AEROSPACE

SAFETY

UNITED STATES AIR FORCE

APRIL • 1961

ENGINEERING • SUPPORT • FACILITIES

HOW URGENT?

Major General Perry B. Griffith, Deputy Inspector General for Safety

Because of some information I had learned as an active participant in a recent accident investigation, I was personally interested to see what the formal Accident Investigation Board came up with. The Findings, "Primary Cause: Pilot Factor, in that the pilot attempted to land when the existing weather was below minimums." Other cause factors: poor judgment for not going to his alternate, rapidly deteriorating weather conditions, IFF failure, and so on. Missing from the report was another cause factor and possibly primary—the desire to get home. Three days before a holiday, the pilot had been ordered to fly a load of freight to a base about a thousand miles away. After off-loading, the aircraft developed mechanical difficulties, delaying takeoff for a day and a half. The pilot continually hounded transient maintenance to fix his airplane because he had holiday plans that couldn't be changed. Before the airplane had been buttoned up he had filed his clearance and was ready to go. There is little doubt that he and his crew were victims of "get home-itis."

"Get home-itis" is a sort of madness overriding a pilot's otherwise good judgment. We have all been victims of such an urgency sometime in our flying careers. The fact that you're reading this means you didn't kill yourself as a result; and I am sure at one time or another you and I have gotten into real tight spots when our personal desire to have at it overruled good judgment.

We are constanly searching for the factors making an accident inevitable or bound to happen. In the case of a cargo accident that occurred last year, again, the mission was to deliver freight and return to home base after a long period of TDY. The trip was uneventful. After a short layover the long trip home began. Due to some poor flight planning, towards the end, fuel became a real problem but the desire to complete the mission and get home overrode a decision to land at an intermediate base. In a desperate effort to conserve fuel, one engine was feathered on the descent but the attempt to restart the engine was unsuccessful. The bird crash-landed and the Instructor Pilot was killed. At the time of the crash, the crew had been on duty for over 24 hours. The logical conclusion of the Accident Board for the poor judgment of the Aircraft Commander and Instructor Pilot, the inadequate flight planning, and violation of crew rest regulations was "Get home-itis." Eighteen days of temporary duty and the proximity of home overrode all else!

This sense of urgency to complete a mission not associated with operations or to get home can hit any of us if we don't do some soul-searching and ask why we're knocking ourselves out to get there. Assume: Operations calls you at 1600 hours with an offer to make a personnel pickup at a base five flying hours away. Flying time has been hard to arrive by lately, so you accept the trip and that is fine. On the way out you feel great; you're knocking off weather and night time. When you start the return trip, however, it's not the same story. By now it's nearly midnight; you're bushed; you've smoked too many cigarettes

EDITORIAL

and haven't eaten too well or at all. Back at home the weather is sitting right on GCA minimums and the forecast winds to home and alternate will cut your reserve fuel to "maybe." And there is work to be done tomorrow morning. So this is the moment of truth. This is the point where your better judgment says "Go to the VOQ" but an inner voice says "What's the matter, afraid of a little weather?" or even perhaps "Remember what the boss will do to you if you're late with that paperwork."

What's your decision to be? Better hit the pad, son. There is no mission urgency here. But you *thought* there was, so, as you might suspect after landing for fuel once, and then really pooped in the last part of the flight you find the weather has gone all to pot; and your fuel is almost gone. Despite your best efforts you are faced with the decision to eject or attempt a deadstick landing at night in zero zero weather. Quite a choice! . . .

Count the number of other than operational flights you have made since the war that, had you been a day late, would have made a vital difference in your mission. To be sure, some of you will be able to remember one or two that might have warranted the risk of your life, your crew, and the aircraft, but most of you will be hard put to recall such an instance. I suspect that the birthday, wedding anniversary or club party for which you *had* to get home seems pretty insignificant now.

There is *some* risk any time an airplane takes off and there are some missions which warrant a greater risk than others. As members of the Air Force we accept these risks and live with them. But we must not accentuate these risks by letting our good judgment be overruled by a false sense of mission urgency or personal desire.

You, as a pilot, must be able to make the correct decision to go or not to go. If you are a commander or supervisor you have the responsibility to develop good judgment in our younger and less experienced pilots, so they will be able to make the right decision. Don't fail them.

We don't want an Air Force of timid flyers. But we do demand pilots with sufficient foresight to analyze whether the mission calls for a "Go" sign when you're up to bat, have two strikes, no balls and no bat in your hand. ★★

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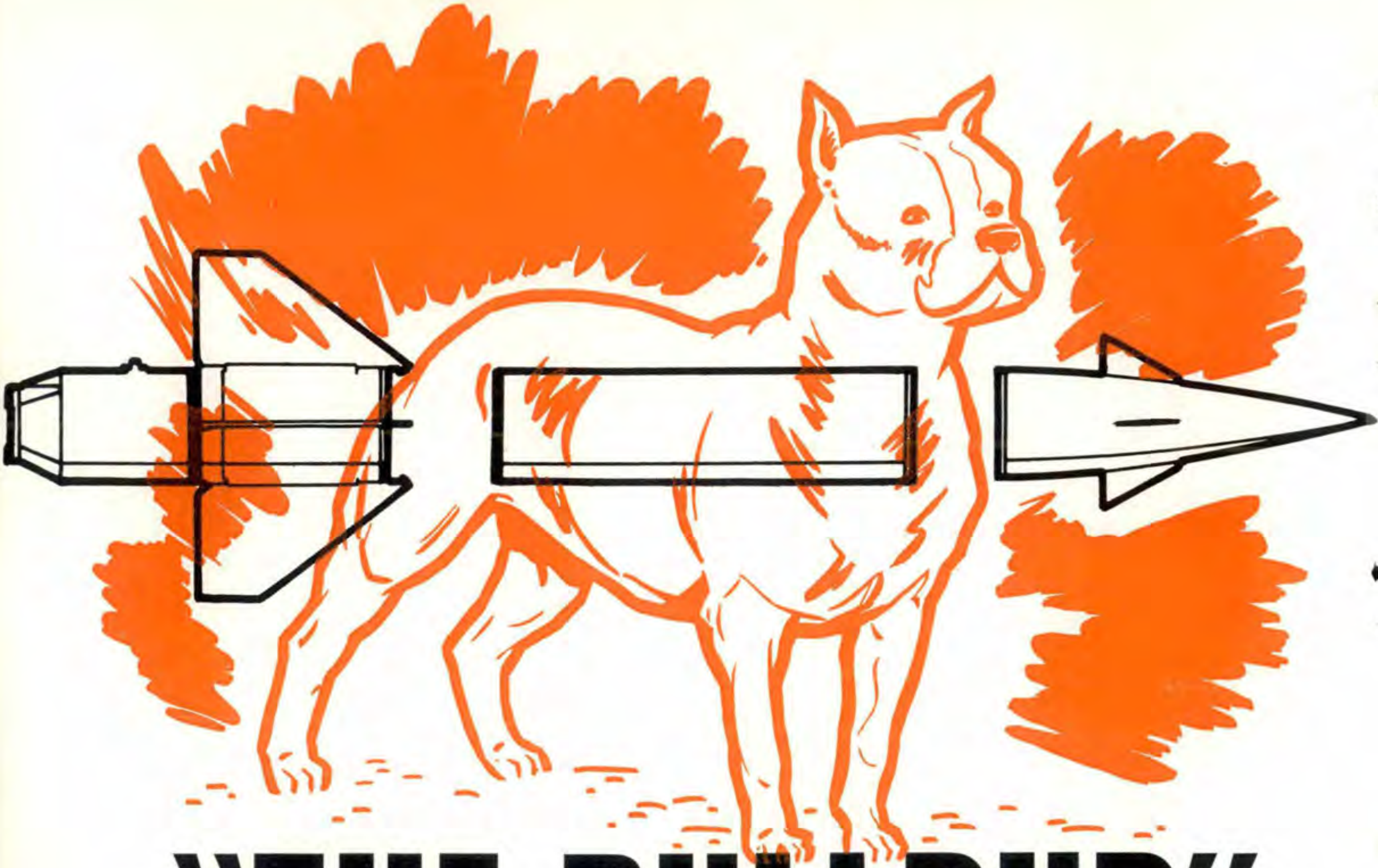


"THE BULLPUP"

Newton Black, Jr., GAM-83 Engineering, The Martin Co., Orlando, Fla.

An Air Force pilot flying high above the enemy coast spots a supply train snaking its way toward the harbor. He banks his Century Series fighter for a better look, rolls into a dive and presses a button . . . a slim, deadly missile rockets from under the plane's wing.

Seconds later, a devastating explosion! The train is a shambles of twisted steel, bits of metal spray into the air.

A missile, the GAM-83 BULLPUP, 11 feet long and weighing less than 600 pounds, has hit its mark under the pilot's steady hand while the airplane was still almost two miles from the target.

Less than three seconds after the missile was launched it exceeded twice the speed of sound while the pilot kept it under control with a simple hand switch. The BULLPUP sped to the right of the elusive train . . . the pilot nudged the guidance switch . . . the missile reacted and came back into line . . . now, a little low . . . another slight nudge, and in scant seconds, a thundering bullseye!

BULLPUP is a far cry from bombs and unguided rockets of World War II and the Korean Conflict when pilots put their lives on the line because they had to drop within "spitting" distance of their intended targets.

Built by The Martin Company in Orlando, Florida, BULLPUP was conceived to fill a need emphasized in the Korean Conflict where American pilots flew more than 255,000 sorties in three years of bloody fighting. They struck from 13 U. S. carriers and from land bases in Korea and Japan. The pilots unleashed everything they had against ammunition dumps, bridges, tanks, and scores of other targets.

There was one drawback. The pilot had to come down low and wade through everything the enemy could throw at him. Bad weather and rugged terrain made his mission tougher. He aimed his bombs or unguided rockets by flying his plane straight at the target until the last possible second. Then he would release his payload and hope he hit the target. The longer he waited before launching his rockets or bombs, the greater his chances of hitting the target. But this was costly; the greater his success, the greater his danger. Sometimes he didn't return. The safety of both the pilot and his aircraft were in great jeopardy.

The result spoke for itself. It cost too many men and

Steps in preparing the GAM-83A for action are shown in this picture sequence. Top left, two crewmen connect nose section to the rest of missile; simple lock ring holds missile together. Top right, MJ-1 lift is shown in use, lifting missile from its cradle after arriving in the aircraft loading area. Lower left, ground crewman makes electrical check on launcher prior to loading BULLPUP on the F-100, and in last photo the ground crewman loads missile on F-100 launcher with the MJ-1 lift truck. Wings and canards are attached after BULLPUP is mated to the aircraft.

too many planes to hit enemy positions by conventional means. A better method had to be found—a weapon that would be more accurate than earlier ones and at the same time reduce aircraft losses. Such a weapon, also should be simple, reliable and economical. The order was filled on April 25, 1959, when the BULLPUP air-to-surface missile joined the Navy as an operational weapon. Soon afterward the missile was scoring bulls-eyes on practice ranges for the Air Force.

What's the secret of BULLPUP?

The pilot doesn't have to fly down enemy gun barrels. He can launch his missiles several miles away and guide them to the target while he stays outside the range of effective antiaircraft fire. Unlike conventional rockets, after BULLPUP is launched the pilot, by radio command, continues to fly it directly into the target. He is, in fact, flying two aircraft at once.

To aid the pilot in guiding the missile to target, two flares are mounted in the aft section. They are started, and burn with a constant intensity of approximately 100,000 candlepower. By visually establishing a straight line composed of three points—his airplane, the missile, and the target—the pilot can achieve high accuracy. The probability of hitting his target is much greater than if he used earlier weapons; fewer sorties and thus greater safety is assured.

Let's see why BULLPUP personnel can rely on the safety of this missile.

The missile comes in three sections: nose section, center section, and aft section. Each is packaged in a sealed bag with a chemical compound added to maintain a moisture-free environment and prevent missile failure due to component corrosion.

Safety features are built into each section at the factory. The aft section comes to the Air Force equipped with a rocket motor. If this motor were to ignite accidentally, the aft section would fly off like a balloon let loose by a child—blasting everything in its path. Therefore, a thrust neutralizer is installed at the factory at the same time that the motor is installed in the center section. In case of an accidental motor ignition, the neutralizer would neutralize the motor's thrust and the aft section would not move. Just prior to aircraft takeoff the neutralizer is removed. The two pyrotechnic tracking flares are not installed onto the missile until it is mounted on the aircraft thus ensuring the safety of personnel if a flare were to ignite.

Ready-to-launch GAM-83A receives final checkup prior to test firing flight over Nevada desert near Nellis Air Force Base.

The primary safety precaution incorporated into the center section is a warhead arming device. The center section comes to the Air Force with the warhead installed; however, the warhead arming device must withstand a powerful acceleration (the thrust of the motor when the missile is launched) for a length of time to arm the warhead. Thus, the shock of accidental dropping or other rough handling prior to launch will not set off, or arm, the warhead.

In the nose section there is a small charge (comparable to the power of a firecracker) which, when ignited, closes a switch that allows an electric battery to furnish power for the missile receiver. This charge is set off automatically by the pilot when he presses the launch switch.

Thus, these are various safety factors in each section of the missile. These precautions might suffice, but there are more. After the missile is mounted, just prior to aircraft takeoff, a ground crewman pulls two pins to which are attached large red flags from the missile. The first pin, unless removed, prevents the electric motor-starting mechanism from operating. The second pin must be pulled before the small explosive in the nose section can be ignited.

Other safety factors are built into the system. For pilot safety the following methods of launch are possible:

- Conventional launch at target.
- In an emergency, just drop the missile.
- In an emergency, fire unarmed missile to nonpopulated area.
- In an emergency, jettison missile, launcher and pylon.

In one early BULLPUP test, a pilot launching the missile on his first try, hit a small target two miles away. In Operation William Tell at Indian Springs Air Force Base, Nevada, Captain James Portis showed thousands of spectators the missile's one-shot accuracy. This pilot from the 4525th Fighter Weapons School, Nellis AFB, dived toward a simulated target, fired a BULLPUP and splintered a wooden structure on the Indian Springs bombing range. Slow motion movies later revealed he had hit the bulls-eye painted on the target.

A brief training period assures pilots of high GAM-83 accuracy. Simulated launches on a ground pilot trainer teach the trainee how the missile reacts to pilot control.

The BULLPUP is considered extremely reliable. Rear Admiral Paul D. Stroop, Chief of the Bureau of Naval Weapons, said that the Navy is so sure of the reliability of BULLPUP that it has made it the first operational missile requiring no test equipment. It is treated as another round of conventional ammunition.

Why is BULLPUP reliable?

It is reliable because it is simple. Design simplicity, however, doesn't mean ease of design. It would be easier to make the missile complex. You have to make it do everything it's supposed to do—with fewer parts; but by using fewer parts, there is less chance of failure. Thus, the fewer parts to go wrong, the greater the reliability.

Each of the weapon's three main sections houses components to fulfill a specific function. The nose section contains the guidance and control equipment that obeys the pilot's radioed commands.

A radio signal issued by the pilot to the receiver of the missile initiates a directional command which is applied to the proper solenoid-operated control valve. The valve, in turn, deflects the control surfaces (called canards), enabling the pilot to control the missile's path.

The pilot issues the signals by means of a hand switch. Because more than one airplane may launch BULLPUPS in the same target area, a number of different operating frequencies are provided to eliminate mutual interference.

The center section packs a warhead which, as we saw, is so reliable that it is received with the fuse installed. The aft section propels the missile to speeds exceeding Mach 2 during its flight to a target several miles away.

Each of the three sections is interchangeable. Thus, any forward section will fit any center section and any center section will fit any aft section. During assembly the three sections are quickly fitted together and held in place with simple snap rings.

What's the future of BULLPUP?

Early in June, 1960, using a Marine Corps helicopter, Major Jeff Harpe fired several BULLPUPS from different altitudes, speeds and launch angles. One missile, fired from an altitude of 1500 feet, hit within inches of an orange disk more than two miles distant. This was the largest radio-controlled missile ever fired from a helicopter.

Engineers are now fitting the Air Force version for nuclear capabilities, thus vastly increasing the firepower of the missile. They are also working on a new electronic control package, already successfully tested, that will permit pilots to launch missiles from an "off-set" position. That is, they can fire at a target while flying parallel to it, instead of diving directly toward it. ★

THREE LAYERS OF SKY

In the conterminous states of the United States (meaning those with togetherness), we have, during the past several years, become accustomed to having two airways structures: the low altitude system extending from ground (700 feet, that is) up to 24,000 feet, and the high altitude route structure occupying the Continental Control Area from 24,000 feet up to infinity.

Effective this month, we will have not two, but three, separate and distinct airways systems:

- The *low altitude system,* which will now extend up to, but not including, 14,500 feet. Airways will be essentially the same as at present, except that the Transcontinental Victor 1500 Series Airways will be deleted.
- A new *intermediate altitude airways* system will be designated for that airspace from 14,500 feet up to but not including 24,000 feet. This system of *express airways,* based on VOR and VORTAC facilities and replacing the Transcontinental Airways, will provide for easy flight planning, and flight plan filing, and ready chart reading by aircraft on "long haul" routes both from coast to coast and from the southern part of the United States to the Canadian border.
- The present *high altitude route structure* from 24,000 feet up will remain in effect.

With the implementation of the new intermediate airways system, the Continental Control Area will be dropped to 14,500 feet. This means that *all IFR flights in this area either on or off airways will be under the direct control of Air Traffic Control.*

And that is the essential difference in operations in this intermediate area, plus the fact that you have a streamlined airways system. There is no change in your position reporting procedure—report according to your chart. For flights off airways, your flight plan should provide for your reporting at least every 200 miles, the same as in the present low altitude system. There are no changes in the positive control airways which will still extend from 17,000 to 22,000 feet (17,000-24,000 when underlying a positive control area), except they will conform to the new airway width that will range from 8 to 16 miles in this system. You'll still use the same procedures for getting into and out of positive controlled airspace. There's no change in radar beacon (SIF) procedures just because there is a new intermediate altitude airway system. Nor are there any changes in altimeter setting procedures. Use QNH in this area. There is no change in off-airway cruising altitudes—present rules for altitudes below Flight Level 290 apply. No change in visibility minimums for Air Force pilots. Check AFR 60-16.

There will be a new set of charts covering the system. Perhaps you have already seen the samples distributed to base operations offices together with the ACIC brochure "FLIP Goes Intermediate." If you haven't seen the new charts, suggest you stop by your Base Operations office and ask about them. If you've seen them, you have probably noted that they do not differ too greatly from our present FLIP charts. Printed in blue to represent VOR facilities system, they're large sized sheets accordion-folded to a small size to facilitate use in the cockpit and storage. This chart represents joint military/civil development, and it is believed pilots will find it easy to read and use. It's uncluttered and presents the new system on eight charts or four pieces of paper. You may continue to use your Enroute Supplement to obtain any information not found on the chart.

A survey letter was sent out to all recipients of the Enroute Low Altitude and Enroute High Altitude to determine requirements for the charts, and distribution will be made immediately prior to the effective date, established as 6 April 1961.

The matter of transition to and from the intermediate altitude system is being given consideration both by the Federal Aviation Agency and the Department of Defense. No doubt you will have to refer to the low altitude chart in such transitions and carefully plan your flight to take this into account, at least for a period of time. As soon as Air Force Base Commanders have established departure procedures in accordance with AFR 55-106 for transition to this system, and major civilian bases have also established such procedures in accordance with FAA policies, the matter of getting from the ground to 14,500 feet, should be greatly simplified.

The new system should not have any appreciable effect on jet aircraft operating in the high altitude structure. If you've been operating primarily by benefit of departure procedures, Enroute High Altitude Charts and the Terminal-High Altitude publication containing transitional data, this should still do it.

No doubt there are some bugs in the new system which will have to be worked out after it is put into effect. It should, however, simplify the job of the air traffic controller and accordingly help him to provide you, the Air Force pilot, better service. It will open up additional airspace in the 14,500 to 24,000 feet strata previously taken by an infinite number of airways. All in all, this new system should serve to facilitate flight operations. ★

F. H. Redmond, Aeronautical Chart and Information Center, St. Louis, Mo.

Encounters with damaging hail aloft reported by aircraft illustrate the seasonal movement beginning around the first of the year in the southeast and gradually moving northwest, receding during the fall months. If you're unlucky and get clobbered, report it via Channel 13.

UBIQUITOUS HAIL

Capt. Leo S. Bielinski, 4th Weather Gp (MATS), AWS, Kansas City, Mo.

Using a "two-bit" word can sometimes get a person involved in a lot of work. I once used the word ubiquitous (u-biq'ui-tous, adj., "being present everywhere") to describe hail aloft. Well, one each "Command Jockey," with some 6000 flying hours, didn't think the word very apropos. With higher flying aircraft, improved ground and airborne radar, and better hail forecasting techniques, he argued that in-flight hail was no longer the problem it used to be. A pilot could simply fly over hail areas or steer around them with radar.

I pointed out that radar measurements of convective type clouds indicated some tops to 70,000 feet and, while a few aircraft may be designed to exceed this altitude, hail still might be encountered during ascent or descent.

Well, he wasn't convinced and I had to "put up or shut up." I "put up" and then the work began. It ended some three months later after I had surveyed every single Aircraft Weather Incident Report on hail which had been received by the Severe Weather Warning Facility. I examined 240 damaging hail incidents since 1951, plus 32 other reports of in-flight hail damage, plus 541 PIREPS of hail. Probably this is the best collection of detailed in-flight hail information in the world, made possible by the cooperation of Air Force pilots.

I don't even know where this "Command Type Jockey" is now; but if he reads this, and looks at Figure 1, perhaps he'll agree with me on the ubiquitousness of hail. A few other items on hail might also clue him in on how to better coexist with hail; because it's still pretty much of a problem, in spite of his higher flying aircraft.

Here are some of the facts uncovered in my survey. Fifty-six jet aircraft were damaged by hail during the four-year period 1952 through 1955. From 1956 through 1959, the number increased to 76. While this reflects an increase in jet flying, it also shows that the hail problem has not lessened with higher-flying aircraft. Almost half of the 272 damaging hail incidents occurred at or above 20,000 feet, as shown in Figure 1. Note that the maximum altitude of the hail encounters gets higher as the year progresses, reaching a peak in about June with an isolated case at 44,000 feet in September. It appears that, for the months of January, February, November and December, the possibility of encountering damaging hail above 20,000 feet is quite remote, at least in the United States. It should be noted that hail occurs most often in May and June. So, during the storm season, if this "Command Jockey" can't fly over it, and he can't fly under it, then I say it's ubiquitous in the vertical!

One surprising item brought out by the survey was

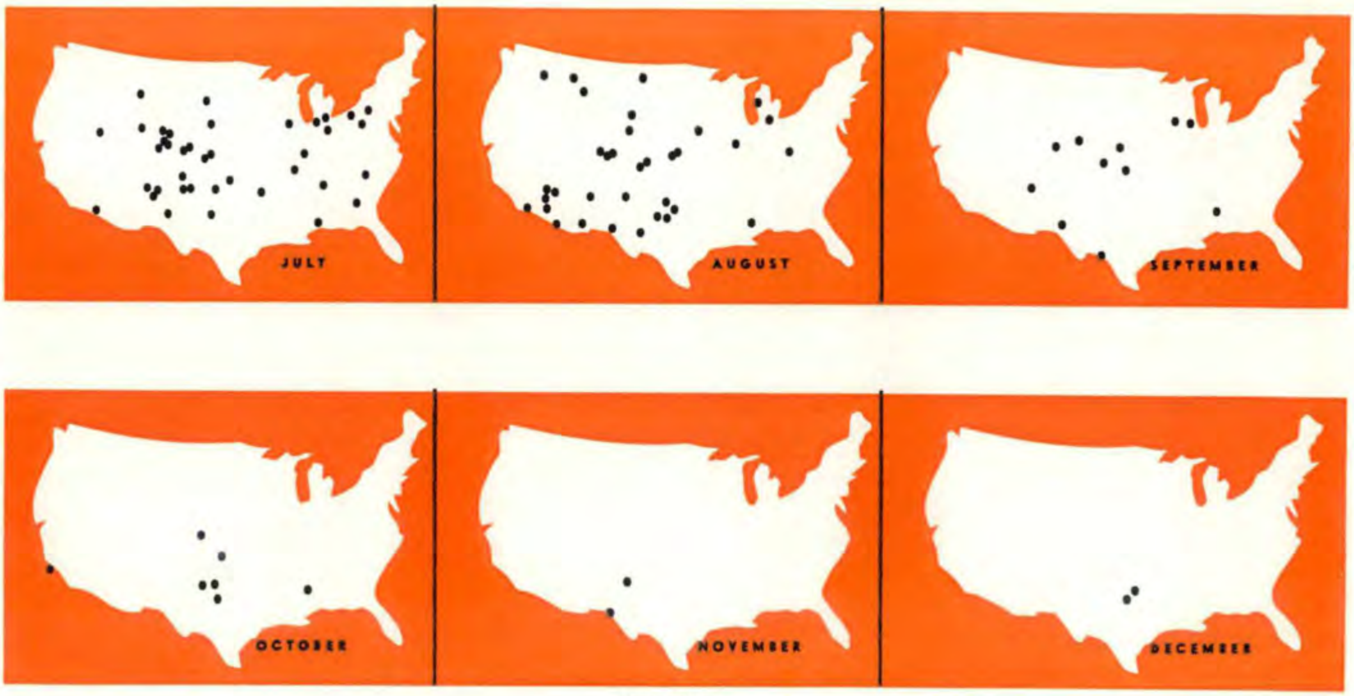
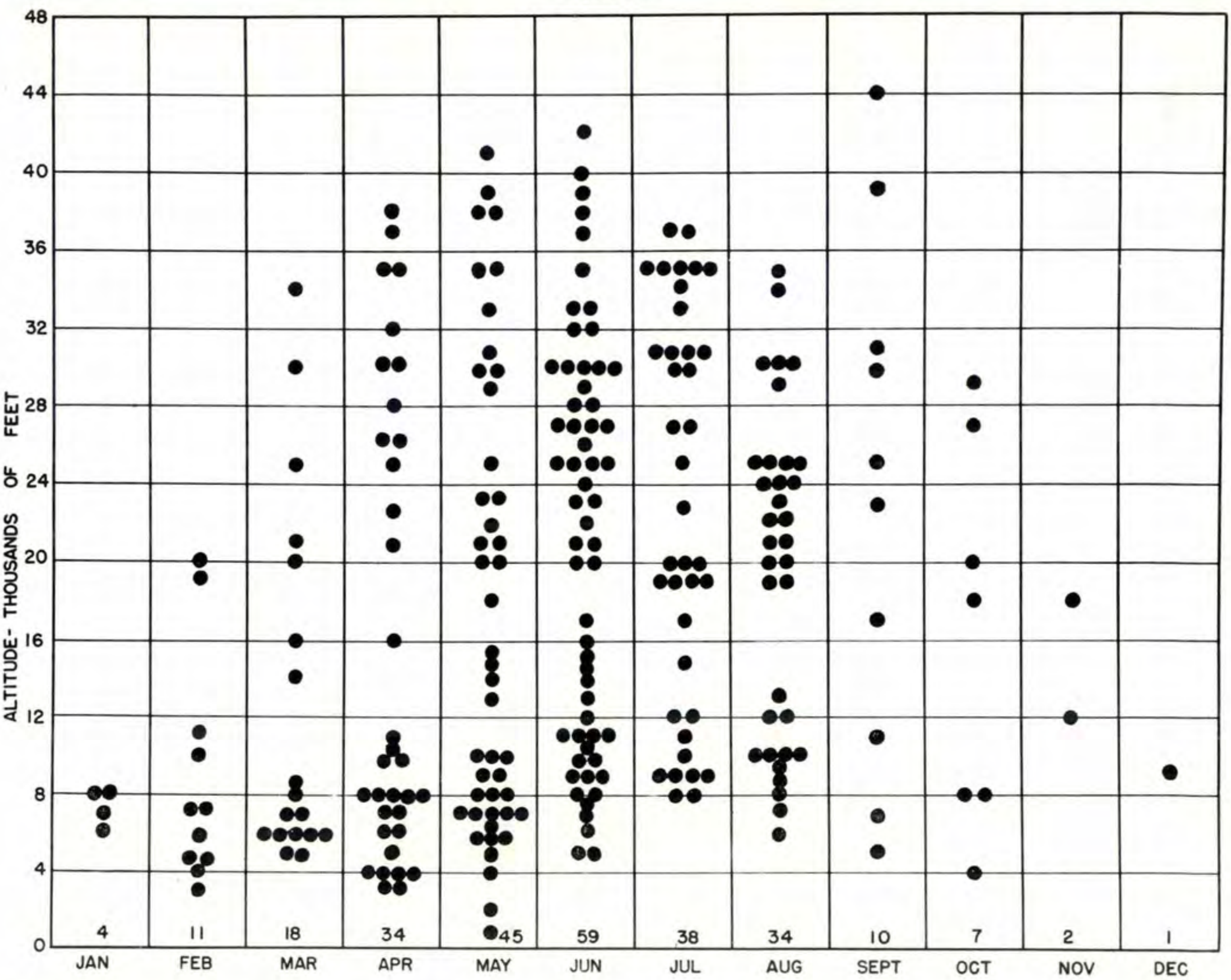

JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER

Figure One


ALTITUDE - THOUSANDS OF FEET
48
44
40
36
32
28
24
20
16
12
8
4
0
4
11
18
34
45
59
38
34
10
7
2
1
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEPT
OCT
NOV
DEC

that nondamaging hail (probably less than ½ inch) rarely occurred at or above 20,000 feet. Practically all hail reported at these altitudes caused some sort of damage. Now one might suspect that "Jet Jockeys" simply ignore the reporting of nondamaging hail. But such is not the case; for it was shown that below 20,000 feet the jet boys report nondamaging hail at about the same proportionate rate as the conventional boys. Therefore, it's a pretty good rule to assume that any reported above 20,000 feet is capable of "clobbering" your machine, but good!

Can you imagine what a 5-inch diameter chunk of ice would do to your machine at 29,500 feet? That's enough ice for several glasses of "scotch on the rocks." Then there are other reports of 4-inch hail at 31,000 feet, 3-inch at 37,000 feet, and 2½-inch at 25,000 feet. These incidents occurred at temperatures well below zero degrees Centigrade; however, there is reason to suspect that the largest hail size occurs near zero degrees Centigrade. This is based on the fact that five out of six reports of 4-inch hail occurred near this temperature, which is the altitude range from 11,000 feet to 15,500 feet.

What sizes of hail constitute damaging and nondamaging hail? About 78% of the damaging hail reports for jets and about 70% of the damaging reports for conventional aircraft listed a hail size of ¾ of an inch or larger in diameter. Most of the nondamaging hail reports gave a size of ½ inch or less in diameter. Thus, a damaging hail size probably begins around ¾ of an inch.

While attempting to circumnavigate or to top thunderstorms, pilots frequently encountered hail in clear air, adjacent to the build-ups, or from overhanging clouds. In the period covered by the study, 23 such incidents were reported, about 87% of which occurred below 20,000 feet. Sometimes you can't fly over hail, under it, or even around it. And that's 3-D ubiquity!

Getting off the subject of ubiquity of hail momentarily, here's an interesting phenomenon that I found in studying hail reports. How many pilots have experienced this? You're being tossed around by turbulence, being beat up by hail, and then you suddenly read zero airspeed! (Guaranteed to raise the hair on the back of your neck.) Witness nine such reported incidents below, then expect this possibility and don't panic when this happens to you.

Altitude	*Type Aircraft*	*Air Speed Fluctuation*
8,000	B-52	Decreased gradually to 0
10,000	C-119	Between 150K and 0
10,000	C-54	Between 150K and 0
20,000	T-33	160K to over Mach 1
28,000	B-47	Between 630K and 0
28,000	KC-135	Between 650K and 0
29,500	B-47	Between 400K and 0
30,000	F-86	Decreased gradually to 0
33,000	F-102	Decreased gradually to 30K

That is a strange, unexplained phenomenon which is sometimes encountered in hail areas and which can apparently be experienced at 'most any altitude and by any type of aircraft. Granted that extreme turbulence and aircraft control may account for some of the air speed variations; however, it appears that under certain atmospheric conditions in hail areas the air speed indicator system may be affected in some manner.

From a small area in the southeastern United States in January, the aerial extent of the damaging hail aloft spreads northward and westward as the year progresses The northernmost extent of the damaging hail aloft is probably reached in August, after which a southward recession takes place. The few hail reports in the northern United States may not present a true picture of the hail risk there due to less flying in this region. The rare occurrence of damaging hail in the Gulf States during the summer months, on the other hand, is undoubtedly representative of meteorological conditions there.

PIREPS are tremendous aids for avoiding hail, and all pilots should report immediately over Channel 13 all hail encounters. From the 541 PIREPS of hail for the period covered by the study, it does appear that better descriptive terms for hail are required. For example, a pilot reports "heavy" hail. Does this mean numerous small hailstones or a few large size hailstones? Would this be damaging to your aircraft? "Intense" hail might be taken to mean numerous small hailstones or large size hailstones. What kind of hail would a pilot anticipate upon receiving a report of "moderate" hail? These are very common reporting terms for PIREPS, but perhaps better descriptive terms might be "few large hailstones with 1-inch diameters," "intense small-size hail," "intense nondamaging hail," or "damaging hail," etc. In all cases, the type of aircraft and the altitude should be specified in pilot reports of hail.

The best procedure for avoiding hail aloft is to heed the severe weather warnings and check via Channel 13 on any ominous-looking situation. It is not possible to avoid hail in all instances; however, certain considerations, which are summarized below, may aid in minimizing damage:

• During the winter months, most of the damaging hail aloft can be expected in the southeastern portion of the United States. During the spring and summer months, the region between the Rocky Mountains and the Mississippi River is highly favored. In some cases the vertical extent of hail may be as high as 70,000 feet.

• Any forecast or report of ¾-inch hail is *most likely* to be damaging hail and any hail reported above 20,000 feet *may* be damaging. Due to decreased convective activity, damaging hail aloft is less likely during the hours between 2300 and 0900 local time.

• Damaging hail aloft rarely occurs during the late fall or early winter and damaging hail above 20,000 feet during January, February, November and December is not too likely. The largest hail can be expected near zero degrees Centigrade, or in an altitude range from 10,000 to 18,000 feet.

• *Allow plenty of leeway* in circumnavigating convective type clouds.

• *Report all hail encounters immediately over Channel 13.* Aircraft Weather Incident Reports should be submitted for all hail encounters, particularly any damaging hail. But the clincher is that our aircraft are still being clobbered simply because hail occurs unexpectedly in many different places. Hail is ubiquitous! ★

T-BIRD QUIZ

William W. Richards, Lockheed Aircraft Corporation, Burbank, Calif.

Here's a quiz on emergency procedures which was made up by the manufacturers of the T-33 aircraft. You will find the answers in this same issue, but try to forget about them until you've quizzed yourself first. After you've read the *symptom* and *malfunction*, describe in the space provided the *procedure* that you would follow.

1. Symptom: Complete power failure during takeoff run.
   Malfunction: Fuel starvation or engine failure.
   Procedure: ....
2. Symptom: Complete power failure with no chance to abort.
   Malfunction: Fuel starvation or engine failure.
   Procedure: ....
3. Symptom: Engine failure during flight.
   Malfunction: Fuel starvation, induction or fuel system icing, fuel control or pump failure or negative acceleration.
   Procedure: ....
4. Symptom: Unsuccessful air start.
   Malfunction: Improper procedure, mechanical or materiel failure.
   Procedure: ....
5. Symptom: Hydraulic pressure loss.
   Malfunction: Faulty gage, hydraulic leak or pump failure.
   Procedure: ....
6. Symptom: If canopy fails to jettison.
   Malfunction: Canopy jammed or improperly rigged.
   Procedure: ....
7. Symptom: If seat fails to eject.
   Malfunction: Improper procedure or seat linkage malfunction.
   Procedure: ....
8. Symptom: If automatic safety belt fails to open.
   Malfunction: Improper hook-up or linkage malfunction.
   Procedure: ....
9. Symptom: Engine fuel pump failure.
   Malfunction: Sheared shaft in engine driven pump.
   Procedure: ....
10. Symptom: Leaking or syphoning fuel tanks.
    Malfunction: Fuel line or system failure or unsecure filler cap.
    Procedure: ....
11. Symptom: Illumination of the gyro instrument warning light or inverter-out warning light.
    Malfunction: Main inverter failure.
    Procedure: ....
12. Symptom: Runaway trim.
    Malfunction: Faulty trim switch or failure to return switch to neutral.
    Procedure: ....
13. Symptom: Erroneous airspeed and vertical velocity indications.
    Malfunction: Clogged or iced up static ports, or pitot head.
    Procedure: ....
14. Symptom: Air conditioning and pressurization system malfunction.
    Malfunction: Control valve failure, turbine cooler or heat exchanger failure, leaking air lines or valve failures.
    Procedure: ....
15. Symptom: Partial power loss during takeoff.
    Malfunction: Partial fuel starvation, fuel system icing or main fuel control failure.
    Procedure: ....
16. Symptom: Fluctuating fuel pressure and/or engine vibration.
    Malfunction: Fuel system icing, fuel starvation, nozzle malfunction, bearing failures or turbine failure.
    Procedure: ....
17. Symptom: Smoke in cockpit.
    Malfunction: Spilled oil or hydraulic fluid when serviced; oil fill cap unsecure or actual fire.
    Procedure: ....

(Answers located on page 13)

Now it's "Noseover," a subject of interest to every unit commander and pilot flying the F-101 aircraft. How long has this maneuver been occurring? Well, it isn't exactly new, since the latest available data at this Headquarters dates back to February 1959. Why hasn't something been done to fix this? Well, hang on to your hats!

These incidents have never been reported, as per the provisions of AFR 62-14, Sec. B, Par. 6L, which state clearly: "Unusual occurrences or near accidents determined by the commander concerned to be of value in the prevention of USAF aircraft accidents." As each F-101 noseover incident occurred, it seems that the pilot and unit commander concerned regarded the happening as a transient occurrence that was peculiar to that particular flight. They failed to relate the incident to the F-101 fleet as a whole. In a few instances, the unit involved did submit an Operational Hazard Report, but only a few took this limited action. The result of this lack of communication: two known F-101 major accidents and a record, as of now, of 15 incidents.

Let's take a look at the background. Early in January of this year an F-101B pilot, at turn to final beam attack, altitude 39,000 feet, computed airspeed Mach 1.19, called "20 seconds." He was cleared by target aircraft and approximately at the point where the pilot would have called "Splash," his aircraft nosed down rapidly. It rolled 50 to 180 degrees and entered a nearly vertical, extremely high speed dive, rolling very slowly. Sixty-five seconds later it struck the water!

In light of the foregoing report we moved into high gear to determine the cause of this and any similar occurrences of record and, if possible, to discover a possible cause factor. A review of official data on file offered no clues. However, we had recently received an informal report of a similar F-101 noseover incident at another base and took action to get an official report of the happening. As soon as official confirmation was received, the aircraft in question was grounded for a thorough check of all systems involved in this Flight Control malfunction. Concurrently we asked all major command users to report any F-101 noseover incidents that had occurred within their command. The results—as stated earlier—are an official record of fifteen F-101 incidents and two major accidents.

It is evident that had the individual pilots, and particularly the unit commanders, seen their isolated incident in relation to the entire F-101 fleet, the problem would have been brought into clear focus—and fixed. Instead, we're in a position of being several weeks, even months, late in getting these complex problems thoroughly wrung out and completely fixed.

Be that as it may, the present F-101 noseover incident-accident trend is receiving active, on-the-spot attention by the manufacturer's specialists and technicians, and all USAF agencies having responsibility for this aircraft. We are concentrating our efforts on reaching an early solution of this complex problem.

One more time, men, the name of the game—**R E P O R T**—is clear. If you'll report 'em we'll get 'em fixed . . . Starker, Schneller, Schoener!

F-101

Lt. Col. Jackson Saunders, Fighter Branch

F-104

Loss of oil has caused twice as many F-104 aircraft accidents as any other single cause factor. In fact, at the very start of business, it became apparent that our oil servicing procedures left something to be desired; and oil servicing procedures were changed. Conditions that made additional changes necessary were: Number 3 bearing sump lines were failing because of vibration, resulting in loss of oil. Dampening clamps were installed. Gearbox seals were faulty and, of course, this too resulted in the loss of oil. New seals were installed. Oil quantity was difficult to measure, so a dipstick was installed. In addition, a light was installed to indicate a low engine-oil-level. Actually, this is a misnomer since the light operates off a pressure switch. Tab washers on the No. 1 scavenge pump were failing, and detailed inspection criteria were issued. Scavenge pumps began to fail because of the oil system contamination, and only by the efforts of all F-104 users were we able to "sell" the fixes required. Modification of the oil system is continuing. So, what does all this add up to? Simply this: Your chances of having an inflight emergency because of oil system problems are twice as great as any other cause.

Here's a suggestion for pilots flying the '104: If you are in doubt or have any questions about the oil system of the J-79, it might be a good idea to discuss the matter with your Maintenance Officer and the Tech Rep at your next Flying Safety Meeting. On second thought, why wait 'til then? Do it today!

Major Robert M. Scott, Fighter Branch

F-105

"Peek before you pull."

We think that pilots should know their way around their cockpits so well that they can find the numerous knobs, buttons, handles and gages—while blindfolded. We hope that before you check out in the '105, you can do this. But—for business reasons—after you reach this state of proficiency, don't intentionally shut your eyes for practice when you reach for a lever. Four particular levers I have in mind are the emergency brake handle, the auxiliary stores release handle, the air refueling probe handle and the emergency gear release handle. In the F-105B, the handles are lined up left to right in the order just mentioned, more or less at the level of the bottom of the instrument panel. Unfamiliarity with these handles can lead to all kinds of trouble.

Not so long ago, an Air Turbine Motor (ATM) cut out on a bird as it was turning a corner after the landing roll, and the brakes went off, per design. (We could write more on the subject of the ATM alone, but won't—in this issue anyway.) Before the pilot could grab the emergency brake handle, the aircraft hit the usual drainage ditch alongside the runway and the gear collapsed. Now, whether or not the pilot wasn't alert enough to grab the handle in time to prevent this mishap, is conjecture. The point is, in this bird you do *personally* have to pull the handle when you lose normal brakes, and it has to be pulled all the way out. In certain types of emergencies, you'd better know where to find it in a hurry and also what happens when you do pull it.

In another case, a pilot started to pull the air refueling (AR) probe handle to check the extension mechanism while the aircraft was at maximum speed for probe extension. Just as he was getting ready to give the handle a yank, he realized with a shock that he had hold of the emergency landing gear release handle. You can imagine the results of a gear extension in this bird at 350 knots.

To elaborate on our statement that you should learn your way around the cockpit, it is suggested that you might study the difference in the arrangements of these handles in the "B" and "D" models. When the "D" came along, apparently a different group of people participated at the mockup board, and they decided to put the emergency landing gear release handle near the landing gear handle itself, which is where we thought it should have been all along. This action reversed the positions of these handles in the two aircraft. So if you've been practicing on the "B" aircraft to find the brake handle in a hurry, perhaps you'd better "unpractice" a bit when you start your checkout in the "D" model.

We don't see any real problem in this area unless, of course, you happen to be in the enviable position wherein you may fly both models concurrently.

We realize there aren't many jocks flying the F-105 as yet, but for those of you who are, how about a C-Note regarding any pet peeves or helpful hints you may have from a safety standpoint? ★

Major Glenn Crum, Fighter Branch

3 in 1

Reprinted from FLIGHT COMMENT, RCAF

A T-33 trip to ferry a pilot to Wiarton and then proceed solo to North Bay was programmed by me recently.

The second pilot made up a flight log the day before, including three possible alternates (depending upon the weather). The next morning, I checked the weather, and decided to use North Bay as my destination. The other pilot filed an F48, and gave me a flight log for the trip. Conditions were normal to Wiarton, on top of cloud at 36,000 feet. At Wiarton, an SJRA was carried out, and the second pilot dropped off.

The clearance from Wiarton to North Bay read. "Cleared to the North Bay range station; 1000 feet on top, above 25,000 feet. To climb on 060°M to 16,000 feet. Do not proceed above 7000 feet until three minutes northeast of the Wiarton range."

Climb instructions were followed; at 16,000 feet a 20° track correction to starboard was carried out, to make good a track of 107°M. Track was established around 35,000 feet; I topped all cloud at 36,000 feet. Here I tuned in the North Bay range, identified it, and selected the compass position. The compass indicated the range as being a few degrees off the nose.

North Bay approach was contacted nine minutes out. I was cleared to the beacon and told to stand by. Although the beacon was weak, the idents were readable. When the ARN6 was switched to the compass position, I had to make a heading change from 107° to 010°, to home to the beacon.

About five minutes later I contacted North Bay and requested further clearance. I was told that they had been trying to contact me so I assumed I had intermittent radios. Now, however, I was cleared to the beacon, to descend to and maintain 25,000 feet. At 30,000 feet the static was heavy enough to make the beacon idents unreadable. I slowed the aircraft to 220K to improve the readability but had little success.

When I asked for an ADF steer on 137.7, approach advised me that my readability was strength one-half; but I was given a steer of 010°. When I requested an ADF approach, I was informed that there was no qualified controller on duty.

About four minutes later I was told to steer 195°. I decided to climb back to on-top conditions and head for the range, because it was the stronger of the two signals. When on top, the range indicated that a southbound heading was required, but the beacon indicated a northbound heading.

At this point I went to GCA and tried to establish contact by IFF. This didn't work, so I advised approach that I intended to contact GCI on 141.66.

After many minutes I was in radio contact with GCI. IFF contact could not be made squawking all modes, including an emergency squawk. They advised, "No contact your squawk four."

During this time I was attempting to set myself up on a lost orientation on the range station. The quadrantal heading of 135° put the range station on the nose, but I couldn't get any significant volume change.

Here I lost contact with the GCI site, and had only 100 gallons of fuel left. My last weather report from North Bay indicated a 4000-foot ceiling. I decided my best course would be to descend and orient myself.

Descending on a heading of 135° with the North Bay range indicating on the nose, I broke out at 4000 feet, over water. This, I hoped, would be Lake Nippissing but a check on the letdown plate indicated it would have to be in another quadrant. Visibility was five to seven miles at 1100 feet under a scattered layer of cloud.

After continuing on 135° for some time, I saw land. I had been trying to contact North Bay on 121.5 but when over the land I realized I must have passed over Lake Ontario and was now on the American side.

At this point I declared a MAYDAY. I received answers from several stations; Griffiths advised its approach radar would try to make contact. I described my position: a small town, river, and highway, running about 130°. The highway led to a four-lane highway. Here I turned and followed traffic.

Syracuse tower said they thought I might be in their area, by my description of the terrain and the power of my transmissions. Since I now had 45 gallons left, I considered landing on the highway, as westbound traffic was light.

About this time I saw the outskirts of a city, and an airstrip. With 40 gallons of fuel remaining I decided to land there. I let down to 400 feet to check the runway surface, when Syracuse tower advised that they had me in sight. I pitched and landed down wind (10K), with 40 gallons on board.

In summation, I made the following errors:

- As captain of the aircraft I did not check the flight log for accuracy. At the same time I was not familiar with the route, and still didn't pick up a 65° heading error.
- I declared my MAYDAY much too late. It is well known that jet navigation is accurate within a few miles and minutes. When an error of more than five minutes exists on a 20-minute leg, there is a mistake somewhere. A PAN call would have given me all the assistance possible, as I was in the Toronto-Trenton area.
- By letting down blindly, I ran a great risk of running into high terrain—plus the considerable cut in my endurance and VHF range.

My recommendations are very simple:

- Do NOT accept another man's flight log without first checking it yourself.
- Be familiar with your route and nearby aids.
- Let people know you are in trouble. Don't be proud! They are there to help you. ★

· TWO POINTS OF VIEW ·

"Never bother with glasses, 20-20, you know." "Sorry, sir, but your airplane is over there."

· · · · ·

· T-BIRD QUIZ ANSWERS ·

1. Throttle off, request barrier (if installed), wing flaps-UP, apply brakes, canopy full open, jettison tiptanks (if they contain fuel).

2. Maintain flying speed and control until touchdown is made. Throttle: Off, landing/gear: Down, tiptanks: Jettison, Approach: Straight ahead if possible; speed brakes: Up, wing flaps: Down, main fuel shut-off switch: Closed, canopy: Jettison (after TD), shoulder harness: Lock, battery and generator or battery generator switch: Off (before TD).

3. If accompanied by symptoms of fire, explosion, smoke overheating, or vibration indicating mechanical or materiel failure, eject or make forced landing. Otherwise use the following: fuel switches: Gangload, thottle: Retard to 80-96%, check for fire; emergency fuel switch: Emergency, fuel filter de-ice switch: On. Actuate for 30 seconds. Land as soon as possible, using a flameout pattern.

4. Attempt another airstart using main fuel system if there is no indication of mechanical or materiel failure. Otherwise eject or make forced landing.

5. If the hydraulic pressure gage indicates no pressure, operate the ailerons to determine if gage is faulty. If the pressure is lost, follow procedure for aileron boost failure and use emergency procedure for extending the gear.

6. Open canopy electrically or mechanically. If this fails, eject through canopy.

7. Release trigger and squeeze again. If this fails, bail out from inverted position.

8. Manually open belt, kick free of seat and pull lanyard above 14,000 feet. Pull D-ring below 14,000 feet.

9. Engine fuel pump failure will cause flameout. With engine fuel system No. 1 gangload, switch to "Emergency Fuel"; airstart ignition, and use AUTO starting fuel. With engine fuel system No. 2 gangload "Emergency fuel," airstart ignition and starting fuel to MANUAL.

10. Consume fuel from syphoning tank as rapidly as possible. Land immediately to preclude fire.

11. Switch to standby inverter.

12. For runaway trim (nose-down): override switch to "nose-up," speed brakes down, retard throttle. For runaway trim (nose-up): override to "nose-down," forward stick pressure, retard throttle.

13. Turn on pitot heat. Request chase plane to monitor traffic speeds or make radar or ILS power controlled approach.

14. Descend to lower altitudes to prevent frost accumulation. Jettison canopy if fuel is low and frost can not be removed. Land as soon as possible.

15. If you decide not to abort—throttle open, jettison tips, gangload, emergency fuel on, watch EGT and RPM, gear-up, 30 sec. of de-ice, maintain at least 130K flaps up, and get it back on the ground, using flameout pattern.

16. Gangload fuel switches, 80% to 96% RPM, check for fire, emergency fuel on, 30 sec. of de-ice, land from a flameout pattern.

17. Check for fire, oxygen 100%, battery-generator switches off, pressurization outlets closed, dump cabin pressure, temperature rheostat to cold, defroster off, speed boards down, cockpit ram air to open, jettison canopy if smoke increases. Land.

(Not too good a score? Then, get out the Dash One and have a session with it.) ★

FOAM ON FOAM

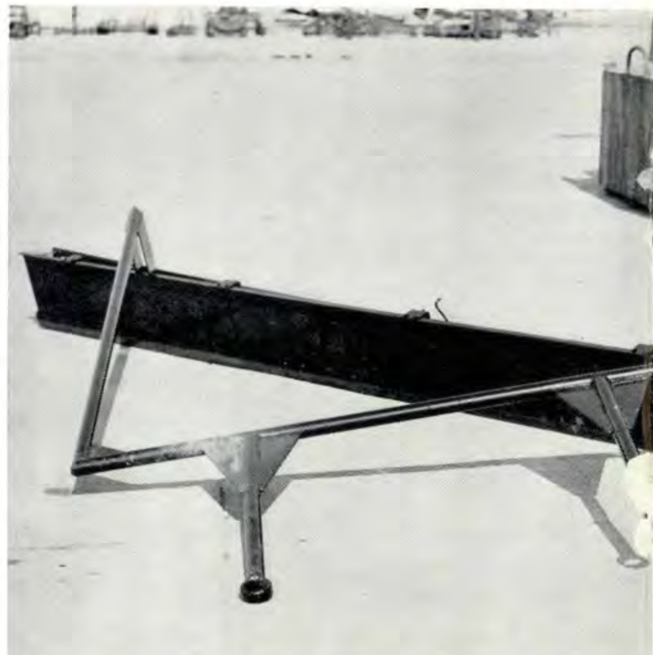
One problem often creates another. Kelly Air Force Base found this out several years ago when it solved the problem of laying foam on the runway for emergencies by converting a refueling trailer to a foam dispenser. The trailer worked very nicely by spreading a foam strip, varying in size from 11 x 6400 feet to 23 x 3000 feet, in one pass down the runway at 12 miles per hour.

The second problem, however, was how to remove the foam in order to open the runway as quickly as possible. The old process—washing the foam off with water trucks or sweepers—was too slow. The Kelly AFB Fire Department, assisted by Lt. Col. Hubert L. Goodman, Civil Engineer, and Capt. J. N. Brown, Jr., SAAMA Flying Safety Officer, attacked the problem and developed a "squeegee" type foam remover. Built mainly from scrap material, the remover resembles the blade of a road grader, but has a rubber edged blade to prevent damage to the runway. It is designed to be attached to the rear of a fire truck, model 0-11-A or 0-11-B, but with modification can be used on any vehicle.

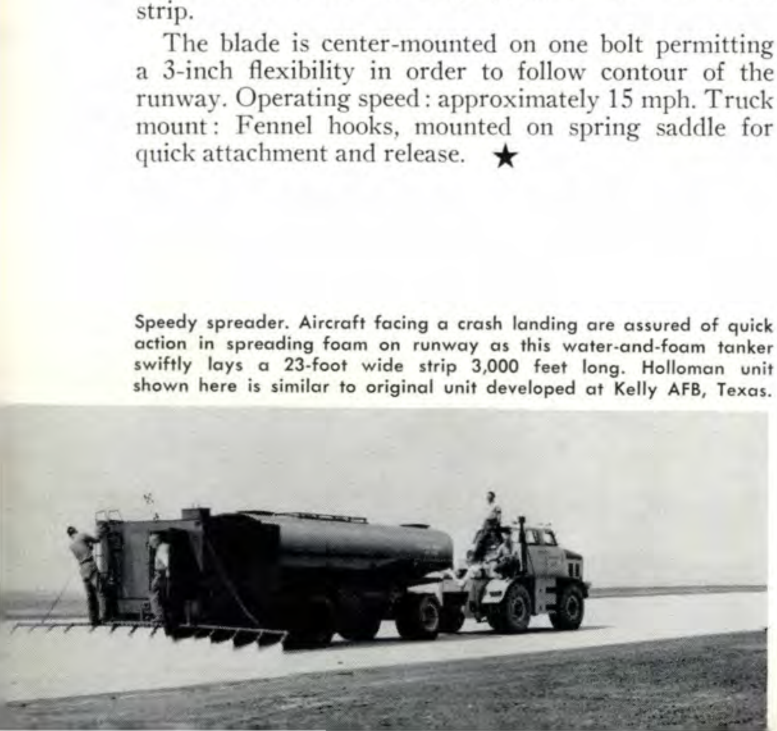
The blade sweeps a path 15 feet wide. Assuming a 20-foot wide strip of foam covers the center of the runway, two passes by the four Kelly units could clear the runway in about 15 minutes. One pass with the sweepers would move the foam blanket 60 feet from the centerline, at a speed of 15 miles per hour.

More information about this equipment can be obtained from the Chief, Fire Protection and Aircraft Crash Rescue Branch (SABAF) or SAAMA Flying Safety Officer (SATF), Kelly Air Force Base, Texas. Specifications: Length of Blade: 16 feet; height: 14 inches; rubber squeegee: 2 or 3 strips, ⅜ inches thick and 3 inches wide; rear strip: ½ inch wider than front strip.

The blade is center-mounted on one bolt permitting a 3-inch flexibility in order to follow contour of the runway. Operating speed: approximately 15 mph. Truck mount: Fennel hooks, mounted on spring saddle for quick attachment and release. ★



Speedy spreader. Aircraft facing a crash landing are assured of quick action in spreading foam on runway as this water-and-foam tanker swiftly lays a 23-foot wide strip 3,000 feet long. Holloman unit shown here is similar to original unit developed at Kelly AFB, Texas.



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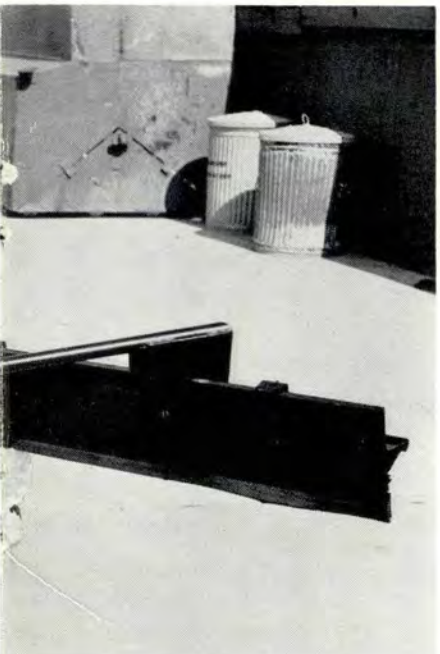


A king-size squeegie makes an excellent foam-remover. Details of simple device are shown in picture at left. At right, it's attached to fire truck. Quick removal of foam is shown in lower photo as trucks in tandem, each cutting a 15-foot swath, move swiftly down the runaway. Four of these units can move a 20-foot wide strip 60 feet from centerline in about fifteen minutes.

SOMETHING'S BEEN

In the operation of jet aircraft the formation of ice has long been a prevailing problem. Moisture, ever-present in jet fuel, freezes and accumulates as ice on critical components within the fuel system. By freezing certain valves into the open or closed position this ice destroys the pilot's capability to regulate fuel flow from various tanks within the system. In the more severe cases, ice may build up to a degree in which it completely blocks the flow of fuel to the engine, causing an engine flameout. This problem has not been limited to piloted aircraft alone but has also been detected in missile systems using a jet engine power source.

In efforts to solve this problem many design modifications in both the aircraft system and in the ground fuel servicing equipment have been made. Although these modifications have alleviated the problem, it cannot be said that a complete or even adequate solution has been provided. To acquire such a solution an extensive program has been conducted by the Wright Air Development Division to investigate the possibility of utilizing a chemical compound as a jet fuel anti-icing additive.

Before presenting in detail the anti-icing additive program, certain factors related to the icing problem must be presented to provide an understanding of the capabilities required of such a compound or of any ice-preventing mechanism for jet aircraft.

In the design of a jet engine fuel system it is necessary to have a very close control on the flow of fuel to the engine. In meeting this requirement the fuel controller in the jet engine must have smaller clearances and closer tolerances than the device controlling the flow of fuel to the reciprocating engine. To assure that the fuel is rid of contaminants prior to burning, the system must also possess fine strainers. Since jet engines utilize from five to eight times as much fuel per unit time as is used by the reciprocating engines the jet aircraft fuel system must handle much higher fuel flow rates. Although fuel used by the reciprocating engine may contain the same amount of moisture as a jet fuel, the jet engine system will be tolerating five times as much as the reciprocating engine in the same amount of time. Then too, the mechanisms within the jet system will require much less ice to become clogged or jammed.

Although the design of jet fuel systems presents a major contributing factor, the fuel icing problem is also made more difficult by certain properties of jet fuel itself. First, jet fuel is more difficult to rid of excess moisture than gasoline. If the settling rate of water in each of the two fuels is compared, it is found that minute particles of water will settle four times faster in gasoline than in jet fuel. To illustrate, a 5 micron particle will settle about 4 inches per hour in JP-4 and about 1½ feet per hour in aviation gasoline in the same time. Hence, jet fuel must remain dormant longer to get rid of an equivalent amount of moisture. Experience has also shown that filtration characteristics provide additional difficulties. Filtration devices used at Air Force bases to separate water from fuel can only perform satisfactorily with jet fuel when operating at two-thirds the flow rates representing their capacity for aviation gasoline.

Although rigorous precautions are taken to assure that fuel being pumped aboard an aircraft contains as little water as possible, an aircraft containing fuel with no moisture is an impossibility. This is due primarily to the great affinity which jet fuel has for water. Even if fuels are prepared, handled, and used without ever contacting liquid water, they will contain moisture picked up from the air. The extent of such water pick up would depend on many factors, the principal ones being temperature fluctuations and the relative humidity of air contacting the fuel.

Four factors which have great significance in considering the problem of fuels containing moisture and the conditions to which they are exposed are especially pertinent:

- **Dissolved Water.** As illustrated in Figure No. 1 the water saturation value of jet fuel varies greatly with temperature. This solubility relationship follows Henry's Law rather closely; however, the Henry's Law Constant depends upon the fuel composition as well as the temperature. In general, it can be assumed that the water content of a saturated fuel is equal to the fuel temperature in parts per million by volume, that is, saturated fuel at 75°F will contain 75 parts per million while the same fuel at 10°F contains only 10 parts per million. Although these figures seem quite small, it can readily be seen that they represent a hazardous quantity of potential ice when the fact is considered that certain jet aircraft use tens of thousands of gallons of fuel per mission. The icing problem arises when a warm, saturated fuel is serviced to aircraft and is cooled during flight. Supercooled droplets coming out of solution form a hard glazy ice when contact is made with metallic fuel system components.

- **Dispersed Water.** The small difference between the specific gravity of water and jet fuel (1.0 to 0.77, respectively) complicates the task of removing excess water. Although in practice adequate settling time is given in the storage tanks, water can become entrained in such fine particles that it is impossible for it to settle in a reasonable length of time or to be separated from the fuel by filtration coalescers.

- **Tank Condensation.** Perhaps the primary source of water in the fuel systems of jet aircraft is condensation within the fuel tank magnified by the "breathing" of the tanks while the aircraft is in flight. This has been verified by reports of dry fuel consistently being added to aircraft and yet quantities of water repeatedly being drained from the fuel tanks of the same aircraft after each flight. When the aircraft is at high altitudes, fuel is in contact with a relatively dry atmosphere and loses much of its moisture. However, much of the moisture which leaves the fuel condenses when it contacts the upper cold surfaces of the tank. Droplets then form and migrate to the tank bottom. When de-

ADDED

scending, the aircraft again enters a moist environment (cloud formation, etc.), and due to the increase in external pressure an appreciable quantity of water is forced into the tank through the vent system.

• **Frozen Sump Drains.** To keep fuel "icing" at a minimum, Air Force operational units have a requirement for draining excess moisture from the sumps of fuel tanks between flights. However, this requirement is impossible to meet during the winter months at the Northern bases. The water present in the tank seeps into the jiffy drain fittings and freezes rapidly when the aircraft is exposed to low temperatures. Thus the drain is inoperative and throughout the winter ice builds up within the tanks. Then when thawing temperatures are encountered, the ice breaks away in chunks to clog the critical system components.

The degree of fuel systems icing depends largely on the type of aircraft or missile in question and on the type of mission profiles (flight time, altitude, etc.) accomplished. Methods, other than fuel additives, which have either been used or proposed to eliminate this icing are as follows:

• **Exclusion of water from fuel.** This is an ideal solution but cannot be realized in practice. The recent introduction of more efficient water separators is to be commended and will to some extent alleviate the problem. Such devices cannot be expected to remove all water since a reasonable quantity will be obtained during flight. Then too, these separators do not remove dissolved water from fuel.

• **Design changes in fuel systems.** By using larger filters in fuel systems together with the use of fuel controls with larger clearances, an aircraft can be made less susceptible to icing. For many systems incorporation of such modifications is very expensive. Then too, it is no real guarantee that the problem will not exist.

• **Use of Fuel Heaters.** The installation of fuel heaters is one of the adopted solutions to the fuel system icing problem. Use of this device will very effectively prevent ice formation but can only do so for a localized area. Then too, a weight penalty must be paid in incorporating heating devices into the systems.

Although past experience with additives to prevent fuel system icing has been somewhat limited, results obtained in using this approach have demonstrated its effectiveness. During the winter of 1959 the Air Force tested a particular additive under field conditions at a cold weather base. From this test it was concluded that the use of a chemical additive to combat fuel system icing is feasible. While the particular additive tested was not completely satisfactory, there were no inflight malfunctions during this test which could be attributed to icing of the fuel control or screens in the main fuel feed line. Further, it was possible to drain water from the fuel tank sumps at below freezing temperatures. The additive could not, however, be considered for Air Force use since it was found to cause deterioration of a material used in the tanks of certain aircraft.

A program to provide for an additive which would

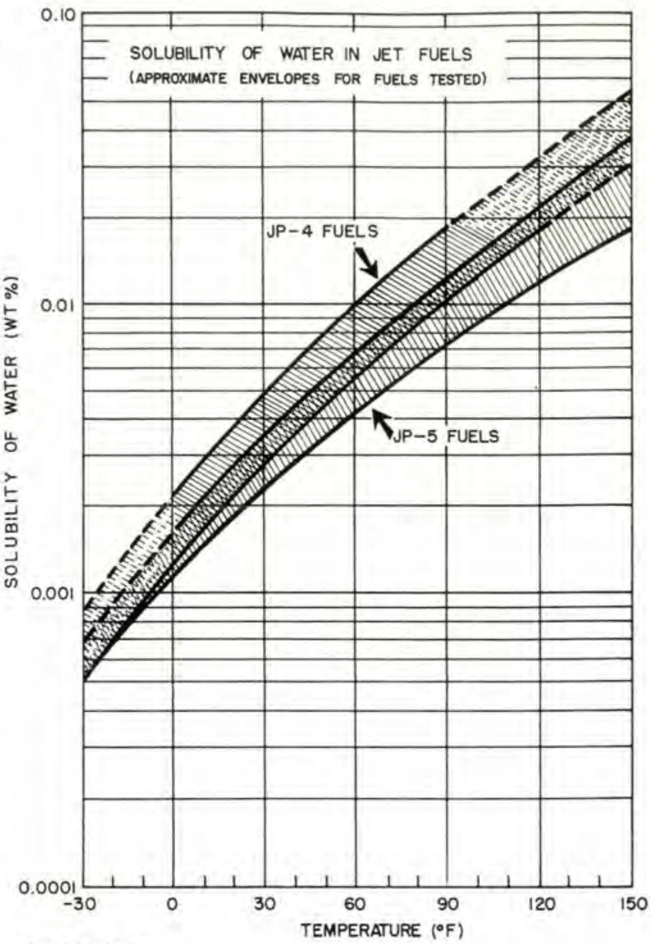


FIGURE ONE

be compatible with aircraft system components as well as effective as an anti-icing agent was initiated by WADD immediately after the conclusion of the test at the cold weather base. Tests were developed to evaluate candidate compounds at WADD and Boeing Laboratory facilities.

To obtain additive candidates for testing, WADD presented the icing problem and the solution offered by additives to all oil and chemical refiners. A request was made for these organizations to submit samples of materials within their inventory for testing. These were to be "off the shelf materials," nothing to be developed. In the event that no commercially available material could be found, WADD established two research contracts to study the basic chemical structures and properties required for a compound to be an effective and compatible jet fuel additive. This could lead to the rapid synthesis and development of a satisfactory material.

This program was set up so that all promising materials were to be evaluated by both WADD and Boeing in the laboratory. Upon meeting the criteria presented in these evaluations, a compound was to be engine tested, flight tested, and service tested prior to approval for use by an operational command. Although flight testing and service testing would be conducted on B-52

This equipment is used to inject anti-icing additive into jet fuel at WP-AFB.

and KC-135 aircraft, laboratory tests were established to measure the effect of the additive candidates on system materials representative of those utilized in all USAF aircraft.

Sensing the potential market if a compound within their inventory could qualify, industry responded to this program by submitting over 150 compounds for evaluation. Approximately the same number of different compounds were studied by USAF contractors in an effort to correlate chemical structures with anti-icing and aircraft compatibility characteristics.

Despite the large number of additives evaluated, only one material could qualify for an Air Force service test. This material is utilized at a concentration of 0.1% (by volume).

The capability of the material was demonstrated in a flight test conducted at the Wichita Division of Boeing Airplane Company on a B-52G type aircraft. During this test conditions were set up to simulate the most extreme "icing" conditions that could be encountered in the field. These conditions were obtained by adding 2cc of water to each gallon of test fuel utilized by certain engines of the aircraft. This fuel was segregated so that two heaterless engines burned fuel with the additive present while one heaterless engine utilized the same water-conditioned fuel with no additive.

On five 10-hour missions conducted using this fueling configuration, three flameouts were experienced on the test engine utilizing non-additive fuel. No flameouts or icing malfunctions were experienced on engines utilizing additive fuel. One 24-hour mission was accomplished to provide a longer "cold soak" of the test fuel. Ice free operation was again experienced with the additive present, although a flameout was encountered in its absence.

In a second phase of the flight test the conditioned fuel was cooled to —55°F prior to loading it aboard the aircraft. This fuel contained 100 parts of water to one million parts fuel (the 2cc H_2O/gal utilized in the previous phase represents approximately 800 parts per million). On each of three 10-hour missions accomplished in this phase a flameout was encountered on the test engine utilizing conditioned fuel without the additive. The additive again eliminated flameouts and icing malfunctions even though water-conditioned fuel was used on four of the remaining engines.

A third phase of this flight test, conducted to further establish the compatibility of the additive with the aircraft system components, included continuous flying which exposed certain components to the additive and others to non-additive fuel. Periodic inspections were conducted to determine the significance of any effects produced by the additive on the components. The last inspection conducted after 309 flight hours and 202 days exposure to additive fuel revealed no incompatible effects resulting from additive usage.

The results of inspections conducted on the test aircraft are particularly significant since the B-52G system contains component materials representative of those utilized throughout many aircraft systems. Then too, this type aircraft possesses a fuel tank topcoating which laboratory results have shown is more susceptible to additive attack than any other fuel system material.

To verify the promising results of the laboratory and flight tests of the additive, a service test was initiated on 5 August 1960 at the 4043rd Strategic Wing, Wright-Patterson AFB, Ohio. This test, conducted under the auspices of the Offensive Systems Engineering Division, WADD, included the continuous use of the additive by all aircraft assigned to the 4043rd facility (15 B-52Es and 10 KC-135s). To date these aircraft have accumulated over 2000 flight hours utilizing approximately seven million gallons of additive fuel. Periodic inspections of the service test aircraft have revealed no adverse effects resulting on the component materials. No fuel system malfunctions attributable to fuel icing or to the fuel being utilized have been encountered. Sump draining of aircraft tanks has been accomplished at temperature well below freezing with no frozen drains reported.

Results obtained in the laboratory, flight, and service testing of the additive were reviewed at a meeting of SAC, AMC, WADD, and various representatives concerned with the additive test program. Use of the additive on a SAC-wide basis was approved by the representatives. This approval, however, did not authorize immediate use of the material by operational commands. Prior to such use funds must be made available to provide for the additional cost of additive containing fuel. The additive which is commercially available will increase the cost of jet fuel approximately 0.3 of one cent per gallon. [*Ed. Note. Latest information indicates the cost would be .2c per gallon, or less.*]

Also, preceding implementation of the additive by SAC, the point of additive addition must be established. Although an additive injection unit was utilized at the 4043rd Strategic Wing to provide additive addition between the base bulk storage and the flight-line ready tanks, it may prove feasible to provide additive incorporation at a point earlier in the fuel distribution system, possibly at the refinery. Refinery injection would be favorable since base level additive addition would increase base maintenance requirements. Tests have been initiated to determine the feasibility of additive injection at the refinery.

The intent of the additive program is to provide a fuel containing the additive for all USAF Commands. Since the testing of the additive is considered applicable to all Air Force systems utilizing jet fuel, it is anticipated that approval for USAF-wide adoption will be given in the near future. Once approved, the estimated date for actual additive implementation must be based on procurement lead times required to provide the necessary additive injection units. ★

1st Lt. John A. Hager, Wright Air Development Div., W-P AFB, Ohio

Technical Sergeant

Marion Hinson

On the morning of 28 January 1960, Technical Sergeants Marion E. Hinson, Search Operator, and Allen F. Heiser, Final Controller, 1297th AACS Sq, Lincoln AFB, Nebraska, were at their duty stations. The weather was bad; 500 feet overcast, with five miles visibility in fog. At 0707Z, they were informed by the tower that LAIR 47, a B-47, was in a penetration turn and was to contact GCA on channel 17 for a GCA approach. Meanwhile, the tower had not received any subsequent transmissions from the B-47.

Finally, LAIR 47 squawked emergency IFF and TSgt. Hinson immediately established radio contact on guard frequency (243.0) by utilizing IFF replies. He knew there was another aircraft southbound and making a surveillance approach north of runway 17 at the same time LAIR 47 was northbound approximately six miles south on a collision course. Sgt. Hinson quickly issued instructions to provide a separation.

WELL DONE

By making use of the IFF replies, Sgt. Hinson determined the nature of the emergency and all other necessary information. LAIR 47 had no operating transmitters. TSgt. Heiser carefully guided the aircraft through one surveillance approach but the pilot was so blinded by the landing lights reflecting in the fog he missed the approach.

The two sergeants controlled the aircraft in a closed traffic pattern and this time the surveillance approach was completed without further incident. The B-47 landed safely at 1735/Z.

Sgt. Hinson and Sgt. Heiser demonstrated a high degree of professionalism and superior knowledge of their duties in saving the lives of the crew and a valuable airplane. Well done, TSgt. Hinson and TSgt. Heiser! ★

Technical Sergeant

Allen Heiser

CAUSE FOR

Capt. Kenneth M. MacCammond

I wonder how many pilots have arrived over their destination smugly thinking, "This is *one* flight that was perfectly planned," because all along the way the ETAs were within tolerance, and fuel consumption worked out within a few pounds. Then, on contact with the tower the pilot finds—much to his complete surprise—that the only runway available is closed for two hours due to construction. Result: He has to hold or change his flight plan to some other place he did not plan for, want, nor intend to go.

What caused this dilemma?

• Did the pilot fail in preflight to properly and thoroughly flight plan through the omission of the NOTAM check?

• Did he understand the NOTAM still encoded, even though it was in the file?

• Did he think it unimportant because it was still encoded?

• Was there a NOTAM actually in the file, describing this hazard to flying safety?

• Was the cause for this dilemma the fault of the pilot, or should it have been attributed to the NOTAM system?

Call it "pilot error," "an inadequate system" or both. They do become apparent when a destination base operations attempts to notify an inbound flight that its arrival will be during a scheduled runway maintenance period NOTAM'd: "RUNWAY CLOSED MONDAY THRU FRIDAY UNTIL FURTHER NOTICE." Some flights must be contacted en route through ARTC and advised of such conditions. In the interest of flying safety, an advisory is issued to assist a pilot to decide early enough to change destination. With an early decision assured, a pilot isn't likely to arrive over the intended destination critically short of fuel, thereby limiting the scope of possible alternate action.

Much has been written about flight planning, *careful* flight planning, *thorough* flight planning. Many flight planning checklists have been devised, including the preflight step: *Check the NOTAM File!*

Why is it, then, that a pilot flight plans thoroughly *except* for checking the NOTAM file?

• Has he landed at the planned destination so often that he thinks he is familiar with every NOTAM at this station?

• Or, in the past, has he checked the NOTAM file and found many of them had little or no reference to flying safety, so in the interest of speeding up his preflight planning, he leaves out this important step?

• Could it be that when he consulted the NOTAM file he found them encoded and was too rushed to locate the decoding key to find out what they really said?

It may be that the really important NOTAM was buried in some lengthy "cautions while taxiing" in certain airdrome areas, or other admonishments to be careful. Rationalizing NOTAM complacency with deficiencies, we can expect complacency to continue until certain of these deficiencies are corrected. Let's take a look at some of the deficiencies:

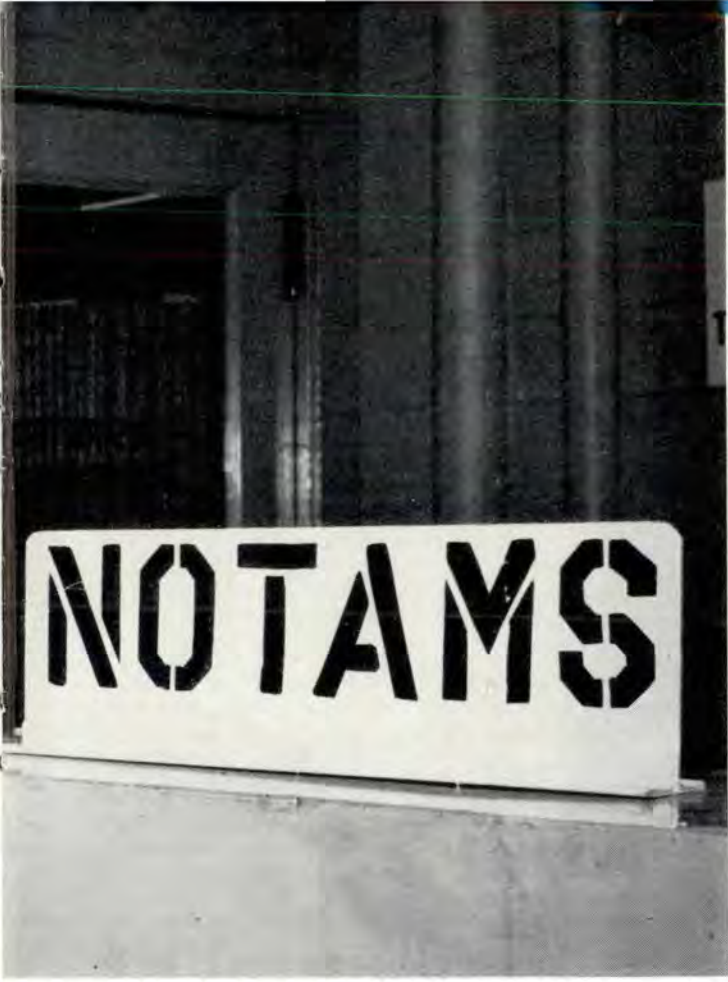
• NOTAMS from the FAA on civil en route navigational aids are not extracted from weather observation sequences for inclusion in the files. If a pilot wants to check the latest status of en route navigation aids, he must refer to the Airman's Guide and the latest FAA hourly aviation weather observation. If he does find NOTAMs appended to any of the en route stations, he must decode them to see if they concern the navigational aids he expects to use.

• NOTAMs are not being reviewed by a competent authority before transmission. This should be done to insure that adequate coverage has been given to hazardous or safety of flight conditions, and to delete NOTAMs not considered pertinent. A designated competent authority should have adequate NOTAM experience and be able to make the right decision on the information to be disseminated.

• Dissemination of NOTAMs must be speeded up. Accidents have occurred because pilots lacked essential information. More stringent operational requirements demand that unnecessary delays be eliminated and handling time reduced.

• Some NOTAMs are too lengthy. They should be concise, yet adequate. A separate NOTAM should be published for each hazardous condition.

• NOTAMs should be absolutely correct when



DILEMMA?

1854th AACS Fac. CKO Flt, Randolph AFB, Tex

transmitted. It would be better to have none at all than to have one that is not correct. And each NOTAM should be handled with utmost care.

While the above-mentioned deficiencies do not make up the complete list, they do illustrate problem areas. In solving the NOTAM problem, one approach would be to scrap the present system and adopt an entirely new one. But unless and until that happens, we must live with what we have now, so what can we—as individual pilots—do to improve our lot?

First, the basic NOTAM regulation (AFR-100-52) gives a definition of the NOTAM and an explanation of what it should contain. The definition: "A notice containing information concerning the establishment, condition, or change in any aeronautical facility, service, procedure, or hazard; the rapid distribution of which, to personnel concerned with aircraft flight operations, is essential for the safe and efficient operation of aircraft."

This definition is broad and vague. Therefore, in order to understand NOTAMs better we should become more familiar with them through habitual use. Once we achieve the habit of checking them we should attempt to eliminate every discrepancy found, and improve this preflight aid. From our basic flying regulation another reason for attempting to improve NOTAMs is: They are directive upon all pilots flying Air Force aircraft. This regulation states that pilots, *before beginning flights,* will familiarize themselves with all available information appropriate to the intended operation, including a careful study of current available NOTAMs.

Under another AF Regulation (96-12), permanent type notices concerning facilities should be submitted for publication in the Enroute Supplement. This regulation states that base commanders will report to the Enroute Supplement publishing agency all corrections (to facilities) brought to their attention even though the pertinent installation or navigation aid is not under their jurisdiction. Therefore when permanent NOTAMs are discovered they should be submitted to the Enroute Supplement. Upon publication, they should *not* go in the file since this information is now with the pilot as he flies.

The importance of checking the Enroute Supplement during preflight planning cannot be emphasized too strongly. According to our basic flying regulation, this publication is also directive upon all pilots. Here's an example of how embarrassing a situation could be, should a pilot not check the supplement: The following advisory was received from a certain destination, "Destination airdrome runways closed until three hours after your ETA. Check your Enroute Supplement."

How would you like to receive an advisory like that? Could be embarrassing, couldn't it?

Another avenue open to all pilots for reporting anything that comprises flying safety is the Operational Hazard Report (the OHR). This means of reporting hazardous conditions is an excellent method of getting the attention and action necessary to correct them. Any time anything is found in a NOTAM file which is a hazard to or compromises flying safety in any way, it should be reported on AF Form 457 (OHR). These forms may be obtained from base operations. Upon completion, they should be turned over to the Flying Safety Officer.

In summarizing why every pilot should make it a habit to consult the NOTAM file, these reasons stand out:

- First and foremost is the intent of NOTAMs: to promote flying safety.
- Second, NOTAMs are directive upon all pilots as established in regulation and failure to consult the file leaves a person open to severe criticism.
- Third, every pilot should monitor closely any NOTAM so as to improve and economize on this extravagant—yet worthy—use of communicative media.
- Fourth, each pilot discovering NOTAMs compromising flying safety in any way should report this operational hazard through proper channels.

The NOTAM device to promote flying safety could and should be better than it is but this situation cannot improve without everybody's help. The quality of NOTAMs depends upon all of us. So until a better method is devised, let's get the most out of our present system. ★

NO SPARKING

A commercial DC-6 airliner was on the ramp at Chicago's Midway Airport being refueled. Aboard were the outgoing crew and five passengers—two women and three children. A ramp tractor, which had been used to pull two baggage carts to the plane, was parked under the No. 4 nacelle, with its engine running. When the required amount of gasoline had been pumped into the No. 3 main tank, the fueler closed the nozzle—and the fuel hose burst! A spray of gasoline, estimated to be 35 feet high, rapidly covered the No. 4 nacelle, the tractor, the baggage loader, and the forward section of the fuselage (including the fueler on the wing).

Observers reported that fire broke out first under the tractor, then suddenly burst over the entire contaminated area. Passengers and crew quickly escaped via the loading stand which was free of flame. The fueler, a mass of fire, jumped from the trailing edge of the wing and ran in terror until he was intercepted by ramp and service personnel who succeeded in extinguishing the flames that enveloped him. In a matter of minutes firemen had controlled the fire on the airliner.

The result? One person critically burned and injured, one severely burned, one with minor burns, one fireman overcome by exhaustion, plus one damaged DC-6 aircraft which had to be dismantled and shipped to the manufacturer for rebuilding.

Again, a T-bird was serviced and readied for takeoff from an Air Force Base on the West Coast. The pilot, alone in the aircraft, smelled smoke just before he started his takeoff run. Glancing back, he found the canopy filled with smoke. He reported the fire to the tower, then taxied back to the line. It was discovered that the rear seat and parachute had burned as the result of sparks thrown into the rear seat by the service equipment. The result? Actually a very small amount of damage. The potential? One pilot, and T-Bird.

What is the link between these two accidents? It's this: In both instances sparks from the exhaust of ground support equipment were the immediate cause or a major contributing factor. This emphasizes the importance of the proper installation of exhaust spark arrestors in compliance with T. O. 36M-1-5.

Despite good fueling practice and safety-conscious personnel, there inevitably will be fuel spillage. For example, the daily variation in temperature at many of our bases is sufficient to cause expansion to the point where several gallons of fuel can be forced from a full fuel tank. So, accepting the practical certainty of occasional fuel spillage, we must rely on measures that will prevent its being ignited. It is axiomatic that aircraft fuel and sparks do not combine to form the happiest safety conditions, and ground support equipment is by far the most common source of sparks on the line. On this type of equipment, spark arrestors are the most efficient devices for suppressing danger-laden particles, glowing with heat, which emit with the exhaust from any internal combustion engine.

Spark arrestors should not be confused with intake flame, or flashback arrestors used on the engine intake to prevent any flashback that might occur during starting, if timing were incorrect, or if the ignition wires were crossed. The spark arrestor separates and traps particles of hot carbon, scale, or other solids, from the exhaust stream of an internal combustion engine. It is applicable to all such engines—gasoline, diesel, 2 cycle, or 4 cycle. It protects against a hazard that continues as long as the engine operates, in contrast to the occasional hazard treated by the flashback arrestor.

Probably everyone knows that sparks emit from the exhaust of internal combustion engines, with the amount varying with the condition of the engine, its speed, and the type of fuel. However, few of us are aware of the number and size of particles. Accompanying photographs graphically show the shower of sparks from a generator during a 20-second period. The size and composition of particles caught by spark arrestors vary in size and weight. Larger pieces are of a very dense metallic substance which will retain considerable heat over a fairly long period. They are common in the exhaust streams of gasoline powered generators, compressors, or refueler engines.

In one 39-month period a western base experienced a series of fires directly traced to sparks from the exhausts of internal combustion engines. Its report read like this:

- Sparks from a truck tractor ignited spilled gasoline.
- Sparks from a vehicle ignited spilled gasoline.
- Sparks from a Diesel generator ignited rope fibers and chock block underneath an aircraft.
- Sparks from a Diesel generator ignited rope fibers, which in turn set fire to a pile of lumber.
- Sparks from an engine ignited dry grass.
- Sparks from an engine generator set ignited stored material.

Happily, none of these caused severe damage or personal injury. But no accidental fire can be termed unimportant, and when the cause is definitely determined, a continuation of the hazard is foolhardy—especially when it involves equipment working near extremely flammable material.

Spark arrestors are comparatively simple devices which mount at the end of the exhaust pipe, or may in certain cases be installed at some intermediate point in the exhaust system. The original design for one of the most efficient spark arrestors was created and designed by F. Raymond Gill, a civilian fire prevention officer at McClellan Air Force Base in California. Several hundred units of Mr. Gill's design were built and put in service at that base during 1955, and are still

giving satisfactory service. The arrestors act to trap the potentially dangerous spark particles before they can emerge with the exhaust. They come in a variety of sizes and shapes applicable to any conceivable individual requirement. For example our company offers 14 different arrestors, rated from 85 to 1400 cubic feet per minute flow, and ranging in weight from one to 12 pounds. With adapters, they will all fit any standard size exhaust.

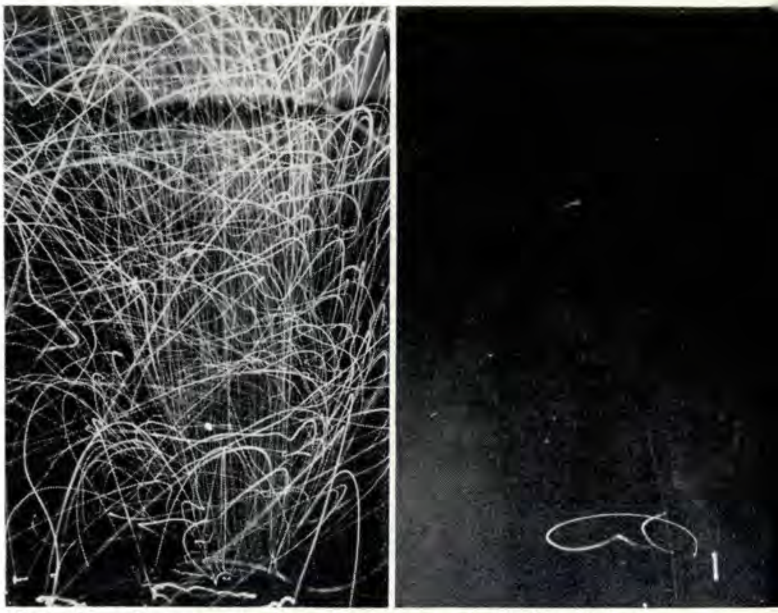
Three major factors determine the quality of spark arrestors—their efficiency, the amount of back pressure they contribute to the exhaust system, and the ease with which they can be serviced.

Efficiency of spark arrestors is measured by their ability to trap potentially dangerous sparks before they are blown out the exhaust. There is only one reason for employing these devices, and that is to prevent fires—and as the efficiency of the arrestor rises so does the probability of safe operation. MIL-A-27302 (USAF), 6 November 1959, requires that an arrestor trap 95% of carbon particles, from .0232 to .046 inch in size.

An arrestor which meets this stringent specification will remove practically all sparks from the exhaust stream. This is particularly true of the larger, and thus more dangerous, particles which have been observed to travel some 50 feet from the exhaust stack under certain wind velocities. The sparks which do escape the arrestor will be very small in size and will ordinarily lose their heat within three or four feet.

The back pressure contributed by an arrestor is indicated by a rating, stating the volume of gas passing through the arrestor at a given temperature and a specified drop in pressure. A low back pressure, within the limits established by the manufacturer of the engine, will ensure full power and only normal maintenance requirements. If an inadequately rated arrestor is used, excessive back pressure will result in engine damage. One AF base installed a number of unrated and inadequate arrestors on large vehicles; four engines ($1200 each) had to be replaced and a fifth required major overhaul. MIL-A-27302 specifies the combined back pressure limit of the arrestor and the entire exhaust system. The specification also contains information on determining the proper rating of spark arrestors for individual applications.

Ease of servicing and inspection must be designed into the arrestor, if we are to encourage periodic maintenance and ensure proper operation. If accumulated particles are not removed, the trap area will eventually be filled, and the arrestor will lose its effectiveness. A dump port, or cup, should thus be provided for this procedure, and it should be accessible without removing the arrestor from the exhaust.

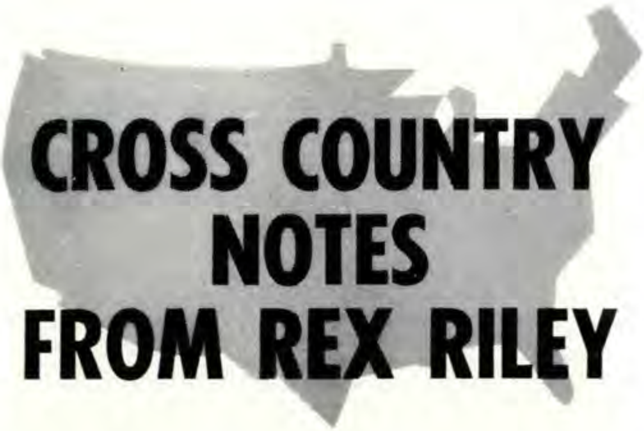


Effect of spark arrestor is shown here. Fourth of July-like display, left, gives idea of hazards resulting from sparks emitted by internal combustion engines. Arrestor nearly eliminated this hazard, right.

All of the above factors are covered by MIL-A-27302, and must be carefully considered in the purchase and installation of spark arrestors required by T.O. 36M-1-5. Arrestors which meet the requirements of this specification will provide the highest safety factor, and when properly installed will not impair engine performance or life.

With the information now available in T.O. 36M-1-5 and MIL-A-27302, plus the advice of company field men, there should be no difficulty in providing all equipment related to flight operations with properly rated spark arrestors. The tremendous potential cost of fires, and the ever-present possibility that a fire could cripple the entire effectiveness of the mission, demand careful compliance with the provisions of T.O. 36M-1-5 regarding the installation of arrestors. However, it is just as important that only those spark arrestors which meet the requirements of MIL-A-27302 be used if maximum safety combined with maximum utility of equipment is to be realized. ★

Art Spleiss, Erickson Products Co., San Francisco, California



CROSS COUNTRY NOTES FROM REX RILEY

At one of the bases where I RON'd recently, first we talked about some specific articles published in Aerospace Safety Magazine. Pretty soon another transient pilot joined us, and he turned out to be an author of one article all of us liked. He is apparently a very busy person too, for his contribution to civic organizations and his participation in club activities—to say nothing of his responsibilities as an Air Force command pilot—are rather outstanding. Then we got to joshing him about his reputation as "a joiner." Our kidding didn't last, however, because he came back with the query, "Why Not Become a Joiner?" He let us know that he meant "to join the contributors!" Much of the conversation drifted to some special articles published in old Flying Safety Magazines (us old diehards feasted on that one). I do believe that many of the pilots are getting used to the name change. At any rate, soon everyone agreed that we could and should help the editorial staff with this magazine by contributing the most useful information. I happened to have a list of the topics for the 1961 program so before we turned in that evening, every transient pilot in that group had made notes of some type. Hope this means that Aerospace Safety can look for some editorial contributions in the very near future. All of you are urged to become a joiner—join the contributors. If you have a suggestion for improvement, if you disagree with a certain article or if you have a story with a safety angle, please put your thoughts and ideas on paper and mail them to the Editor. If your story is published, you'll get the byline. And wouldn't it make you feel pretty good if your "safety story" helped to save another pilot's life? How about making yourself known?

• • •

If you've been reading this portion of the magazine you'll know that Rex has been, is, and will be, on a crusade on flight hazards such as poor NOTAMs, mis-use of Guard Channel, transient facilities, and so forth. According to Rex's one-man survey during his travels the mis-use of Guard Channel is becoming worse instead of better. During his last trip, if an emergency had developed, it's very doubtful that he could have declared the emergency and received help. No joking, this is a deadly serious problem, and it's yours along with every other pilot, tower operator, radio maintenance repairman, and FAA Center personnel.

Air Force Manual 100-24 states: "No transmission will be made on emergency or distress channels except for emergency purposes." Do you suppose this isn't known or that the violators just don't give a hoot and a holler? Take a look at the following complaint reported on an Operational Hazard Report submitted by Reese Air Force Base.

Subject: UNNECESSARY USE OF GUARD CHANNEL, 243.0 Mc. by .... Ground Control.

1340Z, taxi instructions.
1341Z, taxi instructions to Comm. 04-P.
1345Z, taxi instructions to Cess 78-H.
1354Z, "Cess 18-D clear for T. O."
1354Z, "18-E (weather, tax instructions)."
1355Z, "to Comm 64-P taxi instructions."
1355Z, "78-H, cleared T. O." (from an A/C—"you're x-mitting guard").
1356Z, "80-D taxi instructions."
1357Z, "to Cess 18-D instructions / A/C in vicinity (traffic information)."
1358Z, "65-V taxi instructions, T. O. instructions."
1359Z, "Moon 88-E requesting taxi request i.e.: Do you desire an intersection T.O.?"
1359Z, "69-E traffic info."
1400Z, "Say again."

The civilian airport purposely has been deleted. If the FAA would care to have the full report, it will be cheerfully sent.

AACS conducted a 45 day survey specifically for mis-use of Guard Channel. They came up with 645 examples. An important conclusion was reached: "In essence, we do not have a dependable emergency frequency." Unfortunate, but true and we have no one to blame but ourselves.

• • •

Those of you who have questioned the use of landing lights for night takeoff may glean something from a study made of the subject by the Fighter Branch, D/FSR.

The study was concerned with night takeoff accidents and incidents in which only jet fighter and trainer aircraft were involved, and encompassed only those accidents which occurred in 1958 through June 1959. A total of 20 accidents and incidents occurred involving 24 aircraft destroyed or damaged. Fourteen of the accidents or incidents were not considered because they occurred after lift-off and at a time when landing lights normally would have been turned off. That left six accidents or incidents occurring prior to lift-off at both high and low speeds.

The conclusion was that the use of landing lights for takeoff in fighter type aircraft is not necessary for accident prevention and, conversely, should they be used, may become a hazard to safe flight. The Handbooks of the Century Series aircraft make no mention of the use of landing lights for takeoff.

Minor obstructions to visibility are greatly magnified when illuminated, and takeoffs into low ceilings with landing lights on may reflect with sufficient intensity as to cause confusion to the pilot. Formation takeoffs at night with landing lights on, into restricted visibility, could confuse the entire flight, and an overshooting wingman might be blinded. The need to actuate a landing light switch on some aircraft prior to retracting the landing gear may delay retraction during rapid acceleration after takeoff.

These factors overshadow the value of the landing lights when used for purposes of aircraft position identification and observing runway obstructions that are normally lighted and advised of by the control tower. Runway and threshold lights are considered sufficient to aid pilots in aborting takeoff or barrier engagement.

It is recommended that landing lights not be used for takeoff in fighter type aircraft.

• • •

You should have been briefed about this accident by your own fly safe type or your ops officer but there are always those that don't get the word and usually they are the ones that need it most.

The pilot was undergoing his annual proficiency check in a T-33. After completing a no-flap, low approach and pullup into a closed traffic pattern, the pilot reported that he was on the emergency fuel system and that the engine was surging and losing RPM. The aircraft was at 800 feet on downwind, but too close to the runway and too low to turn final when the engine flamed out. Both pilots attempted to jettison the canopy without success. No attempt was made to eject through the canopy. The aircraft crash-landed, gear-up through the top of a pine forest into a plowed hill. Both the pilot and the IP received major injuries. Preliminary investigation revealed that the fuselage tank was empty, but the wing and leading edge tanks were full. The fuel switches were not gangloaded, an airstart had not been attempted and gear was retracted. This accident could have been prevented had the pilot or IP followed the normal and emergency procedures outlined in the T-33 Flight Manual. The degree of injury probably would have been reduced by use of proper forced landing procedures.

How about dragging out your Dash One and boning up? One more question, how qualified are your instructor pilots? ★

REX SPECIAL

The following is a partial quote from a recent Aircraft Incident preliminary report: "While cruising in a T-33 at 37,000 feet, with cockpit pressurized to 35,000 feet, for 50 minutes, the pilot (43 years old) in the rear cockpit complained of pains in his right arm and shoulder and slumped in his seat, apparently unconscious. The pilot descended to a lower level and diverted to a nearby airport. The passenger revived at 15,000 feet. Later he had difficulty in walking and was unable to handle a cup of coffee. *He expressed unwillingness for medical attention.* The flight was *resumed* without further incident to the original destination at 25,000 feet pressurized to 16,000 feet. Upon arrival, the subject displayed extreme motor difficulty and was unable to stand. He was admitted to a USAF hospital in serious condition where immediately he went almost into shock. His condition remained critical for 72 hours as a result of neurocirculatory collapse." At this writing, normal recovery is expected. Reason for faulty pressurization: The metal tip from the bungee cord of the instrument hood was caught on the canopy rail, wedging it open enough to prevent complete pressurization.

This is another case out of many in which collapse occurred following a rather severe case of decompression sickness (dysbarism) in flight. Some similar cases of collapse during or after flight have resulted in death. Undoubtedly these pilots had been told in Physiological Training courses that a delayed reaction can set in even up to *12-24 hours* following exposure and more particularly after a severe case of bends or other decompression sickness. They may remember also that they were told the ONLY cure for decompression sickness is immediate descent. Next, medical assistance should be sought as soon as possible.

It is a pretty safe bet that this man or the front seat pilot would have sought medical assistance if either had been bitten by a poisonous snake, which is no more deadly than the circumstances which occurred here. The pilot in this case did the right thing, *up to a point.* He should have insisted on medical aid, *whether the other man wanted it or not.* The worst thing he could have possibly done was to take off again and re-expose him to *any* altitude, further physical exertion or excitement.

One of several reasons for cockpit pressurization is to keep the cockpit below the altitude at which decompression sicknesses are most likely to occur (30,000 feet). Although some cases have been known to occur below this altitude, pilots should be particularly aware of their susceptibility upon exposure to 30,000 feet and above and that (as far as the pilot is concerned) recompression *below* 25,000 feet is the *only* first aid for symptoms of bends, chokes and skin or neurological symptoms. Of course, the best action is to get on the ground as soon as possible—then seek the aid of the nearest Flight Surgeon or Medical Officer.

AT THE END OF THE LINE

For many years now the Air Force has operated Military Flight Service to provide VFR flight following, clearance, weather, and message relay services. A somewhat similar service has also been provided civil pilots by the Federal Aviation Agency, and its predecessor, the Civil Aeronautics Administration, through their ground radio reporting stations. The expansion of FAA Air Route Traffic Control Center communication capability for direct pilot-controller IFR service has reduced the workload on the FAA Flight Service Stations, (FSS). As a result of a study of military and civil requirements, it was determined that certain of the Military Flight Service functions could be more economically provided by the FAA.

On 15 February 1961, the FAA assumed responsibility for all Military Flight Service (MFS) functions in the ZI except clearance authority and weather support. With this change in responsibility—the name of the Service was changed to FAA Flight Service (FS). AFR 60-16 has been changed to give all pilots their own clearance authority when flying from nonmilitary airfields and military bases when clearance service is not available. Military weather information is still available, and may be obtained by calling the nearest USAF weather briefing facility listed in the Enroute Supplement. The FAA is providing this service from some 180 FAA Flight Service Stations (Old INSAC Stations). Each ZI military base is connected to one of these Flight Service Stations by interphone. In addition to these base operations lines, FAA FS Stations have multiple interphone drops to DF Stations, control towers, FAA ARTC Centers and other locations required to perform flight service functions. Through these interphone lines and teletype loops, FAA can deliver authorized messages between all stations in the U. S.

What can we expect from FAA Flight Service? With the exception of clearance authority and some special weather requirements, FAA gives you the same service as you received from Military Flight Service.

Every military flight plan (DD Form 175) filed in the ZI will be called in from your departure base operations to FAA Flight Service immediately after departure. If you depart a "P" or "PC" type civil airfield, file your flight plan with the nearest flight service station. If an FAA facility is not located on the airfield, you can file by collect phone call to the nearest station. If you are unable to file a flight plan due to lack of communications, and a flight in an ADIZ is not intended, take off VFR and "air" file with the nearest FSS. Special instructions for flying in an ADIZ are in the Enroute Supplement. In any event, if IFR within a control zone or area, get an ARTC clearance before takeoff.

After your flight plan reaches Flight Service, a lot of actions are taken. The destination base is notified of your intended arrival and ETA. The base, if necessary, can then take action to divert you to your alternate, or initiate advisory action on NOTAMs, weather, or hazards. If your flight is composite VFR/IFR, the FAA's Air Route Traffic Control people are notified that your flight has a scheduled IFR leg and where you'd like to have a clearance. This doesn't guarantee that a clearance will be waiting but it does give them advance notice.

The next action on your part, except for the required position reporting, is to file an arrival report. If you do not, one hour after your flight planned ETA or at flight planned fuel exhaustion, whichever is earlier, an action known as a Preliminary Communications Search is initiated. A call is made to every station along your route, including your departure point and destination, to make a physical ramp check for your aircraft. If you are not located, Search and Rescue agencies are notified. When you're overdue, finding you will be the prime mission of many people. If you merely failed to file an arrival or change en route message, the same people will focus their attention in your direction but for entirely different purposes. You must file your arrival to prevent unnecessary emergency action. Do this by personally turning in the duplicate copy of your DD Form 175 to a military base operations, or by filing a message with the FAA Flight Service if landing at a civil "P" field, or by calling long distance collect to Flight Service if you have landed at a civil "PC" field.

Military bases can initiate in-flight advisory action through Flight Service. In addition, FAA will provide destination monitoring of non-military airports.

Ever been lost? Given sufficient time and fuel, any pilot can orient himself, but near the end of flight, time and fuel are vital factors. Should you find yourself in a situation where the proper real estate is hard to find, FAA ARTC Centers are in a position to offer immediate assistance as a coordination and evaluation center for the D/F network. ARTC Centers perform this function for the Flight Service Stations. When D/F Stations hear a distress call they will pass the word to an ARTC Center, which then will alert the D/F net. As courses are obtained, the net control center plots this information to obtain a cross-plotted fix. Information concerning position, course to a base, emergency airfields, and weather conditions is available.

Call any D/F station on channel 14 (305.4) or switch to 243.0 (guard) or 121.5, if a true emergency exists. Approximately 500 aircraft a year are assisted so your call won't be unique or unusual. Use the service *before* you get close to running out of fuel, altitude, time, airspeed and/or ideas! Call it a practice if you like, but declare an emergency if you want the full treatment.

Each year the Atlantic and Gulf of Mexico serve up their quota of big winds with female names. FAA gets into the act here as a communications agency. FAA Flight Service Stations will serve as a communication agency during hurricane evacuations, and pass any messages concerning the evacuation. Aircraft Hurricane Evacuation Plans (AHEP), as outlined in AFR 55-4, are being revised to delineate a major command as the agency responsible for preparing and monitoring Aircraft Hurricane Evacuation Plans.

The least popular function of Flight Service is that of handling and processing of flying violations. FAA is responsible for the accurate identification of aircraft and pilots involved with alleged violations filed by military or civil agencies and the routing of these allegations through the appropriate channels for investigation and action.

The significant changes are summarized as follows:

- The name of the service has changed to FAA Flight Service.
- USAF weather service can be obtained by calling a USAF weather station.
- All pilots now have their own clearance authority from non-military airfields and military bases when clearance service is not available.
- D/F nets are controlled by ARTC Centers instead of MFS Centers.
- FAA Flight Service will serve as a communications agency during hurricane evacuations.
- FAA Flight Service performs all of the communications functions that were performed by MFS.
- FAA is providing Flight Service for you.
- *Use it.* ★

Maj. George W. Morris, Directorate of Operations, Hq USAF, Washington 25, D.C.

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GET OUT!

When the moment of truth comes, it's a wise pilot who knows when to give himself a boot in the seat.

Capt. Victor E. Schulze, Jr.
Chief, Aerospace Medicine Branch
Randolph Air Force Base, Texas

How many times have you thought you might have to eject? Once or twice? Never? The chances are that if you have much jet time, you have entertained this thought. But do you really have a firm idea under what conditions you would eject? Sure, the easy ones are no sweat. Fire, explosion, unglued control surfaces—you have little choice. But what about the close ones? The ones where you can't decide whether to give it a go, or punch out and call it a day. Here is where a little knowledge may save your life.

Data collected at the Office of the Deputy Inspector General for Safety over the past ten years have contributed much to our knowledge concerning ejection situations. In the ten years since the first USAF emergency ejection, there have been slightly over two thousand ejections. The fatality rate has averaged about twenty per cent. The success rate has generally improved through the years, but increasing knowledge of ejection situations could improve it considerably more. In all fatal aircraft accidents where parachuting was not attempted, twenty-nine per cent have been rated as survivable. Of this twenty-nine per cent, ejection or bailout could have provided survival seventy-one per cent of the time. This would suggest that ejection situations were encountered but not recognized by the aircrews involved. Recent questionnaire studies further substantiate the contention that pilots are not very well informed on the indications for ejection. Experience studies and accident statistics show that certain situations are more prone to ejection decision errors than other situations. It might be well to review some of the more important situations regarding ejection indications.

In the event of a flameout with failure to relight, a flameout landing may be considered. Only under favorable conditions do you have a good chance for success. In addition, the high and low keys must be correctly attained. Any deviation from this is an *ejection situation.* A flameout approach to an unfamiliar field in a Century Series aircraft, particularly at night or in weather, is almost certain to end in disaster. Occasionally, the canopy does not fire because of equipment failure or jamming from a mid-air collision. In such cases, ejection through the canopy may be accomplished without injury. The headrest of the seat ruptures the

GET OUT (con't)

canopy before the head comes through. The occurrence of canopy firing failure should not cause one to hesitate to eject.

During ejection, the sequence of events is fully automatic except that you must kick free of the seat. There have been a number of ejection deaths in which the pilot either held onto the seat or made no effort to forcefully separate from it. In early jet aircraft, the seats separated easily from the pilot. Later seats, however, are much more aerodynamically stable and tend to stay closer to the pilot. Automatic separators are being tested in the field and these may eventually obviate the need to kick away from the seat. In the meantime, however, be prepared to "give 'er a boot."

High speed ejections are not as injurious as once thought. Some jet pilots have been known to refuse to connect the zero second lanyard in a high performance fighter for fear of a high speed bailout and opening shock injuries. The concept of injuries due to high "Q" pressures is not well founded and can be an unfavorable factor when a pilot is considering ejection. Only at or near supersonic speeds should this factor be considered in deciding whether or not to eject.

Flameouts immediately after takeoff always present a problem. Before the days of the zero second lanyard, the sky from the runway to three thousand feet was "dead man's zone." Now things are better. A good general rule seems to be that if you have or can get one thousand feet, *eject!* If not, stay with the plane and land straight ahead. Of course, many factors will influence this decision—terrain, obstacles, day or night. Knowledge of the correct procedures, planning, training and skill in executing them will give an extra edge here. In downward ejecting seats, additional altitude of at least 1000 feet more should be allowed. The nose should be pulled up high and the seat activated as the aircraft stalls. In any case, never try to turn back to the field.

Insufficient terrain clearance at the time of ejection has been, and still is, the overwhelming cause of ejection fatalities. Statistics show that seventy per cent of all ejections below one thousand feet have been unsuccessful, whereas only six per cent of all ejections above two thousand feet were fatal. Although some low altitude ejections result from emergencies which happen near the ground, a surprising number of low altitude ejections come about as a result of emergencies which developed at a safe ejection altitude. It is evident that a number of these cases represent ejection situations that are unrecognized as such, or ignored, by the pilot until he is so low that successful ejection is unlikely.

Recently two pilots received fatal injuries when they ejected from very low altitude. They first encountered engine vibration and oil pressure fluctuation above twenty thousand feet. The power available was insufficient to maintain altitude. Ejection was not attempted until the aircraft was less than two hundred feet above the terrain. Zero lanyards were hooked and all ejection equipment functioned properly, but ejection was at too low an altitude for the parachutes to fully deploy. At least nine pilots in 1960 were lost because of this same delayed decision to eject.

It is a popularly held concept that each emergency is a unique situation with many variable factors. It is further assumed that each emergency demands an individual analysis of all these factors before a decision to eject is made. One could hardly argue with the logic of this premise, but frequently the nature of the situation does not afford the pilot the luxury of much "decision time." In this day of supersonic aircraft, greater demands than ever are made on the human operator. The greatest demand is in relation to time. The pilot has to react faster, make decisions quicker, and initiate appropriate action sooner than ever before. Because of this progressive decrease in time to act, thinking in regard to ejection also must change. The ability to arrive rapidly at the decision to eject is an important factor in ejection survivability. Those situations which indicate ejection should be thoroughly familiar to the pilot. In addition, he should be aware of some of the factors influencing the success of an ejection sequence. Every pilot should set down certain ejection criteria in his mind. These criteria should be based on his own experience as well as that of others. Judgment is also essential, but judgment can be compromised during the stress of a life-threatening emergency, so knowledge becomes even more important.

Think about these things. In your mind, place yourself in emergency situations and decide what you would do. Know when you are faced with an ejection situation. When the indication is there, ya gotta go! **Get Out!** ★

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ON YOUR TOES...

... is no place for a whirling blade of steel; it can maim you for the rest of your life.

Let's talk about power lawn mowers! Now that spring is here and power mowers are beginning to make their appearances in many parts of the country, this might be the ideal time to review your own past experience and to profit by the sad experience that others have had to learn the hard way.

Are you taking any action to assure that your maintenance shops are seeing to it that all power mowers are in good repair and adequately guarded?

If you don't already have a Base Regulation governing the care and use of power mowers, *now* is the time to write one—not *after* the mowing season begins.

Now about the use of safety shoes by mower operators? It's mandatory, you know, under the provisions of Paragraph 0401.6 (3) 5 of AFM 32-3. *Mandatory*, not just recommended; yet the number of foot injuries

In the springtime a man's fancy turns to other things. But it shouldn't if you're maneuvering a power mower as these pictures illustrate. The imprudent airman can easily be shot down in his own backyard if he isn't careful. First picture shows position of shoe if operator were standing in front of mower; center, damage inflicted by blade. Probable position of shoe at the time of the accident is shown in last photo.

reported on the '122s make it clear that personnel are either unaware of, or simply ignoring the directive.

Both the "brogan" and the "combat boot" are built to take a lot of punishment, but they won't protect the wearer's foot when it comes in contact with a mower blade revolving at 3000 RPM.

Equally as important as safety shoes is the need for proper policing of the area to be mowed, *prior* to mowing. Accidents caused by bits of debris (nails, stones and glass) being picked up by the whirling blades and hurled outward with tremendous velocity, are about as numerous as those involving direct contact.

Time spent now in careful preparation of a suitable directive governing your mowing operations, and strict adherence to it by all concerned, will pay big dividends in conserving manpower in the months ahead.

Do it now!! ★

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FALLOUT

• LETTERS TO THE EDITOR •

Flying Boot Survival Kit

On page 28 of the January issue appears a picture and description of a flying boot survival kit which was constructed by TSgt Dan Girolamo, 192d FIS, ANG, Reno, Nevada, that certainly points to one excellent solution to an old problem. I'm reminded, however, of past experience as a rated parachutist concerning protruding equipment on the arms and legs. The combat boot with buckles at the top has caused some grief to jumpers when suspension lines became entangled during the deployment segment of the jump. As I recall, it was difficult to work your leg loose prior to landing. The standard fix was to wrap adhesive tape (2½-in. wide) around the top of the boot as well as knives and other items carried.

The picture with the article appears to show this particular application as "wedged" to the boot and this would alleviate any problem such as mentioned in the above paragraph.

The use of adhesive tape in the manner suggested may be unnecessary with present day chute deployment but maybe the idea may help someone who will use the parachute as a means of transportation in the times ahead.

Capt. Douglas C. Myers
8th FMS, APO 929 San Francisco

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Money's Worth

As far as I can tell from official Air Force documents, the manpower people usually plan on a 40-hour week when determining the manpower needs of individual units. In fact, when the Air Force presents its programs to Congress and figures out the cost for the programs personnel-wise, it uses figures like so much per hour for majors, so much for captains, and so on, based on a 40-hour week. If this is so, then USAF certainly is getting its money's worth out of MATS crews if General Waldron's aircrew utilization figures are as stated in his article, "We've Got The Safety Bug." General Waldron states the preliminary report shows that WESTAF crews have only 70 hours unrestricted off-duty time per week.

If a man works 8 hours a day, he can count on 16 hours a day unrestricted off-duty time for 5 days and 48 hours off for the weekend. A little simple arithmetic would figure this total of unrestricted off-duty time to come out to 128 hours out of a possible 168 hours per week. This is the same figure (128 hours) as claimed by General Waldron to be the unrestricted off-duty time for commercial airline crews.

If a MATS crewmember slept 8 hours a day he would average 56 sleeping hours per week and have a grand total of 14 hours per week waking time to do what he wanted. I agree with General Waldron. It appears that WESTAF crews may be working too hard.

Maj. Gabriel Palmero,
Line Navigator, EASTAF,
McGuire AFB, New Jersey

P.S. Please forgive the stationery. I wrote this while I was on Wing Duty Officer as I didn't want to waste one of my 14 hours unrestricted off-duty time.

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Kudos

Reference is made to the article, "Do-It-Yourself Chair," on page 24 of the February issue. The basic suggestion for the T-33 measuring chair originated with a personal survival equipment specialist, Mr. William E. Reed, at the Air Force Command and Control Development Division. Favorable comment was provided by WADD and Headquarters ARDC, but as indicated in the background information, AFCCDD was the originating organization.

Hq ARDC, Andrews AFB
Washington 25, D.C.

Sorry if we seem to have slighted Mr. William E. Reed and AFCCDD, L. G. Hanscom Field. The material for this story came to us from Hq ARDC and did not contain any individual's name. Aerospace Safety Magazine congratulates Mr. Reed for the suggestion in the interest of pilots flying the T-Bird.

Congratulations to the officers listed here. These five men—four from the Air Force and one from the Navy—represent the straight "A" group in Class 40, completing the Flying Safety Officers Course at USC. It takes a lot of hard work and real interest in such subjects as Psychology, Physiology, Aeronautical Engineering, and Education to come up with an "A" average. These officers will have much to contribute to their respective units; don't hesitate to take advantage of their knowledge and training.

Their outstanding work and USAF's safest flying year in 1960 should stimulate their associates to contribute to an even better flying safety record in '61.

Aerospace Safety salutes them!

a•men

Maj. Walter H. Burke (ADC)
Dobbins AFB, Ga.

Capt. Alfred W. Faahs (SAC)
Whiteman AFB, Mo.

Maj. John L. Kelly (SAC)
Lockbourne AFB, Ohio

Capt. Phillip J. Quirk (ATC)
James Connally AFB, Tex.

LCdr. Paul L. Spargo, USN (MATS)
NAS Moffett Field, Calif.

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