise-climb procedures at 96% were used to bring the "T" to 42,000.

Helms decided that flying a left-hand triangular pattern for GCI intercept would be impractical. For one thing, it would waste a great deal of time; for another, his night formation—through lack of practice—was not sharp enough to enable him to crack low ceilings comfortably while flying another's wing.

Time passed. There was no break in the clouds, nor did the glare of city lights show through the undercast. The worried pilot turned farther north to 330° in an effort to reach good weather, even though it meant risking the Lakes. He planned to keep flying until he reached clear weather, or until the fuel was exhausted or failed to transfer.

The tiptanks went dry on schedule. The wingtanks went dry just as Major Helms sighted the edge of the clouds and the lights of a large city reflecting into the clouds to the west. A minute later, another large city came into view dead ahead. He observed a beacon, but it had no alternate green light. Because it might have been an airways beacon, Helms wanted to identify it and discover if it marked the location of an airfield.

When the undercast obscured the beacon and precluded positive identification of the airport, he decided to let down anyway, on the assumption that so large a city must have an airfield. He was right. At 7000 feet the beacon and a lighted runway came into view. A broken deck at 3500 was no obstacle, and soon Major Helms was over the runway. He made a pass to determine its length and condition, and to alert the base. The battery, fuel switches, and navigation lights had been turned on when he sighted the field.

Major Helms made a normal downwind and came over the fence at 105. He touched down on the centerline about 200 feet from the approach end, despite the iced up windshield which necessitated side vision. A tendency to skid on the wet runway was overcome by pumping the brakes and the T-Bird was turned off the strip well before the end.

After parking, Helms attempted to raise the canopy electrically, but the juice gave out. It was cranked open from the outside. Then the surprised pilot noted the Royal Canadian Air Force uniforms. He was in Canada!

The RCAF personnel of the Centralio, Ontario, airfield were most gracious hosts and saw to the Major's comfort and entertainment with generosity and dispatch. In the meantime, after a call to Andrews AFB, an aircraft and maintenance crew were on the way to fix the faulty generator. A few days later, after clearing with Canadian Customs, Major Helms reluctantly took leave of his RCAF friends and winged back stateside.

Major Helms' exemplary management of a dangerous inflight emergency situation occurring under instrument conditions reflects great credit on himself and on the United States Air Force. Well Done! ▲

WELL DONE

Check List

It's still happening! Unbelievable but true is the fact that two USAF airmen have walked into spinning propellers recently. One of the airmen was a crewmember of the airplane involved and the other a member of the alert crew which was parking the plane. Both airmen had years of experience around conventional aircraft and there is no apparent explanation for their fatal lapses. Could be preoccupation but an Air Force base ramp is hardly the place for this. Maintenance supervisors are urged to review ramp safety practices regularly to prevent this kind of tragedy.

✔

Late last year, a C-123 was being taxied, between 5 to 10 mph, in a 30°, 25- to 35-knot crosswind from the left. The aircraft was taxied cautiously and in accordance with pertinent directives. Suddenly, without warning, the left wing lifted and the right wingtip and right engine propeller blades contacted the ramp, resulting in sudden engine stoppage. The aircraft received major damage.

The primary cause of this accident was determined to be "design characteristic" of the C-123 aircraft. When subjected to air loading from strong wind forces applied to the side surface area of the aircraft, it leans to such extent that an accident can result. C-123 operators, take note!

✔

APPROACH PRACTICE—The volume of instrument approach training around airports has increased to such an extent that the FAA is having to place additional restrictions on this function. For safety's sake, both tower and approach controllers must know what you, as the approach-practicing pilot of an incoming plane, are going to do.

Are you landing to a full stop, or will it be a touch-and-go landing? Or, are you planning a missed approach and pullout? Whatever it is to be, make certain the controller knows what you are going to do. But, be ready to accept a no-go. Frequency congestion, marginal weather and traffic density may force a denial of permission for approach . . . or may get you provisional approval a'la "If no clearance received over (fix), abandon approach."

Flight Safety Foundation.

✔

Early this year, Headquarters USAF furnished all major commands information on the subject of Application of Altimeter Error Corrections. It is quoted here just in case some of you may have missed it:

• Paragraph IV, D, 3a, Section II, Planning Document, USAF/USN Flight Information Publication *(United States and Alaska)*, specifies that pilots will apply an altimeter correction for the static pressure systems and/or instrument errors from the surface to 23,500 feet msl. The succeeding paragraph pertaining to operations at 24,000 feet and above does not contain instructions for continued application of altimeter correction data.

• Since altimeter instrument and installation errors are not peculiar only to operations at lower flight levels and are, in fact, greater as speed and/or altitude is increased, application of altimeter error corrections for operations at 24,000 feet and above is considered to be an absolute necessity. Instructions contained in the Planning Document are being revised accordingly.

• Altimeter correction cards which show the summation of instrument and installation errors are being developed by ARDC and AMC. However, these cards are not expected to be available for issue prior to 1961. In the interim, it is desired that, effective 1 February 1960, aircrews be directed to utilize Altimeter Correction Data Charts contained in USAF Pilot's Handbook for each aircraft model and type during flight planning and flight operations.

Directorate of Operations Hq USAF

✔

The following communications info from AACS certainly merits reading by all pilots:

Airborne VOR receivers (AN/ARN-14) may be tuned to any frequency between 108 and 135.9 mcs, thereby providing the pilot with an alternate VHF receiver in the event his primary VHF/UHF receiver equipment becomes inoperative.

In view of this alternate receiver capability, procedure has been established at all AACS operated air traffic control facilities whereby any transmission in the blind to UHF equipped aircraft experiencing lost communications will also be broadcast on the emergency VHF frequency of 121.5 mcs. Furthermore, as a method of pilot education, operating units have been instructed to cover this additional receiver capability at monthly flying safety meetings.

Hq AACS (MATS).

✔

The "Thunderchief"—Republic's F-105—has completed its first calendar year with TAC, the using command, without a single major accident. This is the first time in the history of the Air Force that a fighter aircraft has set such a mark.

The F-105 is operated by TAC's 4th Tactical Fighter Wing under command of Brig. General Joseph H. Moore, with headquarters at Seymour-Johnson AFB, North Carolina.

Congratulations are extended to Hqs WADC, AMC, TAC, and to Republic Aviation Inc., for this fine example of the progress made in flight safety. Here is a sample of what can be done with close teamwork between the Air Force and Industry.

This story relates a typical day in the life of an Airdrome Officer and was written early this year when zero weather was common talk at many Air Force bases. Winter problems, however, are still pretty much in vogue in some areas. With this in mind, FLYING SAFETY invites all AOs now enjoying milder climates to accompany Lt. Richardson on a typical early January tour at Plattsburgh AFB, New York.

If an Airdrome Officer is really tending to business the chances are he will have a . . .

. . . LATE, LATE

Major William Cook, Jr., Director of Safety,

At 0715 the sun has just begun to rise over the Green Mountains east of Plattsburgh AFB, New York.

Since it is January, the temperature is usually well below zero. 1st Lt. Jimmy A. Richardson, a pilot in the 380th Combat Support Group, is about to start his tour as Airdrome Officer.

Since it has been almost 3 weeks since his last tour he arrives about 45 minutes early to look over the AO's work schedule before time to go on duty.

This schedule is painstakingly checked and kept up to date by the Deputy Commander for Operations. It outlines the AO's duties for any eventuality, routine or emergency, like severe weather evacuation, inoperative navigation aids, inflight emergency, or ground accidents.

At 0730, Lt Richardson is joined by the Clearance Officer, Captain Davis, and together, they are briefed by the Base Ops Officer, Major Charters. His briefing is pertinent and comprehensive. It covers base navigational aids status, NOTAMs, and specific as well as overall conditions of the airdrome. He also points out recent changes in the work schedule.

After this, the AO is briefed on *expected* weather conditions. Today, there is a cold front moving down from Canada bringing $-20°$ temperatures and high winds. The front is expected to hit Plattsburgh at about 2100 hours, therefore it is his responsibility to make sure that everything is secure before the front passes.

Jimmy officially assumes his duties at 0800. Right away he points out to a KC-97 crew the runway conditions and briefs them on the NOTAMs.

Then, after rechecking the changes in the work schedule pointed out by Major Charters, he begins the ramp inspection. With the aid of the permanent James Braking Decelerometer attachment on his car, he checks the braking action on the snowy ramp. In the schedule are notes reminding him to look for any chocks, fire bottles, maintenance ladders or any of the other loose pieces of equipment that, left carelessly about, create a safety hazard.

And there it is. An unattended fire bottle—right edge of the taxiway—better get that taken care of. From his car he calls the tower officer who, in turn, calls job control. Before the job control crew gets there, Jimmy checks the inspection tag on the fire bottle. Here's the crew. One fire bottle removed. Another potential accident will not happen.

Next, Jimmy runs over and checks the huge doors on the Black Hangar. Bad weather coming up with the high winds; if these doors aren't completely closed, damage could be done to the aircraft and the men inside might be injured. Better get these doors shut.

LUNCH

380th Bomb Wg., Plattsburgh AFB, New York

Above, as new AO, Lt Richardson studies the latest word. Before assuming duties, AO and Capt Harlan Davis, Clearance Officer, are briefed on recent changes by base ops officer, Maj Ed. Charters. Forecaster provides a complete weather picture for the new AO.

Lt. Richardson points out to a KC-97 the exact location of two inoperative taxiway lights awaiting repair. Right, a snowbank is obviously a hazard to taxiing B-47s and must be removed from taxi and runways.

Next, Jimmy makes sure that the snowplow operator moves the snowbanks back far enough from the taxiway and doesn't stack them too high. A frozen snowbank can really tear up a wingtip. Well, he got them back, good! Whoa! phone in the car.

"Airdrome Officer Lieutenant Richardson."

"Say, Jimmy, this is the tower officer. We've got a KC coming in with No. 4 feathered. Crash trucks standing by."

"Thanks, Major, I'll get it from down here."

Lt. Richardson rushes back to base ops and sees that all needed agencies have been notified. Then he calmly calls for billeting for the men on the aircraft. It's not a Plattsburgh crew.

The KC is now on final; it flares and settles easily to the

A fire bottle left in the middle of the ramp becomes safety hazard. Below, braking action is determined by decelerometer in AO's vehicle.

With high winds forecast hangar doors must be closed tightly. Door tracks must be free of ice and snow to insure mobility. Below, another check to make sure all emergency equipment is in place and operative.

LATE, LATE LUNCH *(cont.)*

runway. No accident, but if there had been, everybody was ready to help the well-trained SAC crash crews.

As the KC taxis to her parking spot, Jimmy drives down the runway to make sure that nothing has fallen from the tanker that could be sucked up by the whirling fans of a B-47 engine. Strictly routine after an emergency landing, but one nut or bolt can raise havoc with a jet engine.

Just as the back exit opens on the KC, Jimmy pulls up. He salutes the Major and welcomes him to Plattsburgh. After helping the crew with their bags, he drives them to base ops. From there they can go to the billeting already arranged.

"How 'bout a cup of coffee, Jimmy?"

"No, with severe weather forecast, I'd better check the strobe lights—those 'end-of-runway identifiers.' If one's not operational, we'll have time to fix it. You want to ride along?"

A little bait for the AO.

"Say, Jimmy, this AO tour is kind of a dirty deal, isn't it? Just an extra duty?"

"Wait a minute—slow down. Dirty deal, extra duty—negative on both! Do you remember that crew I briefed on runway conditions, that fire bottle we removed, and the strobe light I just checked?"

"Well, yeah."

"Day after tomorrow I'll be climbing into the cockpit. If the runway's slippery, I want to know it. I don't want to taxi over a fire bottle. When I land, I want to touch down on the runway, not that frozen field over there. A B-47 weighs as much as a locomotive. The AO day after tomorrow will be taking precautions for me; maybe he's flying today."

By checking the north strobe lights he was making sure a B-47 or KC wouldn't land in that frozen field by mistake.

Telephone in AO's car puts him in direct contact with tower officer. Below, a transient crewmember gets an arrival salute from the AO.

Below, a strobe light is given a routine check. If checked early in day and found nonoperational, there is time to correct or repair it.

The two strobes at the south end work fine. Now the 2-mile drive to the north end.

Now Jimmy runs by and checks his emergency team to make sure they know the procedures for using runway flares. If all the runway lights go out, this team can put railroad-type flares along the runway immediately. They knew their stuff. No problem there.

Next, the Lieutenant sets up a downed flag near one of the taxiway lights. A snowplow can tear up these lights, causing a serious maintenance problem, but the flags tell him to steer clear.

Getting cold. One more light to check, then back to a cup of coffee. The light directs traffic across the runway. Operated by the tower, it's not much help if it's out. Looks all right, works all right. Coffee, here I come.

Whoops, what are those guys doing?

"Hey, you can't pile that snow there! I'm sorry, Sarge, but that's got to be clear so they can tow the '47s into that hangar. You'll have to shove it back off the ramp."

"Oh yeah, OK sir. Shove it that way, Jack. Thanks, Lieutenant."

Maybe now the coffee.

Well, Jim got his coffee, but not before shoving a tack back into a poster that was sagging on the Flying Safety Bulletin Board. Why not? Safety's everybody's business.

As he walked down the hall he had a parting shot: "Too late for only coffee; guess I'll have lunch, too."

And a late, late lunch at that! ▲

Some other AO duties include checking the 20-minute railroad flares in case of power failure; the tower controlled light for directing traffic across runway; the enormous job of snow removal; spotting flags to show location of taxiway lights for snow-removal crews; and finally, even the Flying Safety bulletin board is given the once-over by him.

When set in orbit, chunks of turbine wheels and pieces of buckets can ruin your whole day. Want to avoid this state of affairs? The answer is . . .

....EASY DOES IT

Mr. Leston E. Goodding, Evendale Plant, General Electric Co., Cincinnati, O.

Turbine wheels are a lot like people. People don't work very well and may even go to pieces in a hurry in a climate which is too warm. Likewise, if they are too cold they may not work at all. In between this hot and cold area there is a "zone of comfort" which needs to be maintained in order to operate efficiently.

So it is with turbine wheels. When the temperature goes on the rampage—as in improper EGT tabbing, erroneous temperature calibration, and compressor stall—the wheel and buckets aren't going to stand still for it. Similarly, if the air conditioning is impaired—as in loss of the cooling airflow caused by compressor stall—that wheel isn't going to like it either. Naturally, we want the turbine wheels in the fine old J-47 engines to fulfill their mission with the USAF and there is no evidence to indicate that they won't, if appropriate consideration is given to *their* zone of comfort.

That such consideration has been lacking is most evident by the great concern on the part of both the Air Force and the contractor in the increase in J-47 turbine wheel failures experienced in B-47 aircraft during 1959. Analysis has shown that over 50% of these failures occurred during or shortly after aerial refueling and that refueling may have been a factor in all wheel failures.

There is a critical relationship between compressor stall and turbine wheel failure. It is understandable that compressor stall is most frequently encountered under the strain of the aerial refueling mission. The pilot must concentrate his visual powers on the boom, and very close speed matching must be maintained. Throttle settings are changed frequently and a rapid change in thrust level is sometimes necessary to maintain the hookup. This means then that little time is available for monitoring the exhaust gas temperature. The copilot has no EGT and must rely on throttle and rpm relationship to detect the characteristic of rpm hang-up of a stall. Yet, additional emphasis must be placed on this already demanding portion of the mission.

Catching an engine in stall and retarding the throttle to clear the stall is vital. Since the compressor stall is encountered so commonly by B-47 pilots and maintenance personnel at sometime or other, it may seem a commonplace, unimportant circumstance that requires little more than casual detection and deliberate corrective action. Yet, because the cooling airflow has been disrupted and the EGT normally goes above limits during a stall, serious damage to the turbine wheel can result. In fact, if the engine remains in a stall long enough, failure may occur immediately.

If stall is corrected too late, permanent weakening of the wheel may have occurred which will precipitate a failure at some later overtemperature occasion. The stall needs to be understood from the standpoints of its characteristics, the associated engine problems induced, and the corrective and preventive action that must be taken by both operational and maintenance personnel.

The J-47-25 engine has a 12-stage, single spool, axial flow compressor. There are no variable inlet guide or stator vanes, and interstage bleed valves are not used. These principles are sometimes used in more recent engines to decrease stall susceptibility throughout a wide operating range. The control system is simple by today's standards and works on a hydromechanical principle to meter fuel on a volumetric basis rather than on a corrected fuel flow basis. As in practically all turbojet engines, the J-47 pressure ratio is established at a level as close to the compressor stall or pulsation limit as is feasible to realize optimum performance with minimum size and weight. While the engine is operated in a type of service conducive to stall, the simple, highly reliable design does not contain features for the anticipation, detection, and avoidance of the stall condition.

Two types of stall encountered in the J-47 engine are defined by the operating region in which they are encountered:

• ***High speed stall*** occurs at maximum throttle setting and is associated with some abnormality in connection with initiation of the water-alcohol injection cycle. It is of a momentary peaking nature without the high sustained exhaust gas overtemperatures which result in turbine wheel damage.

• ***Acceleration stall*** which does result in overtemperature along with a hang-up of rpm in the 62-72% region — although stalls have been reported in higher ranges. The remainder of the discussion will be devoted to this type of stall.

During the typical acceleration stall, several stages of the J-47 compressor become overloaded due to excessive back pressure against which they must pump. Under these conditions, axial flow velocity is reduced, hence the angle of air entering these stages is substantially changed. Eventually, efficient pumping or compression is impossible. The favorable flow pattern through these compressor stages collapses, and turbulence, recirculation, and vibration also occur. Frequently, there is an instantaneous reversal of airflow. The compressor is unable to clear itself of stall without throttle retarding action by the pilot.

It is usually found that in stall the throttle is well forward, yet engine rpm has lagged; the control is adding fuel to accelerate, but cannot succeeed in getting the engine through the stall rpm region. Usually the EGT rises above limits as the excessive fuel burns in the lowered air mass flow—remember, the engine is in stall—in an attempt to accelerate.

During ground operation, stall overtemperature can be sufficiently severe to hit the 1000°C. peg of the EGT gage and cause rapid deterioration of the engine hot parts. Engine tests have demonstrated that not only is the EGT limit exceeded in stall, but that the cooling airflow to the forward and aft faces of the turbine wheel is reduced by 50% or more of the quantity normally supplied.

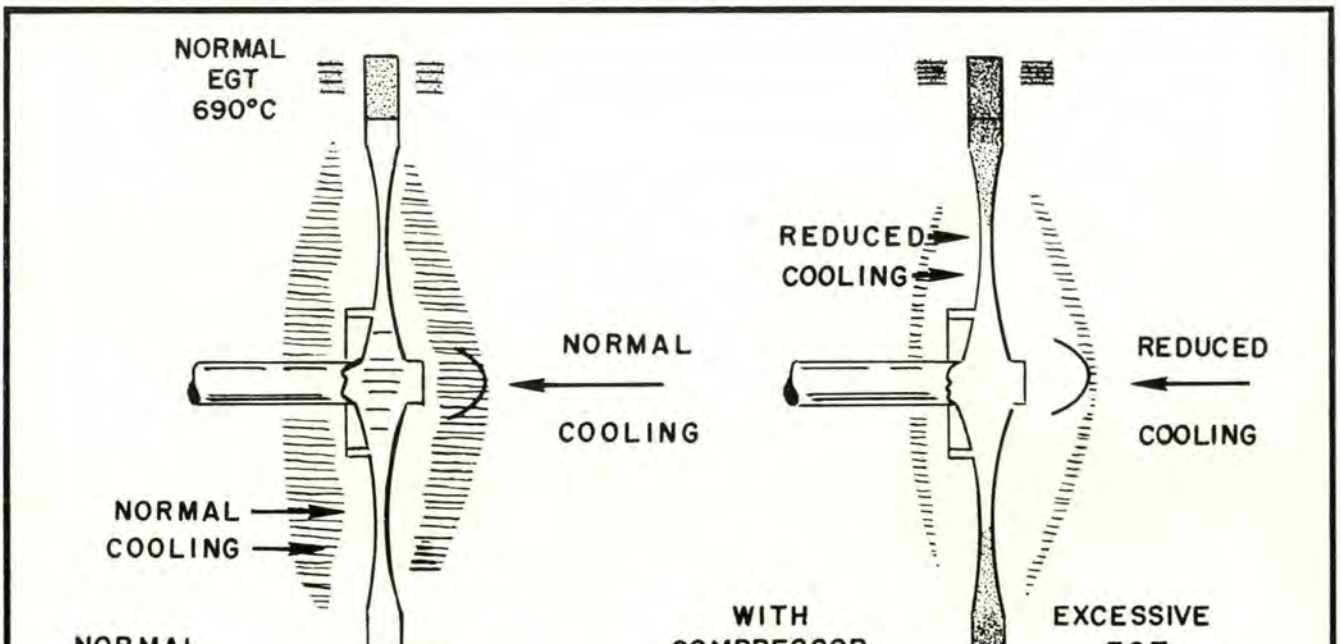
Thus, the turbine wheel is being overtemperatured not only due to the high heat input from the EGT, but because the cooling airflow is inadequate to remove wheel heat. The collapse in flow is to be expected since the compressor output has been reduced due to stall. This is important because even if EGT should stay within limits during stall—as has been reported but never confirmed by engineering tests—the turbine wheel can be subject to excessive temperatures because of the insufficient cooling air available. *(Figure 1.)*

Flight tests of the B-47 have demonstrated the temperature conditions within the engine during aerial refueling conditions. An engine, instrumented with thermocouples embedded in the turbine wheel, was conditioned so that stall could be readily induced. While flying at refueling altitudes, attitudes and speeds, stall was induced by rapid throttle movements in the critical rpm region. Exhaust gas temperatures were watched closely.

It should be realized at this point that the temperature of the wheel follows EGT, and when the EGT is relatively low, as at 70% rpm, the wheel is relatively cool. When the EGT is near limits, as at 100% rpm, the wheel is relatively near its temperature limit.

When the EGT went up immediately, the temperature of the wheel increased slowly. When the engine was stabilized at 70% before stall was induced, a maximum of 2 minutes delay was encountered before the wheel temperature had risen to the maximum temperature permis-

Figure One



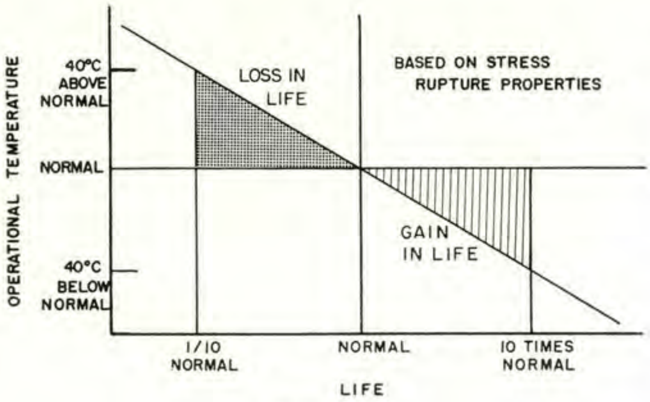
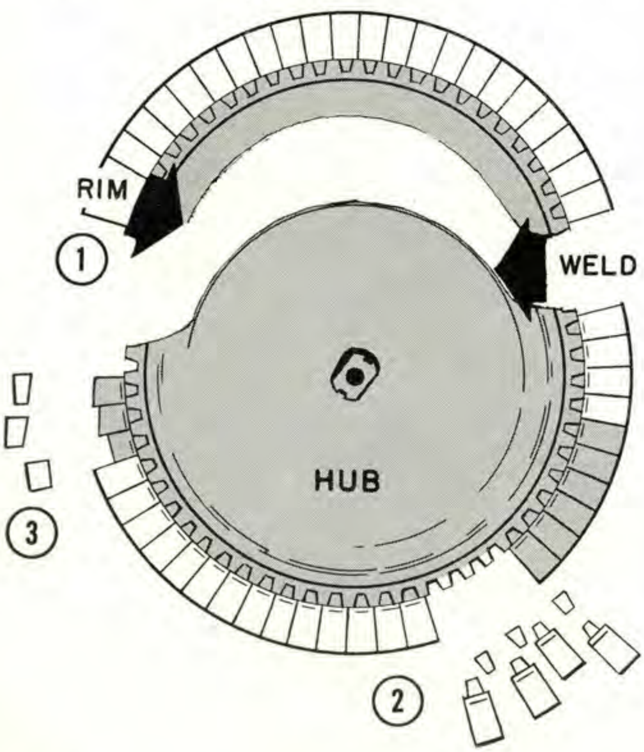


Figure Two

sible at top speed. When the engine had been operating at top speed shortly before the stall was induced, the time for the wheel to exceed the temperature limit of the material was as low as 15 to 30 seconds. This is why *immediate* correction of stall is so vital.

The higher the operating temperature of the turbine wheel, the shorter the life—due to decline in the stress rupture properties. By making certain generalizations, expected wheel life can be shown as an approximate straight line on a graph. *(Figure 2.)* Overtemperature damage is dramatically shown by the illustrated fact that an increase of only 40°C. will reduce the anticipated life to only 1/10 of its normal value. Compressor stall may cause overtemperatures of 100 to 200°C. This reduces the life to a very small fraction of normal, and failure may occur within seconds. To prevent failure, stall must be studiously avoided or—if inadvertently encountered—it must be corrected immediately.

Figure Three: (1) Chunk type failure; (2) rim area failure; (3) bucket failure.



Three types of turbine wheel failures have been associated with extended operation in compressor stall. *(Figure 3.)* Most serious is the chunk type failure. In this instance, the cooling flow to the turbine is probably very low, the overtemperature probably substantial, although not extreme. During stall, the heat is transferred from the gas stream through the rim, deep into the weld-hub area of the wheel.

The wheel is made up of a hub of 4340 steel, onto which a rim of high temperature alloy is welded. Severe overtemperature of the hub results in yielding of the 4340 material to the point that stretching can actually be measured. Under the most extreme conditions this stretch results in "necking down" — local reduction in thickness—of the wheel material near the weld, which reduces the cross-sectional area of the wheel. The physical properties of the wheel materials are exceeded by the combination of high stress and high temperature. The characteristic failure occurs along the path of the weld with a large segment or chunk of the rim tearing itself from the hub.

When the EGT is high and the cooling air to the hub and rim of the wheel is only moderately reduced, severe overstress in the outermost portion of the rim is most probable. In the rim area, the serrations or "christmas tree" profiles have been broached as a means of retention of the turbine buckets. The sharply broached small radii necessary for bucket engagement soon become stressed beyond limits in these regions of high stress concentration. Under continual overtemperature abuse, cracks appear in the serration slots. They progress both axially and circumferentially until the area of support is no longer adequate to withstand the forces involved. At this point a failure of one serration occurs, causing a corresponding failure in one or more adjacent serrations. Both the serrations and the associated buckets are thrown tangentially from the turbine disc.

Most bucket failures encountered are the result of extremely high overtemperature that can occur in severe stalls during ground operation or use of alert starting procedures. Tests have shown that bucket life is improved greatly by minimizing temperature peaks in all phases of the operation of the engine.

While bucket failures normally are not immediately followed by wheel failure—in fact, the wheel may not have felt the overtemperature causing the bucket to fail—nevertheless, overtemperature operation is known to have existed with possible damage to the turbine wheel. Bucket cracking from overtemperature will begin along the leading—or forward—edge of the bucket. Close inspection will permit removal of cracked buckets before they fail.

Firm emphasis must be placed upon reducing or eliminating the possibility of compressor stall during engine operation through correct maintenance and operating practices.

Previous experience has shown that turbine wheel failures can be minimized by continued orientation of flight personnel, together with adherence to good maintenance and operating practices regarding the engine. Here then are a few simple recommendations:

• Monitor the indications frequently for signs of stall during aerial refueling or other operations requiring throttle manipulation.

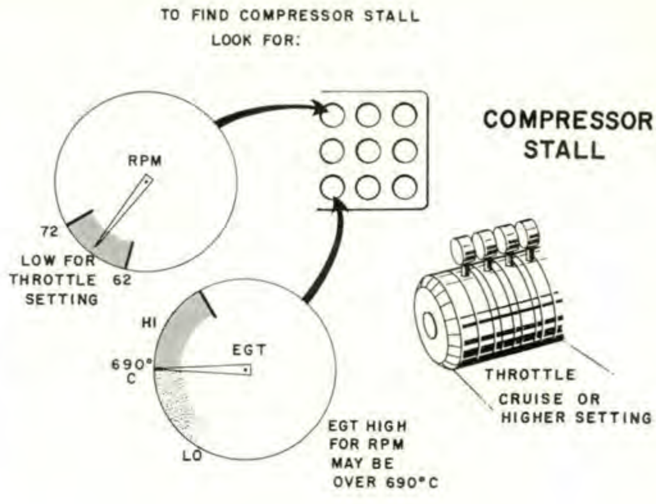
• Use the Engine Stall Protection *(ESP)* system. This was designed as a corrective device for ground stall protection at low ambient temperatures. Nevertheless, additional stall protection can be realized at altitude through its use. Unless completely power limited, this system should be used during all refueling operations and at any time that significant throttle manipulation is required at altitude.

• Make a written report. Write up all overtemperatures and compressor stalls so that maintenance can remove compromised turbine wheels from service, as required. While the temperature *level* should be written up whenever an overtemperature is encountered, the *length of time* the engine operated over the temperature limit is *indispensable information* if the crew chief is to make proper disposition of the turbine wheel after you get back to home base.

If temperature of an unknown duration is logged, the wheel is rejected. This is undoubtedly a safe practice, but unduly difficult on supply if wheels still serviceable are rejected in large numbers. On the other hand, if the overtemperature is not logged you may retain in operational status a wheel that has been severely compromised by the overtemperature encountered. This wheel may fail later under conditions not otherwise severe enough to produce such failure. So, be aware of stall. Be aware of overtemperature and be aware of the time factor too.

• Write up *any* evidence of poor engine condition. Marginal engines contribute to stall or overtemperature operation.

• Whenever possible, use slow, smooth, deliberate throttle movements during refueling and other flight maneuvers. Avoid throttle bursts immediately following throttle chops. Rough and abrupt throttle movements are very conducive to compressor stall. Movies taken in the B-47 cockpit during aerial refueling operations have shown that there is little probability of pilot-induced compressor stall when using smooth, even throttle techniques. This advice should be followed on ground runup too.



A review of the above recommendations will help flight personnel to define and understand the problem, and that's half the solution! Now then, the other half is up to *you* who live with these birds day in and day out.

A closing reminder: Give careful attention to avoiding overtemperature. ▲

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"You're Comin' in Garbled"

All is not dead serious in the flying safety publications department. Occasionally, little gems appear in teletype messages and even in accident reports that tend to lighten up some otherwise somber reading. Here are a few quotes.

- Aircraft repeatedly written up for slop in elevator controls. *(I've told 'em and I've told 'em.)*
- Internal failure for which you were info addressee. *(Just thought I'd tell you.)*
- Pilot executed a landing with affected ear in the foam. *(One point landing?)*
- Aircrew members will be participating in survival straining on 25-26 June at Stead AFB. *(SAC crews will agree.)*
- Subject turbine is being hand carried to OCAMA. *(Samson?)*
- Operator experienced an internal explosion with loss of thrust. *(Bad luck!)*
- At times, during takeoff, the charndelyrnly unlock and slide aft, creating an extremely hazardous condition. *(I should say so!)*
- The choice was to improve or remove ground licking pin. *(What a choice.)*
- The loom opetator notified the receiver aircraft commander that puffs of white smoke were coming out of No. 1 engine. *(And what did the AC say to the loom opetator?)*
- He was unable to raise the tower from the front cockpit. *(Weakling.)*
- The pilot felt a violent explosion in the rear. *(A kick in the pants from the "Old Man"?)*
- Don't cut my parachute harness off, it's all that's holding me together. *(No, please don't!)*
- "Mayday, my tail's on fire." *(Tough!)*
- Q. "Did your motor smoke at any time?"
  A. "It was still in the cockpit, but I couldn't see. Hard to tell at night." *(Especially with a motor in your lap.)*
- And here are some oldies: "Wiggle your tower if you receive." "Gear down and welded."

. . . a matter of form

It has long been recognized that one of the prime weaknesses in Air Force maintenance stems not from maintenance practices themselves but rather from the type of information furnished by flying personnel. We refer of course to the AFTO Forms 781 which the pilot or other crewmembers must complete at the end of each flight. Too often the crew chief and other maintenance personnel are woefully uninformed as to the exact nature of a discrepancy. The pilot either does not bother to fully explain the discrepancy, or he does not know how. We believe that this problem is widespread enough to warrant serious consideration. Perhaps the following interview with CMSgt Howell P. Cauthron, Line Chief, and SMSgt James E. McCambridge, NCOIC, Quality Control, both of the 1002d Inspector General Group, will show you what we mean.

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Question: Sgt. Cauthron and Sgt. McCambridge, too many aircraft accidents today are being caused by a breakdown in communications between the pilot and the maintenance man. With this in mind we thought it worthwhile for *Flying Safety Magazine* to conduct a question and answer session on this problem and try to pinpoint the reasons for this breakdown. As you well know, the major link of communications between the pilot and the crew chief in the Air Force is the AFTO Forms 781. It is here that we are needlessly getting into trouble and, as a result, having accidents. I should like then to discuss with you the major problems the pilots find in completing the forms and, conversely, some of the errors the maintenance man commits. So, to start the discussion, my first question will be directed to Sgt. Cauthron.

- Name in order of priority, if you will, the parts of the Form 781 that a pilot should check before takeoff.

Sgt. Cauthron: *In my estimation the 2 items that should be of most vital concern to the pilot upon his arrival at the aircraft are:*

- *On 781, Part II, Block D, the status of that particular aircraft.*

DATE	CREW CHIEF	ORGANIZATION	LOCATION	ACFT T/M/S	ACFT SERIAL NO.

A							B		C
STATUS OF INSPECTIONS OR MAJOR MAINTENANCE ACTIONS REQUIRED PRIOR TO THE FIRST FLIGHT OF THE DAY AND/OR PRIOR TO RELEASE FOR NORMAL FLIGHT SCHEDULING.							CERTIFICATION FOR ACCOMPLISHMENT OF DOUBLE ASTERISK RQMTS PRIOR TO SUBSEQUENT FLIGHTS.		ACFT TIME
TYPE	SYM	SYSTEM	ACCOMPLISHED BY	DATE COMPLETED	NEXT DUE	FLT NO.	ACCOMPLISHED BY		PREVIOUS
						2			TODAY
						3			TOTAL
						4			TOTAL LANDINGS TODAY
						5			
						6			
						7			

SEE BLOCK A AND AFTO FORMS 781A AND 781B FOR EXPLANATION OF THE STATUS SYMBOL

D				E					
STATUS TODAY		BOX NO.	EXCEPTIONAL RELEASE (ENTER BOX NO.)	FLT NO.	COND AFT FLT OK	COND AFT FLT NO OF DISC	PILOT'S SIGNATURE ENTER AFTER EACH FLIGHT	OVER TEMP ENCTRD	AUX ENGINE OR APU OPERATION
1	7			1					
2	8			2					
3	9			3					
4	10			4					
5	11			5					
6	12			6					

F GUN OR ROCKET STATUS (INDICATE WHETHER HOT OR COLD AND STATE QUANTITY ON BOARD)	G ATO BOTTLES INSTALLED		TOTAL TODAY	
	☐ YES ☐ NO	QUANTITY		

AFTO FORM APR 58 **781** **PART II** AIRCRAFT FLIGHT REPORT AND MAINTENANCE RECORD MWM CORP 5-58 2,500M

H																					
SER NO.	FUEL (GALLONS OR POUNDS)			OIL (PINTS, QUARTS, OR GALLONS)																OXY PRESS OR QTY	A.D.I / WATER
	OCTANE OR GRADE	QUANTITY SERVICED	TOTAL IN TANKS	1		2		3		4		5		6		7		8			
				SER	IN	SER	IN	SER	IN	SER	IN	SER	IN	SER	IN	SER	IN	SER	IN		
1																					
2																					
3																					
4																					
5																					
6																					
TOTAL																					

SERVICING CERTIFICATION (SIGNATURE AND GRADE) (USE STATION SUPPLY OFFICER'S ACCOUNT NO. FOR "AT" ENTRY)

1	BY	3	BY	5	BY
	AT		AT		AT
2	BY	4	BY	6	BY
	AT		AT		AT

I

J ACCESSORIES CHANGED

RE-MOVED	INSTL	ACCESSORIES & POSITION	SERIAL NO.	ACCRUED OR PREV OPR TIME	CHANGED BY

For easy identification, above, is Block H, on the backside of AFTO 781, Part II. Below, shows Discrepancy Block of the 781A.

DATE		CREW CHIEF	ORGANIZATION
FROM	TO		

SYM	DATE DISC'D	DISCREPANCY

DISCOVERED BY (SIGN AND GRADE)

CORRECTIVE ACTION

CORRECTED BY (SIGN AND GRADE)	INSPECTED BY (SIGN AND GRADE)

- *His attention should then go to Part II, Block A; the data here will tell him what major maintenance action has been performed on the plane prior to the first flight of the day.*

The next items of importance are on the reverse side of 781 (Block H). Here, he will be vitally interested in the total quantities of fuel and oil and oxygen that are on board. These constitute the important items on the 781, Part II.

Now, if the aircraft was on a red dash or red diagonal, the pilot should check 781A to find out the nature of the discrepancy. If there is no entry reflecting a particular discrepancy, he should take a look at the 781B where the explanation of the status symbol will be found. Then, he signs the exceptional release.

Comment. Then it seems to me, Sgt. Cauthron, that checking these forms as you've just pointed out assumes even more importance, since the pilot of many modern aircraft can not physically find out all these things for himself. He has to rely on the maintenance man to make correct entries after performing the proper maintenance. This is a very important point in preventing a potential accident before the engines are started.

Question: What are the most common oversights that pilots make in checking the 781 at preflight?

Sgt. Cauthron: *I think that the majority of pilots do make the necessary checks to determine the status as shown on the 781, Part II. However, the problem area is at the termination of the flight when they fail to sign in Block E, Part II and do not make proper entries on the 781A if any aircraft discrepancies have been found. Now it is necessary to complete this form and to make it factual and informative.*

Question: Sgt. McCambridge, in the event that a plane is landing at a base for an intermediate or refueling stop, are there any specific things that a pilot should do regarding these forms after the aircraft has been serviced?

Sgt. McCambridge: *Yes, Part II, Block B of the 781 should be checked to make sure that the basic postflight items have been accomplished. This includes such items as tires, struts, control surfaces, fuel and oil leaks, intake ducts, plenum chambers, and the general external safety of flight condition of the aircraft. In addition to this, the form should be checked to make sure that the airplane has been serviced and the form signed off.*

Question: Sgt. Cauthron, what publication should the

. . . a matter of form *(cont.)*

pilot study so that he fully understands what his responsibilities are regarding the Form 781?

Sgt. Cauthron: *Tech Order No. 00-20A-1. The pilot's responsibilities on Part I of the 781 are located in Section 5, paragraphs 5-17 to 5-32 of this T.O. As for Part II of the 781, the pilot's responsibilities are given in Section 5, paragraph 5-40. This clearly outlines the entries which the pilot is required to make. By completing the 781 properly, the pilot makes the maintenance man's job much easier and he can in turn do a better job on the aircraft.*

Question: Sgt. McCambridge, in a previous question I asked you what the pilot's responsibilities were after landing at a strange base, and you stated that he would be required to make a preflight and sign off the form. I believe that under the new T.O. 00-20A-1, dated 30 December 1959, it is now called a postflight, is it not?

Sgt. McCambridge: *Yes sir, in Paragraph 44, Section 5 of T.O. 00-20A-1, the walk-around inspection is listed as a thru-flight or a basic postflight inspection.*

Question: Sgt. Cauthron, what sections of Part II are the pilots responsible for when they are away from home base without a crew chief or flight engineer?

Sgt. Cauthron: *When landing at an Air Force station the transient maintenance personnel are responsible for all entries on the Part II except, of course, the pilot's signature. The pilot, however, should make sure that the entries are complete. If the landing is at a non-Air Force station, then the pilot is responsible for all entries on Part II and this is what he should do:*

- *First, he should total his time from the preceding day's form in Block C and bring that total down.*
- *Enter the number of landings; check the last status for the day and then record this information on the next day's 781 Part II.*
- *Next, on the preflight or postflight entry, if the transient alert crew performs the inspection they should sign it off in Block A. If the pilot or a crewmember makes the preflight, then that person should sign in Block A.*

Another item of vital importance: the quantities of fuel, oil, and oxygen that have been put aboard the aircraft. In many instances our aircraft go cross-country for a week or 10 days, and there will be no fuel whatsoever shown for the entire trip. So, it is important that that particular column not be overlooked. First, a pilot doesn't want to try to fly without fuel. Secondly, his entry is needed from the standpoint of proper cost accounting records. The last 2 items would be of course the condition of the aircraft after flight. If it was OK he should indicate this with a check mark and then sign in Block E. If he has discrepancies they should be recorded by number in Block E, Part II, and his signature affixed thereto. Then, to verify each of the numbered discrepancies, proper entries should be made in the 781A.

Question: Sgt. McCambridge, with reference to Sgt. Cauthron's last remarks about responsibilities of pilots, in your experience, what errors does a pilot usually make in accomplishing these forms?

Sgt. McCambridge: *Quite often the pilot does not check the 781, Part II to make sure that the postflight and preflight have been accomplished and signed off.*

The second item that he often overlooks pertains to the fuel on board the aircraft. This item should also be signed for, and the supply officer's account number entered at the same time.

Question: Sgt. Cauthron, I'm sure that in your time you've come across some rather weird examples of mistakes that a pilot can make on these 781s. Would you like to comment on that for a minute or so?

Sgt. Cauthron: *Well, one of the most common occurrences of course is the lack of entries on the form showing the amount of fuel and oil aboard the aircraft. It's quite humorous that some of our airplanes can fly as far as they do without fuel! In our organization we feel that we have the most remarkable aircraft in the Air Force because we constantly have them departing this station for a period of from one to two weeks and returning with the same fuel, oil, oxygen and alcohol they had when they took off. Naturally, we feel that our maintenance is the finest when this is possible.*

Question: Sgt. McCambridge, we all know that the forms have to be completed in some shape or manner, so if the pilot doesn't complete them, *who* has to?

Sgt. McCambridge: *Well, if the maintenance or inspections were performed at a base other than the home station, and the entries actually weren't made there, the home base has no way of knowing the accurate information for that part of the form. So this part of the record doesn't tell the true picture of the maintenance performed. There is just no record available for this period of maintenance unless the transient base is contacted. This is terribly time consuming and often inaccurate.*

Question: Sgt. McCambridge, I'm sure that you have found the maintenance man, in addition to pilots, is not always doing his job in keeping up the forms. What is the most common error that he makes?

Sgt. McCambridge: *You're right, sir, maintenance personnel make a lot of Form 781 mistakes, but the one that crops up most often is in clearing a discrepancy or indicating what corrective action was taken. T.O. 00-20A-1 is specific. It states that the corrective action will be shown briefly but specifically as to what he did to correct the defect. The words "replaced," "repaired" or "adjusted" are adequate, provided additional pertinent information is entered.*

Question: Sgt. Cauthron, we still see writeups or discrepancies cleared by the term "ground checked OK." Could a poor writeup cause this?

Sgt. Cauthron: *A poor pilot writeup could contribute to this situation and I will give you an example. A pilot writeup states that the UHF is inoperative. Then the radio repairman adds to the erroneous information by stating* *"ground checked OK." "Ground checked OK" is not acceptable in the Air Force today because it doesn't tell anyone anything. If the radio had been operating intermittently and if the pilot had specified this, then of course the repairman would have had something to go on. As it happens in many cases, he checks it through the channelization and everything appears to be OK. On the next flight, the pilot has no radio contact—so, "ground checked OK" is not acceptable. The mechanic must show the* exact *maintenance which was performed, the system checks, and the fact that the equipment was removed, checked and reinstalled.*

Question: Sgt. Cauthron, what percentage of pilot writeups would you estimate to be adequate to tell the story so that a crew chief or maintenance man can correct a discrepancy?
Sgt. Cauthron: *Sir, the answer to that one would be "about 50%."*

Question: Are pilot writeups or discrepancies supposed to be printed, or is it all right to write them in longhand?
Sgt. Cauthron: *All entries, except signatures, made in the AFTO Forms 781 should be printed characters.*

Question: Do you get any entries written in longhand?
Sgt. Cauthron: *Sir, we get many longhand entries and some of them appear in ink. Sometimes we can't even read the writing. So then we have to contact the pilot to decipher the entry for us.*

Question: We'll acknowledge that pilot writeups are often inadequate for the crew chief or the maintenance man to correct the discrepancies. How many times do you have to contact a pilot in order that he might explain or elaborate on his writeup?
Sgt. Cauthron: *Sir, I would say that approximately 10% of the writeups make it mandatory that we call or contact the crew who operated that particular aircraft for clarification.*

Question: Sgt. McCambridge, will you explain the meaning of the symbols used in the AFTO 781?
Sgt. McCambridge: *The symbols indicating the condition of the aircraft are as follows:*

- *The red dash indicates that an inspection is overdue on the aircraft, and the condition of the equipment is unknown*
- *The red diagonal indicates that minor maintenance is due.*
- *The red cross indicates that the aircraft is grounded until maintenance or corrective action is accomplished.*
- *The circled red cross indicates that an urgent action technical order is overdue and must be accomplished before the aircraft flies again.*

Detailed information on these symbols can be found in paragraphs 1-15 thru 1-39, Section 1, of T.O. 00-20A-1.

Question: Sgt. McCambridge, in looking over 781s quite often I see abbreviations which I don't understand. Can you tell me in what part of T.O. 00-20A-1 I can find these?
Sgt. McCambridge: *These special abbreviations are listed in paragraph 79, Section 1, of T.O. 00-20A-1.*

Question: If an aircraft has equipment or documents classified "confidential" or above, is this shown on the 781?
Sgt. Cauthron: *Yes sir, this is definitely shown on the 781. It should be entered on the front of the 781 binder and marked so that it is quite conspicuous, denoting the type of equipment which is on board. This information is contained in Section 1, paragraph 1-90 of T.O. 00-20A-1.*

Question: Will the 781 show the gun or rocket status?
Sgt. Cauthron: *Yes sir, an entry would be made in Block F, Part II.*

Question: Sgt. McCambridge, when does flight time begin and when does it stop?
Sgt. McCambridge: *Flight time starts when the aircraft begins its takeoff roll and ends when the engines are stopped or the aircraft has been on the ground 5 minutes.*

Question: When an engine is diluted, what information is entered, and where, on the 781?
Sgt. Cauthron: *Anytime that an engine or engines are diluted, an entry should be made in one of the "discrepancy" blocks on the 781A, and should include the oil temperature, outside air temperature, and the length of time of dilution.*

Question: Sgt. Cauthron, is it OK for a pilot to record more than one discrepancy in a major block division on the 781A?
Sgt. Cauthron: *No sir, the remarks should be restricted to one discrepancy per block. Of course he may use as many lines as he desires, but only one discrepancy should be recorded per block.*

Question: What is the purpose of logging engine overtemps?
Sgt. McCambridge: *This is to give a case history on an engine to indicate how long and how much the overtemperature was, and what corrective action is necessary.*

Question: Sgt. McCambridge, is it mandatory now under the new T.O. 00-20A-1 to record the total number of landings?
Sgt. McCambridge: *Yes sir, Section 5, Paragraph 45-e, of the tech order, covers cumulative landings.*

Question: Sgt. Cauthron, referring to the tech order itself, T.O. 00-20A-1, are there too many changes that confuse both the maintenance man and the pilot, and can you give us a few comments along that line?
Sgt. Cauthron: *Yes sir, I think that perhaps the frequency of the changes in the T.O. 00-20A-1 contribute greatly towards the inability of both the pilot and the maintenance man to keep current. It seems that just about the time we become familiar with one issue, a new change comes about. It's the responsibility of the supervisors then to study such changes and disseminate the information to all personnel. The many changes, I think, definitely contribute to poorly maintained records.*

Question: Can you mention one specific change which, in your opinion, was entirely unnecessary?
Sgt. Cauthron: *Yes sir. It seems to me that the manner of entering the date on the forms has been unnecessarily changed. I refer to Paragraph 5-8 of the latest T.O. Here we are required to enter the date entirely in numbers, with the day preceding (e.g., 1-2-60 for 1 February 1960). In the old T.O., it was necessary to spell the month (as in "Mar"). This kind of change is arbitrary and can only lead to unnecessary confusion.*

Sgt. Cauthron and Sgt. McCambridge, we appreciate very much your taking this time to give us the benefit of your experience, and I am sure that the readers of Flying Safety Magazine will benefit greatly therefrom. ▲

Wherein C. Z. Chumley learns that during gunnery missions if you go by the book and look around, you . . .

DON'T KILL YOUR FRIENDS

ARCHIE D. CALDWELL *Operations Analysis Branch, DFMSR*

Through the small knot of eager looking young pilots clustered near the squadron coffee bar, the casual observer might not have noticed the chubby captain who was the center of attention if it weren't for the flame red flight suit and purple polka dot scarf. Captain Chauncey Z. Chumley, self-styled secret weapon of the USAF, was busily relating his latest exploits of the weekend to the new guys who hadn't been the route before.

"Didn't she even get mad?" one boyish-looking lad asked.

"She didn't have time to get mad. After I let her off, I made a clean LeMans start in the Jag and was 2 blocks away before she knew what happened. Everything would have been just dandy, except that the girl's father is a motorcycle cop and was just leaving for work as I took off."

"What will you do now, Captain?"

"My case comes up next week. But I'll give 'em the old sick grandmother story and they'll let me off with a warning."

"Gosh, you sure will put one over on them, won't you?"

"Smart—er than the aver—age," Chaunce answered in his best Yogi-Bear style. "Yes sir! smarter than the—."

"Chumley-Come-Here!" A voice of authority put an abrupt end to C.Z.'s storytelling.

"You bellowed for me, Colonel McCutcheon?"

"I certainly did! I've been looking at your flight progress charts, especially on intercepts and gunnery. Your "D" flight is the worst in the squadron. It's halfway excusable for the new troops but your own record in gunnery looks like something fired by a gun-shy old grandma!"

"Aw come on now, Devroe, you know that the last time we fired my sight was off; and besides that, the air was much too rough to hold steady on and besides that..."

"And besides that, almost everyone else up that day qualified but you. I want no more of your excuses. I want you to set up your flight, brief 'em, and get out on the range. I want good scores and a well run flight. I want you out of here learning the job the Government is paying you for. Now move!"

★ ★ ★ ★

"Inkstand. Gasmask Willie flight of four, ready for takeoff." The tower relayed usual takeoff data and the flight started eating up concrete and sky. "Here we go, lads. Keep a sharp eye out. I hear the 'Hun' is up in force today."

"Gasmask, this is Tow 1. Setting course, have you now passing 4 o'clock about 4 miles. If you have me, you're cleared for your spacing pass."

"Right-o, tow boy. I have you. Good spacing now, lads. Look sharp, fly safe! Leader coming in!"

Chaunce peeled out from the flight and started down from the perch. Being farther out than he had planned, he took the opportunity to roll twice on his reversal then settled down in the groove. The dry run looked good.

"Rat-er-tat-tat-tat," C.Z. mentally visioned himself becoming the only quadruple jet ace in the world. "Leader off. Next pass will be a hot one!"

A semblance of a pattern formed and things progressed normally until the sixth pass. C.Z. had delayed his reversal and ended up in a stern chase. The old master had goofed and he knew it.

"I'm off on this one, lads," Chaunce called, and broke off his run, breaking inside the target and tow ship and headed for the perch.

"Gasmask lead from tow . . . PULL UP!"

Reaction time, closure rate and a second of indecision, and that's all there was! One wing of the No. 2 aircraft and a ball of flame suspended in mid-air marked the point of impact. The No. 2 ship rolled past the target headed down. A canopy, seat and chute let them know the wingman made it out OK.

Meanwhile, back with the leader, C.Z. had his chubby hands full of bent and broken airplane. Despite the shaking, the smoke, and a panel of red and amber lights, the aircraft was still flying. "Whew! That was a close one! How do I look?" he called in the clear.

"Like something that has tangled with a freight train. But it looks like you have all the necessary equipment needed for flight. Are you going to eject or try to make it in?"

"W-e-l-l . . . after considering what kind of a day it has been so far today, I'd better not try an ejection, so alert the field that your old Dad will attempt to bring back the aircraft at all costs."

A somewhat routine gear-down landing was accomplished, marked only by a trail of hydraulic fluid, oil and fuel from the touchdown point on the runway to the center of the barrier. C.Z. tidied up the cockpit, moistened his lips for the photographers, then vaulted from cockpit to wing to ground.

The flight surgeon moved in to intercept C.Z.'s wavering steps. Other medics hastened to remove his parachute to help the Doc with his examination.

"Hold on there, lads, don't be too quick in getting me out of this chute. I think it's the only thing holding me together. Perhaps a martini would help some, Doc. Do you think you could see your way clear? You know, just for medical purposes only, and all that!"

"Leave him alone, boys," replied the flight-type Doc. "He's his normal self. I can tell from here."

★ ★ ★ ★

Chumley entered the office with the quiet dignity of one who had survived an atomic blast from ground zero. The Colonel stood facing the window, his hands clutched together behind his back. His only outward sign of strain was a faint trace of blood where he had dug his fingernails into his palm. Chumley's salute was answered with an icy stare as the Old Man settled in his chair.

"Stand at ease, Captain. I want-to-have-a-word-with-you-about-the-accident-today." His words sounded like they had been clipped from the obituary section of the daily paper. "Just what happened out there on the range?"

"Well sir, you see, everything was going just dandy until I felt this terrific jolt, then, and only through superior airmanship did I bring the aircraft back. Things started to happen which led me to believe that an accident had occurred. We lost the target too and I'm sure that I had really got some hits on it. It was just one of those missions when you know you're doing well. Now if I . . ."

"If the dog hadn't stopped, he'd have caught the rabbit too! If you hadn't used nonstandard terminology on the RT, and a nonstandard breakoff from the target, we wouldn't be out 2 expensive aircraft, have one very badly shocked wingman, and my blood pressure wouldn't be on the upswing."

"It all happened so fast, sir, that I didn't have a chance to . . ."

"It *always* happens too fast! Do you realize, Chumley, that during a 24-month period the Air Force had at least 32 mid-air collisions with other aircraft and targets during gunnery missions and practice intercepts? These collisions were not just running into targets and causing minor damage, they were costly—in lives and in dollars.

"And I'm not talking about collisions in which neither pilot of the aircraft involved knew the other was around. I'm talking about those instances where pilots *knew* where the target aircraft or tow target was and still collided with it. Or, as in your case, where 4 aircraft were supposed to be operating as a flight in a gunnery pattern and knew each other's location. Your unthinking act of breaking inside and short of the tow ship together with your call of being 'off' were just as effective in relieving the Air Force of a part of its combat potential as a bomb from an enemy might be!"

"I guess I didn't think it would make much difference either way by cutting the pattern a little short. I thought that . . ."

"During the years of the Big War the U. S. Navy put out a little booklet for its pilots called "Gunnery Sense." I remember one phrase very clearly. It stated: "*Don't Kill Your Friends.*" By dragging your guns through the tow ship, you endangered the life of that pilot. By nonstandard procedures you almost got your wingman. Just how close does that come to killing your friends, Captain?"

"You're right, Colonel. I wasn't paying attention to my job. I'll do better from now on. You'll see a change. I'll be as alert as a cat in a canary shop. Nothin' will get past your old Dad from now on. No Sir!"

"If I thought you really meant it, Chumley, if I thought that . . ."

"I do! Colonel McCutcheon, I do! Vigilance will be my watchword from now on. Semper Fi—and all that, you know. Just one more go at it, please, sir?"

"All right, one more chance, but I'm assigning you as special assistant to the Wing Gunnery Training Officer for 30 days. You will work with him on all matters pertaining to briefings, flights and everything else that will impress on your thick head the need for safety while flying one of Uncle's machines. The only gunnery you'll see first hand will be from the passenger's seat in one of the trainers. This is, of course, provided the Flying Evaluation Board doesn't recommend that you be made chief of the lightbulb replacement section. Now get out, before I change my mind."

Ol' C.Z. clicked his heels, gave a Basil Rathbone salute and sprinted out the door for his waiting roadster. The Colonel stood silently at the window reflecting on his own words.

All serenity was shattered, however, by the squeal of brakes and the sound of broken glass and twisted bumpers. The radiator and hood of the pink Jag nestled snugly under the rear end of an Air Force pickup truck that had stopped for a red light. A shapely blond WAF strolling half way up the block, but behind the accident, and Chumley still turned around in the driver's seat, told the whole story.

The Colonel's fingernails dug just a little deeper into his palms and a deep sigh was heard in the Headquarters Building. ▲

Tips for T-Bird Drivers....

The number of flameouts/engine failures in the T-Bird is relatively small in comparison with the number of flights made and hours flown. Nevertheless, pilots should be familiar with the types of mishaps that most often occur so they will be able to handle the flameout/engine failure capably if the need arises.

In most mishaps involving flameout/engine failure, the pilot does not know the cause. Recognition of this fact is important in determining corrective action to be taken by the pilot, including the type of airstart to be attempted. The most common types of flameouts/engine failures are listed as follows:

- Flameout from fuselage tank starvation.
- Fuel system contamination—including icing—flameouts and main fuel control failure.
- Failure of compressor—turbine section components: turbine wheels, buckets, bearings, nozzle diaphragm, compressor guide vanes.
- Failure of accessory section components: starter clutch shaft key, upper idler gear key, dual fuel pump drive.

Flameout from fuselage tank starvation. Such flameouts are usually characterized by engine surges or light to moderate vibration or rumbling. Flameouts have occurred abruptly, however, with no apparent warning.

This type of flameout usually is a result of inattention to fuel consumption and status of fuel supply, or because of overconfidence in the liquidometer. Flameout may involve a stuck liquidometer float, causing the liquidometer to indicate full when the fuselage tank is empty, or a malfunction of the fuel low-level warning light. At times a fuselage tank float valve sticks closed, causing fuel tanks not to feed, or it sticks open, resulting in siphoning of fuel overboard.

On early model aircraft, icing of main wing and leading edge tank bypass valves may be a factor. On later aircraft, bypass valves have been removed. In rare cases, malfunction of the cockpit fuel switches has been a cause. Main wing or leading edge tank booster pump failure may also be at fault. Other factors include failure of tiptanks to feed because of an insecure cap; improper alignment of tiptank disconnect; damage to servicing port because of improper servicing technique; faulty fuel cap or fuel cap seal; and failure of sniffle and relief valve.

Fuel system contamination—including icing—flameouts and main fuel control failure. Such flameouts are usually characterized by engine surges or light to moderate vibration or rumbling. Pilots have also reported a muffled explosion at the time of flameout caused by fuel system icing. Again, however, such flameouts have occurred abruptly with no apparent warning.

Compressor-turbine section components failure. Materiel failure is usually characterized by moderate to severe vibrations and explosions.

Turbine wheel serration failure is characterized by an explosion followed by severe vibrations. Such failures almost always occur during the climb; sufficient altitude is usually available for the pilot to stopcock and make a successful emergency landing, or to eject.

Turbine bucket failure is characterized by moderate vibration in case of blade tip failure, or severe vibration in case of platform failure. In case of tip failure, sufficient power is usually available to make an emergency landing. Severe vibration requires stopcocking.

Turbine bearing failure, nozzle diaphragm failure, or compressor guide vane failure are accompanied by severe vibration and require stopcocking.

Accessory section components failure. Flameout caused by failure of upper idler gear key, starter clutch shaft key, or dual fuel pump drive are sometimes accompanied by a "blurp," but flameout with no apparent warning has occurred. In such cases, which fortunately are rare, it is impossible to make an airstart.

Because of the similarity in symptoms, it is apparent that the pilot is at a loss to determine the exact cause of flameout/engine failure. The following guidance may be of help in such situations:

A flameout with no apparent warning or flameout preceded by engine surges, light to moderate vibration, rumbling, or muffled explosion probably indicates either fuselage tank starvation, normal fuel system contamination—including icing—main fuel control failure, or accessory section component failure.

Your corrective action, if you have 5000 feet or more terrain clearance, is to make a manual airstart on the emergency system with the fuel switches gangloaded. This is your best bet, because the chances are that the normal fuel system has failed. So why waste valuable time and battery power, particularly during weather flight, to attempt one or more auto-normal airstarts initially? The accident records are filled with such cases. Temporary overtemperature of 5 to 10 seconds may occur, as it has many times, but the important thing is to get some power. After landing, the overtemperature can be recorded.

A recent review of 32 flameout incidents attributed to icing downstream of the low pressure filter revealed the following airstart data: *(In each case, the pilot did not know the cause of the flameout.)*

	Incidents	Successful	Unsuccessful
Initial Attempt Auto/Normal	23	12	11
Initial Attempt Manual/Emergency	9	8	1

(Editor's Note: The Dash One still recommends that an automatic airstart be tried first. It is anticipated, however, that the Emergency Procedures section will soon delete the automatic airstart. Recently, the prime using command has made the manual/emergency airstart mandatory initial procedure after flameout.)

If you have less than 5000 feet terrain clearance, a low altitude emergency airstart procedure is your most likely corrective action. Six incident reports received by this Directorate indicate that the procedure has been successful and has prevented major accidents.

A moderate vibration or rumbling accompanied by power loss without flameout suggests either main fuel system contamination, malfunction, or bucket failure *(tip)*. There are several things to do immediately.

First, gangload the fuel selector switches and flip your fuel deice switch ON. Activate it for 30 seconds if vibration continues. Then retard the throttle to 80-96% if vibration continues, and finally, if vibration is still present, put the emergency fuel switch to *emergency*. At this point you'd best land, from a flameout pattern, as soon as possible.

If you are jolted by severe explosion and severe vibrations, you've probably had a failure of a compressor-turbine section component. Stopcock, but do not attempt an airstart. When airstarts were attempted in similar past mishaps, the severe explosions and severe vibrations continued, requiring stopcocking again.

So, if your bird begins to sputter sometime or the flame goes out, remember that there is no great cause for alarm. In most instances, corrective action is possible which will enable you to land successfully. ▲

Major John E. Hilburn, Accident Analysis Br., DFMSR

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The young boot had been a Marine all day and he was fed up and standing in another line yet—and not even knowing why. Eventually his turn came and all four fingers and the thumb of his right hand were fingerprinted. After this was over the sergeant who had taken his prints said, "Boot, you can wash your hands over there at the sink." Now, as stated before, the young boot had been a Marine all day and he was fed up. He had to do something—anything—to show his disgust for the whole situation. This attitude took the form of, "Should I wash both of 'em or only one?" in a sarcastic voice. The sergeant, who had been a Marine for much longer than all day and who had heard jazz such as this before, mildly replied, "Just wash the dirty one; I want to see how you do it."

The moral of this story of course is plain. One hand washes the other—that is exactly what we want to discuss.

We are here at the Directorate of Flight and Missile Safety Research to prevent aircraft accidents. In order to do this, we must first know the problem, and in order to know the problem, regulations are published that require reports to be submitted whenever a bird prangs. This is fine and good, even wonderful. But sometimes things happen that we should know about—but do not—because the regulation doesn't state in so many words that these particular happenings have to be reported. The specific of which I speak is *jet engine flameouts.*

Now, we know from various sources that pilots are having flameouts in jet aircraft. Sure, we hear about the ones where damages result, and maybe a very few of the others. But we want to know every time a jet engine flames out in flight—for *any* reason. Only in this way can we build up information as to altitude, moisture, operating time of the engine and/or fuel control, the color of the pilot's eyes and even how much hair he has. This stuff is vital to us because if we find out that the X4Z7 main fuel control failed 16 times during January, we can start to find out why, and take steps to stop this nonsense.

Now you jocks fly these birds and you mechs keep 'em flyable—so all three of us are interested. Naturally, the FSO is interested 'cause he's interested in everything. To help this program along we sent out an all-commands message to let everybody in the field know what we needed and why. As has been said before, this will help—but it won't get the job done! The only way to do that is to get people like you and me and Joe to report flameouts because they want to. We hope that our telling you why you should report 'em will influence you to comply.

So if you're flying one that quits, or if you hear of another guy who was flying one that quit, please see that we get the word and include the known suspected causes. If we do this, we just may be able to do something to prevent it from happening again, and after all, who wants to be goin' around the country flamed out alla' time? ▲

Major Wallace W. Dawson, Fighter Br., DFMSR

The god Thor, red-haired and red-bearded like the lightning, was a fearsome deity of Norse mythology. He was the god of war and thunder. The ancient Scandinavians worshipped him as a benefactor. But they also feared him as an implacable foe who destroyed his enemies with a magic hammer which always returned after being cast as a thunderbolt. The other gods of the Norsemen have faded, but Thor lives on, mighty and menacing. Don't seek him out.

THE HAMMER OF THOR

The cumulonimbus is Thor's abode. Invaders of his domain risk the magic hammer's crushing blows in the form of hail. Observe these rules of thumb and avoid an encounter: Do not fly under anvil tops; do not get within 3 miles of an intense thunderstorm radar echo, and remain 10 miles outside storm clouds. Never assume a thunderstorm is hail-free. Read the complete story beginning on page 8.

*U. S. GOVERNMENT PRINTING OFFICE 520965