AEROSPACE

SAFETY

MAY 1961

UNITED STATES AIR FORCE

Beware of the Invisible CAT · · · page one

TWO POINTS OF VIEW

Yes sir, biggest and freshest flight lunch in the Air Force!

When he said biggest and freshest, he really meant it.

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VOLUME SEVENTEEN NUMBER FIVE — USAF RECURRING PUBLICATION 62-1

The most severe cases of clear air turbulence are usually found associated with either a jetstream aloft or with a mountain wave caused by the deflected winds to the lee of the mountains. In this spectacular photo a Long Wave-length case is shown. Dust blowing from the upper desert is lifted to 30,000 feet. Some years ago, a P-38, with both props feathered, rode the updraft zone from 15,000 to 30,000 feet.

Beware of the Invisible CAT

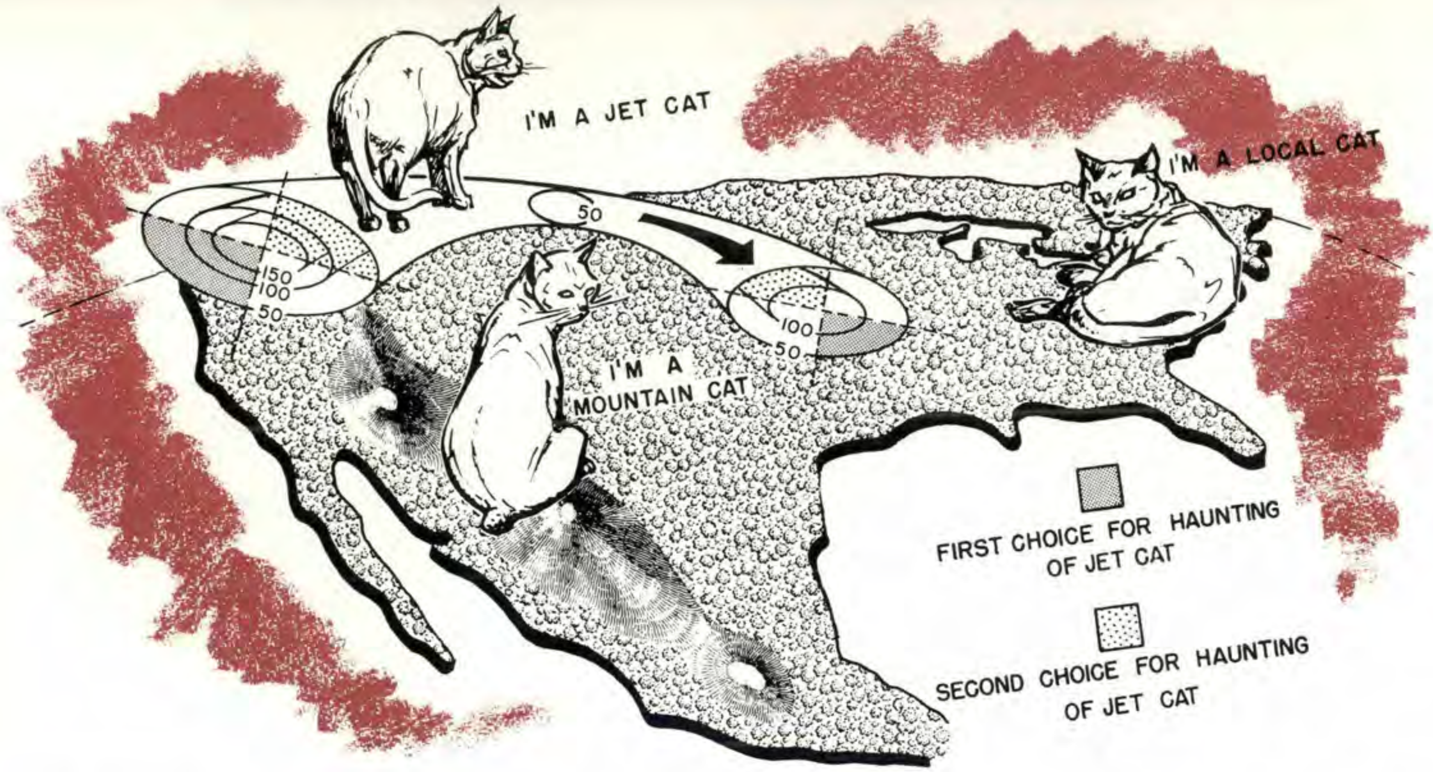
Clear-air turbulence (CAT) is one of the most perplexing meteorological phenomena affecting high-level aircraft operations today. It ranges from light turbulence, which results primarily in crew and passenger discomfort or fatigue, to severe or extreme turbulence, which may cause jet-engine flameouts, similar to those experienced near the tops of thunderstorms, or structural damage to the aircraft.

Clear-air turbulence, as the name implies, is found in cloud-free atmosphere. It occurs most frequently above 20,000 feet, having a maximum occurrence in winter at 30,000 to 40,000 feet. Nevertheless, severe clear-air turbulence has been reported at all altitudes.

Although some 75 per cent of the occurrences of CAT are reported as light, and hence serve mostly as a flight nuisance, 25 per cent are more severe and are a definite hazard to aviation. For instance, the airliner lost near Tell City, Indiana, on 17 March 1960, is one of many which has been identified as a victim of the invisible CAT. In this article, we shall be considering only those hazardous types below 50,000 feet that are associated with the strong wind-speed changes frequently common to mountainous and jet stream areas, since the reports of clear-air turbulence indicate frequent occurrences in these regions. However, all reported cases of clear-air turbulence do not fall into these two categories. On occasion CAT that is not readily identified with either the mountains, the jet stream, or a definite meteorological counterpart has been cited. It is believed, however, that the frequency of these latter examples of CAT are in the minority compared with the jet stream and mountain wave variety.

The most severe cases of CAT are nearly always

Lloyd V. Mitchell, Hqs Air Weather Service, Scott Air Force Base, Illinois



found associated with either a jet stream aloft or with a mountain wave caused by the deflected winds to the lee of the mountains. Lenticular (i. e., lens-shaped) clouds, similar to those frequently seen in Colorado, are associated with the mountain wave and often form just below the CAT layer.

Unfortunately, almost three-fourths of the instances of strong CAT are associated with the jet stream in other than mountainous areas and hence have no such visual tell-tale clouds to signify their presence. Weathermen have found that such clear-air-turbulence areas can best be identified on upper-level wind charts by locating those regions having the largest wind-speed changes in relatively small horizontal or vertical distances.

CAT areas are shallow when compared, for instance, to the vertical extent of low-level convective turbulence, which is characterized by the well-known "bumpiness" one experiences when flying over bare ground on a hot day. The former usually vary between 500 feet and 2000 feet in thickness, between 10 and 20 miles in width, and between 40 and 50 miles in length (along the jet). Since the patches of CAT are frequently smaller in horizontal dimension than the distance between the reporting stations of the upper-level wind network, they cannot always be determined or pinpointed from the weather forecaster's upper-level charts. However, the general regions where clear-air turbulence is most likely to be found can usually be recognized from these upper-level charts.

In the event you are flying under a jet stream core in the direction of the jet stream winds, be aware of the invisible CAT to your left, especially if you are entering a region where the winds are turning sharply to the left. On the other hand, if you are flying over a jet core but again downwind, be especially aware of the lurking monster to your right—particularly if the winds indicate that the jet is bending sharply to the right. Naturally the reverse is true, should you be flying in a direction opposite to the winds (upwind). These areas are identified on that portion of the accompanying drawing which pertains to the jet stream.

Frequently, vertical cross-sections through the jet stream picture the jet as being more or less circular because of a greatly expanded vertical scale. In reality, however, the jet stream is even flatter than shown in the picture, since its true vertical dimension is measured in feet while its horizontal dimension is measured in miles. Regions of CAT are usually associated with those jet streams which exceed 100 knots, and when the turbulence is usually confined to those portions of the strong-wind region where the winds exceed 50 knots. The intensity of the invisible CAT varies along the jet stream just as do the wind speeds.

For the most part, seasonal variations in the frequency and location of the CAT's lair are associated with seasonal variations in the intensities and locations

of the jet streams. For example, CAT occurs most frequently in the United States during the winter, the season of the strongest upper-level winds, and less frequently during summer, when the strongest winds are usually farther to the north. On the other hand, France, at its more northerly latitude, observes its most frequent jets and, similarly, most frequent clear-air turbulence, during summer.

Many non-meteorological factors, such as airspeed, aircraft design, weight, and attitude, affect the aircraft's reaction to turbulent air. All other things being equal, an increase in airspeed will result in an increase in the intensity of the turbulence. As one would expect, "stiff-winged" aircraft react differently to turbulent air than do "soft-winged" aircraft. Flight from smooth air into severe CAT areas in a "rigidly stressed" aircraft can be likened to one's driving an automobile without shock absorbers at a high speed from a smooth-paved highway onto a cobblestone street or washboard road, whereas a flight under similar conditions in a less "rigidly-stressed" aircraft would be likened to the same car having shock absorbers. Two identical aircraft flying at the same airspeed, but having different payloads, different speeds, or different attitudes, would react differently to the same turbulent conditions such that they would experience intensities of CAT ranging all the way from light to moderate or even severe. Pilots have found also that aircraft with a swept-wing design or a high-wing loading are the least affected by turbulent air.

Frequently, inflight weather can be used as an indication of your approach to a clear-air-turbulence area. For instance, if you are flying below the jet stream level and approach the polar side of the jet stream from the north, the temperatures will increase rapidly as you near the region of the jet. (Recently, a DC-8 reported a temperature change of 8°C in 15 nautical miles while experiencing moderate CAT.) Such temperature indications as these, or indications of rapid changes in the wind speed, assist the wary pilot in recognizing that he may be approaching the invisible feline. On occasions, however, clear-air turbulences may be unavoidable or may be encountered unexpectedly. In such cases, pilots are well aware that a change in flight course, in cruising level, and a reduction in airspeed can do much to decrease the harmful effects of the turbulence.

Accurate and comprehensive pilot reports are the most valuable information that the weather forecaster has for locating and informing other aircrews of the existence and location of CAT areas. These PIREPS can pinpoint events which otherwise the weather forecaster can only define in general. Reports that state whether the turbulence is occurring in clear-air, cirrus clouds, or convective-type clouds, and include the type of aircraft, the time that turbulence was encountered, the altitude, the duration, the intensity, and any statement of the pilot's difficulty in controlling the aircraft are particularly significant for the safety of others who may be flying through the same area a little later. Needless to say, meteorologists of the Air Force, Weather Bureau, NASA, FAA, and civilian airlines are all engaged in studies pertaining to the habitat and behavior of the invisible CAT. If they are able to find its lair, predict its motions, and snatch some of its would-be victims from disaster, they must first look to the aircrews who provide the observations presently available from no other source. ★

If you experience clear air turbulence in a mountainous area, don't be surprised. It's an area where the CAT can be expected. Photos below and left, show cloud moving with wind from right. Notice dark rotor cloud capped by lenticular cloud indicating extreme turbulence above. Photos at right are typical of standing wave.

GONE WITH THE

If you have become accustomed to associating clear-air turbulence solely with jet stream activity and are employing the classical jet stream evasion tactic of climbing and turning toward the cold air mass, the following discussion may be enlightening.

Recently, a B-52 flying at 36,000 feet in clear skies over the western mountainous area encountered clear air turbulence. Initially, the turbulence was light to moderate and the only cause for concern was its nuisance value to the navigators taking their first celestial fix. The aircraft commander elected to maintain altitude and airspeed to complete the celestial work. By the time the shots were completed the pilots had difficulty reading their instruments because of the buffeting. The decision was then made to climb to the next higher hemispheric altitude with the idea of getting completely out of the turbulence. High altitude turbulence had not been forecast for the area.

As the aircraft climbed through 37,000 feet, a violent bump and lurch was felt. The nose and right wing dropped rapidly and, despite full left aileron/spoiler application by both pilots, the aircraft continued a nose-low, right roll of about 410° when the wings momentarily stabilized. Within 3 to 4 seconds, the aircraft went into another violent rolling motion from which it did not recover. The only survivors were the navigator and copilot, who successfully ejected. It was reasonably established that the vertical fin failed during the initial violent roll and additional disintegration occurred in the second rolling condition.

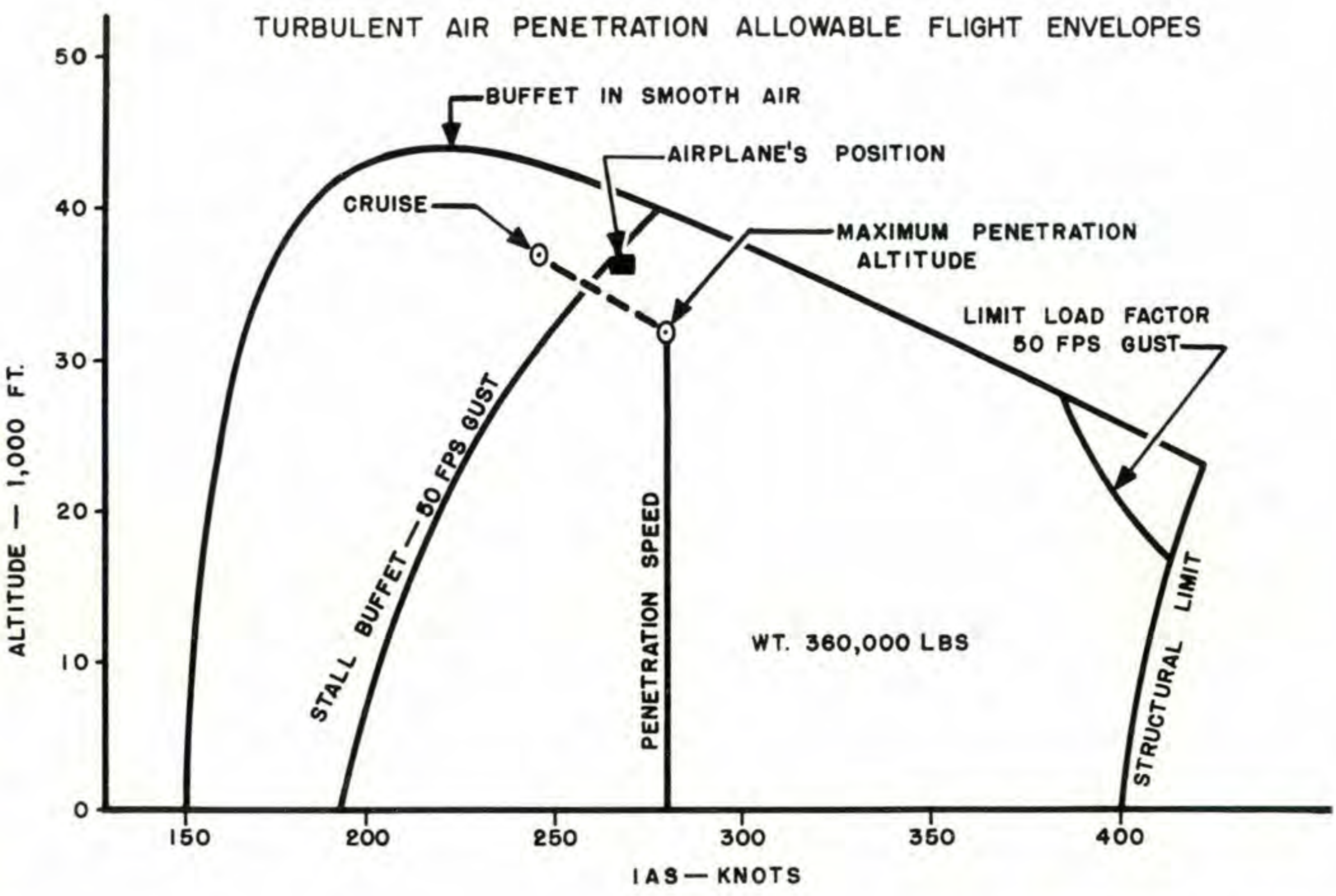
Wreckage was strewn along the flight path for 12 miles. Exhaustive laboratory analysis of failed parts is being continued in an effort to determine whether or not materiel failure was involved. In the interim, the investigation board has determined that it is possible for this accident to have been caused by turbulence and thus there is a lesson to be learned.

In presenting this possibility, the board was able to demonstrate that the turbulence that was present could have precipitated a right hand spin. Coincident with this random weather phenomenon, the aircraft was at an altitude 5000 feet higher than the turbulent air penetration altitude recommended in the flight manual.

There were three significant, turbulence-producing weather phenomena present at the time of the accident: (1) the aircraft was between two converging jet streams about 275 miles from the core of each, (2) conditions were favorable for the formation of local mountain wave effects, and (3) the aircraft was in the proximity of the tropopause in an area where vertical undulations in wind flow can produce sizeable vertical gusts. These combined effects were considered capable of producing vertical gusts on the order of 40 feet/second.

After considering many hypotheses involving control

Figure One

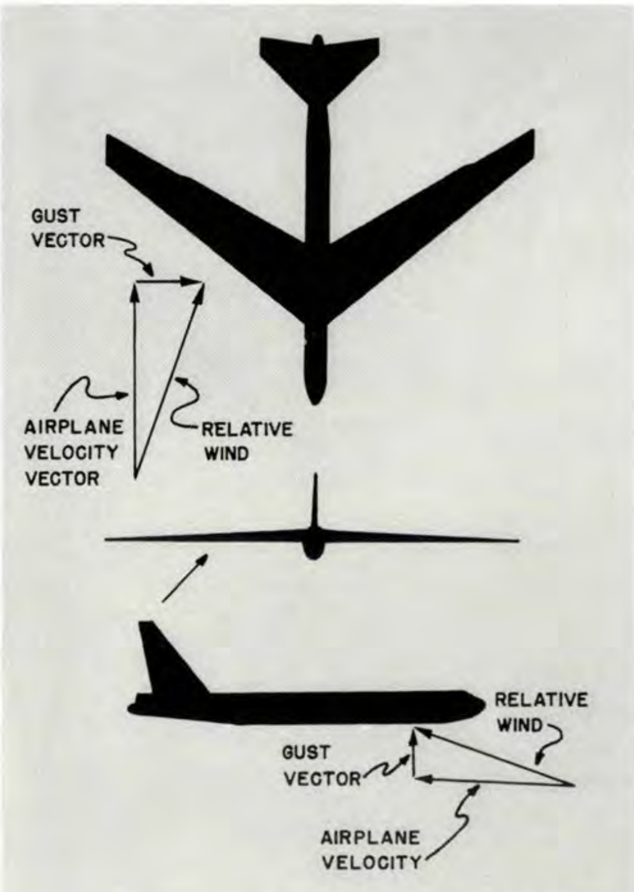


RELATIVE WIND

applications, maneuvering loads and dynamic loads on aircraft structure, the board was able to show that the aircraft could have been placed in the initial violent right hand roll or spin by a severe asymmetrical gust on the right wing. At the time of the mishap, the aircraft was already very close to low speed stall for the existing turbulent conditions (Figure 1). Vertical gust velocities calculated to produce a symmetrical wing stall at 37,000 are of the order of 43 feet/second. Vertical gust velocities required to produce an unsymmetrical stall are somewhat less, depending on the angle at which the gust strikes the quarter chord (Figure 2). In analyzing the reason for the sudden nose right yaw and right wing down condition, it is reasonable to assume that the right wing received the effect of a vertical gust at an angle unfavorable to both the sweep of the wing and the angle of attack as illustrated in Figure 1. This vertical gust would produce two effects: (1) to stall the right wing and (2) to impose a side load on the vertical fin which would tend to yaw the nose to the right. With the yawing condition, no rudder application by the pilot would be necessary to set a spin in motion. Once the aircraft began to rotate to the right, the right wing was kept in a stall by the relative wind vectors on the underside of the wing produced by roll velocity and up-elevator control. This rolling motion

Typical mountain wave, right to left flow. Cap cloud obscures mountain peaks to right. Rotor cloud is at center of picture with lenticular formation immediately above. Extreme turbulence can be expected at high altitude.

Figure Two



could not be stopped by counter control application until such time as the stalled condition on the right wing was relieved. The stall condition was relieved as the aircraft velocity increased in a nose down attitude, which explains the briefly stabilized period following the initial roll. As in any uncontrolled spinning/rolling maneuver, the aircraft had developed large side slip angles. These, coupled with the relatively high airspeed, imposed loads which exceeded the structural capability of the vertical fin. The most probable time of failure was during or subsequent to inverted flight.

Adherence to the speeds and altitudes for turbulent air penetration presented in the flight manual and shown in Figure 1 would have required vertical gust velocities on the order of 70 feet/second with identical vectors to produce a similar maneuver.

Several recommendations resulted from this accident including additional research to improve clear air turbulence forecasting and developing a means or technique which will enable pilots to discriminate between the varying degrees of turbulence. The object of the latter is to provide us with a means of making correct decisions for turbulent air penetration. These are presently being acted upon by the responsible agencies. In the meantime, it behooves all of us to:

(1) Immediately report clear air turbulence to the nearest en route weather facility (observation and verification are essential to the development of accurate forecasting) and (2) F-T-B-F-M (Follow The Blessed Flight Manual). One way to be prepared for unexpected turbulence is to annotate your flight plan or fuel log at periodic intervals with the penetration airspeeds and altitudes for the various gross weights shown in the Flight Manual.

The chances are slim that you will encounter a condition similar to the one just described (all bets are off in a thunderstorm). However, if you are flying a multi-engine, swept-wing aircraft, believe me, it *can* happen!! ★

Lt. Col. Cornelius G. Brosnan, Bomber-Cargo Branch, DFSR

A LOUD SCRAPING NOISE

Once upon a time, when the Air Force was young, aircraft designers knew little of aerodynamics and streamlining. With so little knowledge, aircraft were built with two wings, open cockpits and landing gear that were installed to stay in one immovable position. Pilot's liked this arrangement and displayed their appreciation by remaining carefree and happy, zooming and diving all over the wild, blue yonder. When it came time, they side-slipped and fish-tailed their Spads and Jenny's and Waco's in for the landing with confidence the gear was still in that one and only immovable position.

With the passage of time and gaining of experience, an enterprising aircraft industry incorporated retractable landing gear into the design of airplanes. This advancement in streamlining ranks with the variable pitch propeller and wing flaps, without a doubt. It is also without a doubt, and undisputed history, that since this practical design was hatched, it has been the source of a long line of "faux pas" for pilots.

Landing with the gear up has been likened as the first cousin to the two most heinous of all crimes: taxi accidents and buzzing. Not only does forgetting the rollers prove a costly mistake, but in that cockpit will be one of the silliest feeling pilots for miles around.

The aircraft today are aerodynamically designed with neat, round, smooth undersides. It would seem appropriate that the advances in metallurgy would have kept pace with aerodynamics and developed a belly skin able to withstand the strain—the strain of the abrasive effect that friction produces on that underside as it makes contact with the runway at 100 knots or more when an otherwise competent pilot forgets to lower the gear!

A hasty spot check of the bird manufacturers revealed no plans to produce a model able to withstand an inadvertent no gear landing with un-noticeable results. The word's out that conscientious pilots will have to continue following instructions in the Dash One and put the gear down before landing. The aircraft can then be taxied with much less confusion.

Cadets and flying schools have produced their share of humiliation in the no gear department. Take the case of the mister who made an undesirable landing without benefit of those two essentials. At a mass formation of all the students, this hapless specimen was presented with one of the wheels, complete with tire and tube, and charged with the care and well being of that piece of equipment for the remainder of his stay at that school. It was further decreed the little part of mistreated undercarriage was to accompany him at all times, never leaving his sight. In the latrine, in the mess hall, in the theater, during inspection, everywhere the cadet went, that little wheel was sure to roll. Probably the cadet never again forgot to lower his gear. He is also probably the only pilot flying around today with his hand firmly holding the gear handle instead of the throttle.

By now everyone must have heard the yarn about the fighter pilot who was on the final approach with the gear in the same place as his head. For the benefit of newcomers I repeat an incident that is sworn by bomber pilots to be the pure truth. There was once a real smoldering boulder steaming down final in no condition to land (no gear). Despite the numerous warnings and screechings from the tower regarding the aircraft's inadequacy to land, the aircraft continued on to a touchdown for one of the nicest "you know what" landings ever witnessed at that base.

The base commander, having witnessed this abominable display of airmanship and having heard the tower's warning calls over the radio, promptly gunned his jeep and charged out to the scene. Confronting the sheepish looking culprit, the "old man" laced his interrogation with some choice wording reserved for erring fighter pilots. He also demanded to know *why* the pilot disregarded the tower's warnings. Without batting an eye, the pilot replied, "But, sir, I thought the tower was hollering at some other idiot!" The service lost a good officer when the colonel had to be retired early because he suddenly developed a severe antagonistic attitude towards fighter pilots.

The prize for the "faux pas" of all "faux pas" goes to the pilot who landed belly to the ground twice on the same day—in the same airplane! This twin incident involved an Air Corps model of quite a few years back. It was a model designated the A-17A. There was also an earlier model designated the A-17. On this particu-

Capt. Douglas J. Beggerly

lar day, it seems there was a requirement levied on an attack group for an A-17 to participate in a flight demonstration and static display at a civilian field down south. A young, tigerish pilot was selected and on the appointed day, he eagerly proceeded to his destination and arrived over the crowd-lined grass field at the appointed time. He at once went into his repertoire of acrobatic maneuvers and high speed passes. The crowd was so impressed they just knew it was Captain Eddie or at least an ace putting the plane through its paces.

After exhausting his bag of tricks, our hero turned onto final and glided in for a dust raising, grinding, pancake landing! Seems as though the difference between an A-17 and A-17A was a little matter of retractable landing gear and this was his first flight in an A-17A. Smarting from such an unswashbuckling like arrival, this boy let it be known he was making plans for an ASAP departure—in that airplane!

Flying safety and maintenance regulations not being what they are today, the pilot cleverly had the airplane jacked up, the gear pumped down and after the local blacksmith straightened the prop blades, promptly took off for home base. You'd think this was the end of this little fiasco, but alas, it wasn't. On arrival at his home base he again forgot to pump the gear down and repeated his short field belly flop! Probably he's a cousin of the guy who thought the tower was hollering at someone else.

Today, in 1961, aircraft are still being landed with the gear handle unmolested from the "up" position. Why? There may be several reasons, but a survey points a heavy finger at single place and tandem cockpit model jet trainers, fighters and bombers. Among these aircraft are several that have been in the USAF inventory sufficiently long for the pilots to have logged over 1000 hours. This much time in one aircraft sometimes breeds complacency and carelessness regarding flying habits and checklists. Listed below are some of the factors that can compound these traits into a gear up accident:

- Flying a mechanical landing pattern without benefit of a checklist.
- Distraction by tower operator requesting additional calls or information at a time the gear is normally lowered.
- Distraction by other aircraft in the pattern.
- Poor location and sound level of the landing gear warning horn. (The effectiveness of this device is further lessened by close fitting helmets and cockpit defog blowers.)
- On a bright day, the red light in the gear handle may not be bright enough to attract attention.
- On night flights, the red light in the gear handle tends to blend in with the red cockpit lighting of the console.
- Too infrequent landings by instructor pilots from the front cockpit.
- Too infrequent normal day landings by all pilots. (Terminating all missions with an instrument landing creates a habit of lowering the gear when specifically instructed to do so.)
- Failure of tower and mobile personnel to make a surveillance check with binoculars of each approaching aircraft.

To lessen the possibilities of inadvertent, embarrassing and costly gear up landings in any unit equipped with single cockpit or tandem cockpit type aircraft, the following suggestions may be applied:

- Dedicated use of a landing pattern checklist.
- Surveillance by mobile and tower personnel with binoculars, of every daylight approach, making a transmission only when gear does not appear to be down. (Followed by light-gun and flares.)
- Visual check by pilot of at least the two main gear. (Flush mounted mirrors can be installed on tip tanks or engine nacelles to give the pilot a view of all gear.)
- Closely observe the selsyn position indicators before and after actuation of gear handle.
- Know the approximate time of gear extension or retraction for your particular bird.
- Be alert for aerodynamic changes and power requirements during and after gear extension.

It may sound ridiculous to outline procedures for preventing gear up landings, but let's face it, they're still doing it and if you are at least cognizant of the problems, chances are you will never hear "that loud scraping noise!" ★

1001st Operations Group, Andrews AFB, Washington, D.C.

IT'S IN THE BAG

Ever get that sinking feeling that comes when you reach for the terminal book you need, or a chart, and discover that it is missing from the kit, or maybe, the entire kit is missing?

Moments like these are long remembered by those who live to reminisce on them. Unfortunately, there are those no longer among us to whom this situation has ceased to be a problem. Vital information not available at a crucial moment can easily mean the difference between a successful mission and "Scratch One Aircraft." Dad used to strap on his dope and fabric bird and churn his way up to three or four thousand feet. If he was real brave, and lucky enough to be flying the latest aerial hot rod, he might go all the way to 10,000 feet, providing, of course, that he could see the ground.

But there have been some changes since Dad pulled on his goggles and homed in on the AT&SF. The highway map he'd picked up at the gas station on his way to the airport just won't do the job today, and the publications that have taken its place have made a scholar of the old man.

The navigational data going into the kits we now use are not only complicated, they are numerous and necessary. Aeronautical Information Publications (AIP) are defined in AFR 96-12, which says that they should be available for each flight. But the regulation doesn't spell out how they should be maintained. The result is that methods vary and some of them are far from satisfactory.

The Air Materiel Command has adopted an approach that may be useful to other commands having problems with AIP kit maintenance. AMC Supplement 1, 6d, says: "Activities with AMC assigned aircraft will maintain AIP kits for issue to the aircrew, as required, for the flight mission . . . "

How does the AMC system work? Here's the way it goes at Norton AFB, where the present method has been in effect since September 1960. Responsibility for maintaining the kits is assigned to one person, and it is a full time job. In this case it is Mrs. Alice Thomas, who occupies one corner of the dispatcher's office, where she and the kits are handy to the pilots.

Two types of kits are available to Norton pilots for conventional aircraft: a small one for local flights, and a more elaborate one for cross-country missions. Pilots are encouraged to always take the big kit, but the smaller one is favored for local flights because it is lighter and more compact. The contents of the two kits are similar, except that the big one has more. It contains two sets of en route low altitude charts, a Norton departure sheet, a local chart, ONC 404 (Operational Navigation Chart) and terminal low altitude books for each of the four sections of the U. S. The local flight kit has the en route low altitude charts, local area chart, Norton departure sheet, but just one terminal low altitude book, covering the southwest.

Flight information Publications are checked by Mrs. Alice Thomas prior to checking out each kit to pilots. In photo at right, Mrs. Thomas checks out a kit to Capt. Richard V. Gerdau at Norton AFB Flight Operations.

There is also a jet kit which, in addition to the cross-country conventional material (excluding terminal low altitude charts), includes local and cross-country terminal high altitude books. The new intermediate altitude charts will be placed in all kits.

The containers are manufactured locally of heavy canvas and each kit's number is stenciled on it in easy-to-read numerals. As soon as amendments to the publications are received, they are logged and immediately incorporated into the kits on hand. As kits are returned on termination of a flight they are brought up to date. Although there are enough kits for all aircraft in case of an emergency, they are not all up to date at the same time. The additional kits make it possible to keep a supply of current kits on hand for issue and pilots are not forced to take a kit that has just been turned in and which may not be up to date in all respects.

As the kits are checked in, the amendments are logged into the front of the books; however, time doesn't permit each plate to be checked. This doesn't cause much of a problem, but occasionally pilots stick plates in their pockets and forget to return them to the kit. Therefore, each pilot is urged to check the plates necessary for his mission. If any are missing they are immediately replaced prior to flight.

Each morning the kits on hand are checked for amendments, current ONCs, and a complete set of en route charts. The local charts are those frequently missing.

When a pilot plans a flight he checks out a kit and fills out SBAMA Form 54, Trip Kit Receipt. He is then held accountable for the kit until he returns it. Once in a while a pilot in a hurry, or arriving late at night—or just plain forgetful—throws a kit into the back seat of his car and never notices it until Mrs. Thomas reminds him by phone to "please turn in your kit." If a kit is out for an undue length of time, the pilot is called, and if he is TDY, a followup is noted for a day or so after his expected return.

Prior to the inception of the current system the kits were kept in the aircraft and maintained by the crew chiefs. The condition of the kits varied with the habits, efficiency and workload of the crew chief. Kits were found with material as much as eight months out of date.

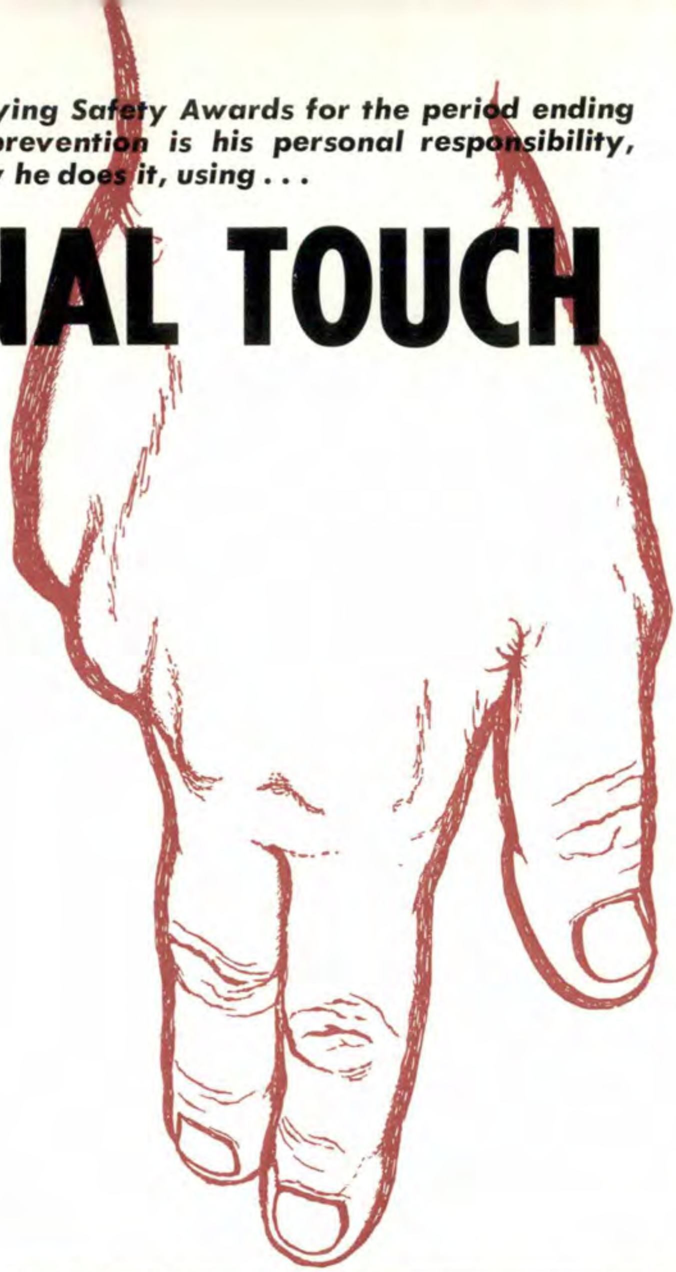
At first, as with any new way of doing something, there were some groans and complaints from the troops. Their main point was that they were accustomed to the kits being in the aircraft and might forget to pick them up at dispatch. Now, however, the system is well accepted and there are few complaints, except from an occasional jet pilot who wonders where he is going to find room for the bag in a tight cockpit.

If you are having problems with keeping your kits up to date, this system may help you. It provides a means of accounting for important navigation materials and assures the pilot having the proper publications with him on any mission. ★

Bob Harrison

Reese AFB was one of the winners of the Flying Safety Awards for the period ending 31 December 1960. Believing that accident prevention is his personal responsibility, the Commander tells how he does it, using . . .

THE PERSONAL TOUCH



Colonel L. C. Hess, USAF
Commander, 3500 Pilot Training Wing,
Reese AFB, Tex.

Maj. Jack E. Turner, Cdr, Reese Base Weather Det., reminds all pilots of minimum clearance to be maintained over mountainous terrain.

The author carries out the personal touch by frequently visiting his pilot training squadrons (above second from left). At right he interviews newly assigned officers, outlining his policies and their responsibilities, and the high standards expected of them.

Sixty-nine thousand accident-free hours may not seem like a lot to some Commanders, but to me it represents 481 accident-free days from 7 September 1959 through 31 December 1960. Considering the obstacles we've overcome, I am very proud of our record.

First of all, our students come to us with only the very basic fundamentals of military flying acquired at the primary schools and solo after only 10 hours of instruction in the T-33 aircraft. Also, in each class we had foreign students who posed a language and communication problem. During this period, a total of 483 American students and 66 foreign students entered the basic pilot training course.

We had no auxiliary landing field facility on which to shoot touch-and-go landings until October 1960. In fact, during most of the entire period we had only one runway because of lighting and other extensive construction projects on the second runway. This placed us in an extremely vulnerable position since we averaged approximately 160 student sorties per day at an average of 1½ hours per sortie, for a total of about 240 student T-33 hours and 480 landings per day. This includes our student traffic only. The statistics for an average day for all traffic are: total sorties 170; average per sortie 1½ hours; average total hours 275; number of takeoffs and landings 510. During November our average was much higher. We flew an average per flying day of 175 sorties; 287 hours; and made 515 takeoffs and landings. For the reported period of 481 days, there was a grand total of 210,888 landings. As you can see, this taxed the capability of our runway and placed us in a very vulnerable position.

In April 1960, we were notified that we would be one of seven bases in Air Training Command to conduct the consolidated pilot training program. The expansion of any program or a change in mission always creates a certain amount of inefficiency because of inexperience and an increase in personnel.

Col. Hess receives membership card in the Flight Four Protective Association—pilots with a common bond to protect their safety record. FFPA has set goal for other Squadrons.

One old adage, "begin at the beginning," has proved to be of great value time and time again. My idea of "begin at the beginning" is to personally interview all the new, incoming officers. During our 30 to 40 minute discussion, every effort is made to acquaint them with my policies and to impress on them the high standards that I expect of them. I personally cover the aspects of flying safety as it applies to them because there is no better time to start this approach than when an officer first arrives at the base.

Philosophy will never replace leadership and it isn't enough for a Commander to just show an interest in accident prevention. I subscribe to the proposition that each flying outfit is different, whether it be brought about by geography, type of equipment, mission, or the experience of those doing the flying. For example, a SAC wing with large expensive aircraft with six or more power plants, and pilots with thousands of hours of experience, certainly is confronted with a different set of circumstances than a pilot training wing with single engine jets, the average age of its pilots only 25, and students just learning how to fly.

What is the answer then to a flying safety program, if Commander and leader interest isn't enough? I believe that accidents can be prevented only when each individual—regardless of how remotely he is connected with the flying business—strives to do his own job to his utmost.

A professional approach is the answer to accident prevention. It is easy to prescribe a beautiful flying safety program with all the ingredients that look and sound good. Implementing it is another thing. I'd like to discuss a few points of our program which have enabled us to achieve our record.

First of all, I feel that the professional approach has filtered down to all operating levels. An example here is my honorary membership in the "Flight Four Protective Association." Major Robert L. Hill, Flight Four Commander, is an aggressive officer who has been with us for two years under the SAC Exchange Program. Through his desire to maintain an unblemished safety record and at the same time build esprit de corps and professionalism in his flight, he conceived the idea of the "Flight Four Protective Association." Its members

THE PERSONAL TOUCH (Cont.)

are pilots of his organization who have a common bond to protect their safety record. This flight was formed in February, 1959, and has flown over 6600 T-33 single-engine jet hours without an accident, and over 1000 of these hours were student solo hours. This officer's aggressiveness and professionalism have not only been imparted to the members and students of his "Cherokee" flight, but provide an incentive and goal for other flights to attain.

Another example of how professionalism has been filtered down to the operating level is best shown by quoting a letter from the Commander of the 3502nd Flight Line Maintenance, Squadron, Major Joseph B. Burdick, to all personnel of his squadron:

"Our past record of furnishing sufficient 'Fly-Safe' aircraft to the training program to satisfactorily complete the mission on schedule has been outstandingly successful. However, we must always be on the alert to discover and correct unsafe conditions. In this respect we must:

• Never compromise good maintenance practices by scheduling an aircraft for flight with known or suspected mechanical deficiencies.

• Keep *all sick aircraft on the ground* until they are well again. *No one* is in a position to pressure you into doing otherwise.

• Keep our aircraft clean, free of fuel, oil and hydraulic leaks, and free of all flying safety defects.

• Never sacrifice sound maintenance practices for speedy aircraft scheduling in order to promote a high aircraft in-commission rate. From time to time you will be pressured to furnish more aircraft to the training program; however, it is the final decision of the maintenance personnel in this organization to say, 'It is ready.'

"In final analysis, we must all continue to use our own good judgment in the performance of our many duties. I am well pleased with your efforts but we *must not become complacent* just because we know and have been told that we're the best in the Command. Should we do this we will assure the untimely loss of an aircraft and possibly the loss of life. The very lives of the instructor and student pilots of this base are in our hands. *Keep them safe!*"

Properly supervised training is one of the most effective devices the Commander has at his disposal to increase his overall effectiveness and thereby increase flying safety. It stands to reason that efficiency and safe operation of equipment go hand in hand. If an individual is properly trained in any tool—whether it is operating a bulldozer or safely flying an aircraft—then he becomes sharper and safer at all times.

Participation in our flying safety program and accomplishment of our mission are encouraged. Personal invitations are extended the local citizens to visit the base and be guests on conducted tours to get first hand knowledge of what we are trying to accomplish.

My Flight Surgeon is the Chairman of our Human Factors Team. Its function is to be available to all pilots for consultation on any matter—personal or physical. This gives individuals an out-of-channel access to a solution of personal problems that they might otherwise be reluctant to seek. I feel that a number of accidents have been prevented as result of the efforts of this Team.

Here in Lubbock we have an active organization called "The South Plains Aviation Safety Council." Its membership is composed of an equal number of aviation-minded individuals, both military and civilian. The action of this Council has solved numerous problems involving air traffic and safe clearances between civilian and military aircraft *before* they became critical. For example, at one meeting it was revealed that a civil airway crossed over our new auxiliary field, then under construction. The Council, realizing the necessity for military traffic to have priority over this field, immediately went into action to notify the 400 private pilots within a 60-mile radius of Reese Air Force Base of the beginning date and time of operation. The value of this action is inestimable.

At Reese accident prevention is everybody's responsibility. I'm sure this is true at other bases too. I have encouraged and used an open-door policy for any individual to approach me on what he thinks is a danger area. For example, during the fall of 1959 some of our students arriving from primary schools were experiencing difficulty in landing the T-33 aircraft. In fact, several students were eliminated for not being able to land the T-Bird. Because of the aggravating nature of the problem and its frequent recurrence, 12 of our people went to the primary schools to determine the cause. After flying the T-37, we found that its characteristics were entirely different from the T-33, and were able to take corrective action to overcome this problem. This is only one instance in which we have possibly prevented an accident by taking positive action to correct the cause.

Another most important area that I feel has contributed to our accident-free record is the operation of our runway supervisory units. The stringent criteria and careful selection of our runway supervisors has definitely been one of the contributing factors in our safety record. Personal visits are made to the runway supervisory unit at least twice a week. I feel that by first hand observation of its operation I have personal assurance that positive control of all aircraft is being exercised by the controllers.

Last—but certainly not least—the services of our Base Weather Detachment Commander, Major Jack E. Turner, have been an invaluable aid to our success. His facility provides us with a continuous up-to-date flow of information about hazardous flying areas, those now existing and those threatening! My Deputy Commander, Colonel James D. C. Robinson, is charged with the responsibility of the safe conduct of all weekend flights. Each Thursday afternoon he is briefed on the weather throughout the country and those areas presently hazardous or predicted to be hazardous, so that any flights into these areas may be rerouted.

Success is a just reward for those who work at it and we really do work here at Reese. We've demonstrated that we're capable of continuing for an indefinite period and, of course, this is our intent . . . using the Personal Touch! ★

MARK THE SECOND SLIPPAGE

The biggest gap in our flying safety doctrine, I believe, is the thousands of flying hours between the events covered by our checklists.

Mandatory checklists cover the high-risk events of preflight, takeoff, landings, and specific emergencies. The thousands of hours between those high-risk events are the hours I want to talk about. These are the hours, you remember, that the classic definition of flying calls "hours of boredom interrupted by moments of stark terror."

This definition is too true for comfort. There are too many emergencies that, so far as the nonalert pilot is concerned, loom suddenly like a big black bird out of nowhere.

My point is that those "hours of boredom" actually exist and give the lie to the drum-beating sessions we have in the Flying Safety Program to the effect that we must get alert, stay alert, or we'll sure enough have an accident. The actuarial probability of an accident is extremely low. In fact, since the Air Force accident rate is approximately 5.1, this means the average pilot who may fly 200 hours a year is a pretty safe risk. He is good for about 100 years of flying per accident. How safe can we get?

On the other hand, there is that business about an emergency suddenly striking like a bolt from the blue. Contrary to this misconception, investigations show that most of our accidents result from several causes. In other words, there were two or more unsafe events or conditions that the pilot should have corrected well in advance of the final emergency. He permitted his fuel reserve to get too low, or failed to divert to an alternate when minor mechanical trouble, like a popped circuit or fluctuating pressures, appeared, or he ignored initial stages of fatigue or, etc., etc.

In summary, many emergencies are preceded by two or more little slippages. What's the answer? Perhaps the answer can best be made with a story. A man walked into a bar one evening and asked the bartender for two double martinis. As the bartender poured the gin into a mixer, the man stopped him and demanded that he mix the two drinks separately. Grudgingly, the bartender poured part of the gin into another container and mixed the man's first drink. While he was mixing the second one the customer seemed to ignore the first drink, but when the bartender set the second glass before him, the man paid for both, drank the second drink and turned to leave. Whereupon the bartender, overcome by curiosity, ventured to ask the customer about the first drink. "Frankly, I don't like martinis," the man replied, "but I found out a long time ago that martini number two is the one that really packs a wallop."

This man's logic may be faulty. But the second or subsequent event is the one that packs the wallop. Be sure to mark the second slippage and take action before it's too late. ★

Col. Clark L. Hosmer, Lackland AFB, Tex.

THE PILOT DID IT

Col. Frederick L. Smith, Chief, Bomber-Cargo Branch, DFSR

You can see by my title that I'm not in the fighter business, but I'm not sticking to the script this time. Being a pilot, I am allergic to accident findings tabbed "Pilot Factor." This, you know, is the polite way of saying Pilot Error. I'd like to use a fighter accident I've just read about to illustrate my point.

A flight of two took off on a local, conventional gunnery mission. After firing, the leader instructed his wingman to land first, then he landed from a straight-in approach because his guns had not been fired. He flew a normal, straight-in final and touched down approximately 700 feet from the approach end of the runway. Then he lowered the nosewheel to the runway, engaged nosewheel steering, and pulled the drag chute handle.

After touchdown, the aircraft veered to the right. The pilot attempted, unsuccessfully, to correct it with nosewheel steering. Then he attempted to re-engage with differential braking. When neither proved effective, he jettisoned the drag chute, thinking a crosswind may have caused the sudden veer to the right. Despite the pilot's efforts, the aircraft swerved off the runway, crossed a drainage ditch, and the nose gear collapsed. Two pertinent facts were that the aircraft landed with a flat or nearly flat tire, and the runway was wet.

The Board findings? Operator Error: Pilot allowed aircraft to develop a swerve without taking immediate corrective action. However, nothing in the investigation or board proceedings proved this to be true. As result, D/FSR has changed the findings of this investigation to be "Materiel Failure" based on the failure of the right main gear tire, cause unknown.

Recently I participated in three B-47 accident investigations within a two-weeks period that took me from coast to coast and back. Preliminary information indicated two of these accidents resulted from pilot error. It almost appears that through a process of elimination, the pilot invariably is blamed. The engines and structure check out, and the hydraulic system looks okay. In fact, everything checks the way it should, so *why* did the aircraft crash on takeoff? Must have been the pilot.

The obvious and real reason for solving accidents is so that corrective action can prevent a recurrence. We can't learn much from accidents blamed on the pilot merely by the process of elimination. Circumstantial evidence, alone, shouldn't be enough. All of us must increase our efforts to determine *just what did happen* to cause the accident. I've yet to meet my first pilot who didn't want to live. Have you? ★

CROSS COUNTRY NOTES

The Federal Aviation Agency wants you to report the following types of inflight malfunctions of navigational or air/ground communication equipment to FAA Air Traffic Control as soon as possible after you discover them:

• Loss of VOR, TACAN, ADF or low frequency navigation receiver capability.

• Complete or partial loss of Instrument Landing System (ILS) receiver capability.

• Impairment of air/ground communications capability.

In making his report the pilot should state to what extent his ability to operate IFR in the air traffic control system is impaired and the kind of ATC assistance he desires. The FAA pointed out that the regulation places very little additional burden on the pilots and that this information is needed so that the full traffic control facilities of the FAA can be used to assist pilots experiencing airborne equipment failure. Air traffic control services can assist a pilot experiencing navigational or communications difficulty only if the pilot makes his difficulty immediately known to ground facilities. Immediate notification will alert air traffic control to the fact that the pilot may not be able to comply fully with traffic control requirements, or that an emergency situation may develop. Immediate notification will also permit a more complete utilization of the resources of the traffic control system. FAA controllers can provide considerable assistance during en route operations, during entry into holding patterns, during holding and during the approach and landing, provided traffic control radar capabilities exist and communications can be established with the pilot.

Two Luke AFB troops had a more than interesting hassle with an F-100F recently—in fact, to them, it was probably downright frightening. Anyway, the student with an instructor pilot were out on a hooded-instrument mission and towards the end they entered into a straight-in GCA. The student intercepted the glide slope at 195K. As his airspeed decreased the pilot noticed that there wasn't much back stick travel remaining. After a correction to get down to the glide path the student asked the IP to take over controls as he was unable to stop an excessive descent. The IP took over between 400 and 500 feet, advanced the throttle to full military power but couldn't stop off a rate of descent of 1200 feet per minute. With both hands on the stick the IP told the student to retract the gear. Quick as a fox, the IP kicked up the flaps and then held the '100 in the air by brute force. With the airplane in clean configuration he managed to level at 200 feet over the desert and as the airspeed increased a climb was possible. Leveling off at 10,000 feet the IP went through simulated approaches until he found the best he could do was a 500 feet per minute rate of descent, no flaps and at 195K. A straight in final approach was made with the rate of descent controlled with power. A good touch down was made and another F-100 was saved.

The primary reason for retelling this story is to pass on to F-100 and all other jet pilots how one sharp fighter jock used his head. Maybe, just maybe, this could happen again. If it happens to you, maybe you'll remember it.

For the maintenance mind, the investigation revealed that the nut and washer were misisng from the forward attaching bolt on the bungee, horizontal stabilizer control system override. The bolt had worked out and was binding on an adjacent structure. Had the bolt backed out one-eighth of an inch more, there would have been a complete loss of stabilator control. This isn't too healthy a position to be in when you are fresh out of ejection altitude. You probably have guessed that maintenance personnel had failed to safety the castellated nut to the bolt with a cotter key.

Here is a letter Rex thought you might find interesting—particularly the T-33 pilots. If you have additional or different thoughts, spend a few minutes and let us know what your feelings are.

"TO: Editor, Aerospace Safety Magazine

1. Reference is made to the article by Major Wallace W. Dawson, ATC, titled, "Less Than A Hundred For '60" which appears in your Feb 1961 issue of Aerospace Safety Magazine. Major Dawson solicits comments in regard to the reason for fewer major accidents in the T-33 during 1960.

2. I am not an authority on flying, only a living pilot. To clarify this statement, I have just 2800 total flying hours with less than 200 in the T-33. But the standout factors that come to mind when I ask the question, "why did the number of accidents go down in 1960? . . . are as follows:

a. Two qualified T-33 pilots are now required for most all CRT flights. This team operation undoubtedly contributes to safer flying by reducing the mental and physical stress loads of the front cockpit pilot. This is particularly true during weather flying when two hands are hardly enough.

b. The increased capability for radar directed departures and letdowns. Especially the radar penetrations with the GCA handoff. This is a near perfect setup for a safe termination under marginal conditions and at night.

c. The improvements in approach lighting that have been made. Improved approach lighting permits much better transition from final approach to the line up—roundout phase of landing.

3. I am sure that there are many other significant factors other than those above which have contributed

FROM REX RILEY •

to a lower 1960 accident rate, such as improved flight planning, shut down with 80 gallons minimum fuel, and last but not least, improved flying safety literature, and indoctrination from you people.

R&D Staff Asst., Biomedical Sciences Division
WILLIAM M. HARRIS, Captain, USAF
Office—Assistant for Bioastronautics"

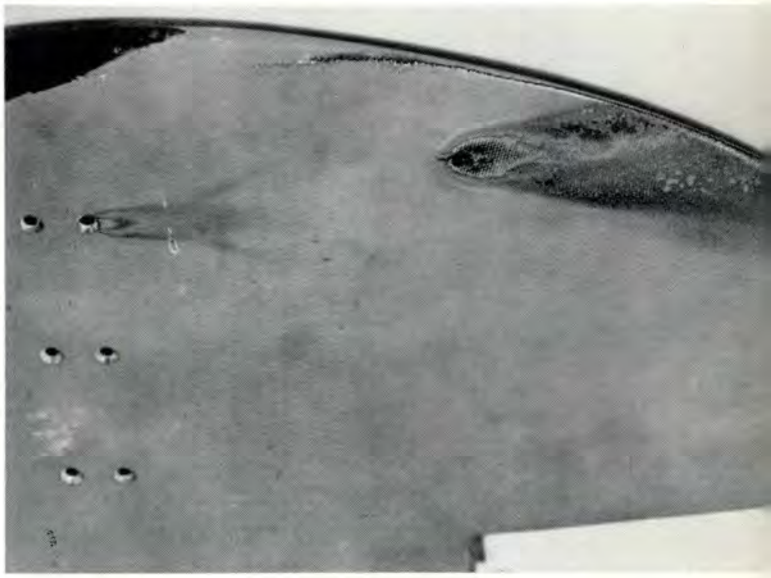
"Closed Except For Official Business" is the sign put up 1 March 1961 at the following seven training bases conducting undergraduate pilot training: Vance AFB, Oklahoma; Moody AFB, Georgia; Craig AFB, Alabama; Williams AFB, Arizona; Webb, Laredo, and Reese AFBs in Texas. Maximum service will still be available at other ATC bases. The limited resources available for the establishment of the consolidated undergraduate programs forced the restrictions on the seven bases named.

"Official Business Only" airfields are closed to all transient military aircraft except those with written orders to conduct Government business at or near the airfield. "Official Business Only" restrictions do not, however, preclude the use of bases in emergencies or as an alternate airfield during IFR weather conditions. Refueling is not considered official business.

In addition to the above restriction, with the exception of Webb AFB, Texas, the bases will be closed weekends, holidays, and nights between midnight and 0600 to all transient traffic. Webb AFB is unique in that it is the only one of the seven with a tenant ADC interceptor squadron, and is prepared to offer around-the-clock service to any pilot who might need it, provided he is on official business. Runway lights will be left on at all bases to provide for aircraft experiencing emergencies. ★

Have you hassled any this year with thunderstorms? If you haven't, it won't be long before you'll have your choice of penetrating, circumnavigating or doing a 180° degree turn. Here is the pilot's story of a T-33 penetration near Monroe, Louisiana; altitude 31,000; time 1400CST; weather was scattered cumulus with a line of thunderstorms across flight path.

"This thunderstorm penetration occurred at flight level 310. The thunderstorm appeared to top at 35,000 feet, and did not appear any more severe than scores I've penetrated. Moderate turbulence and slight windshield icing was experienced. Lighting struck the aircraft four times in a period of less than five minutes. The strike was preceded by a moderate "crack" of sound and we both experienced mild shock on top of head and parts of body in contact with seat and throttle. Flight altitude was altered to 37,000 feet and the penetration was completed without further event."



Above, the initial contact point of the lightning was on the screw heads. Note burned fiber glass. Below, left, a pencil inserted into the fiber glass antenna housing shows 10-inch split. Below, right, lightning also burned 2-inch hole in metal antenna.

LESSONS FROM THE

You could say that 1960 was a safe year at the Bomarc sites. After all, nobody got killed. You could, however, be less charitable and point out that several people did have to be hospitalized, and that some expensive hardware was damaged beyond repair. Whichever way you look at it, 1960 has taught us some valuable lessons on how to improve the safety record in '61.

Looking back over the accidents and near misses of the past 12 months, certain well-defined patterns emerge. Most injuries resulted from hazardous chemicals—oxidizer, electrolyte, and so on—while the majority of missile accidents which could have harmed personnel had to do with problems in the launching equipment.

There was no predominant "blame factor" worth examining. Faulty hardware and operator error seemed to be so interrelated in the histories of these incidents that little would be gained now by discussing *who* was at fault. Much more useful is the fact that everything in the 1960 accident record was avoidable; that is, it could have been and is now being prevented from happening again.

The most spectacular accident last year was the series of explosions in shelter 2-4, McGuire AFB, New Jersey, on 7 June. At 1451 EST smoke and flames were observed coming out of the shelter. The base fire alarm also signalled a fire at this time. At 1453 the fire was determined to be class 4. Twelve minutes later the site had been evacuated; Explosive Ordnance Disposal (EOD) and firefighting crews moved in shortly thereafter. From exhaustive post-accident investigation, safety teams pieced together the following sequence of events:

First, there was a helium tank explosion, followed almost immediately by the ignition of the JP-X tank. Four or five minutes later, the intense heat of this fire touched off the 80 octane tank. Sections 41 and 43, all control surfaces, and the top half of section 44 were completely demolished. The rocket package and—miraculously—section 42, still filled with oxidizer, were the only parts of the missile that survived. While the shelter was damaged beyond economical repair, it was not destroyed. It contained the Fire and Explosive Force. The primary cause of the accident was materiel failure in the forward dome boss of the helium tank. Fortunately, no one was injured.

To reduce the likelihood of such an accident happening again, Boeing immediately instituted several measures, both in-house and in cooperation with the Air Force. Quality control in helium system production was tightened. A fatigue test program and other investigations were undertaken. Engineering Change Proposal (ECP) 391-3 (T.O. 21-IM99A-553), "Helium System Reinspection and Rework," was issued with "urgent action" priority. Work on this Tech Order has been completed at all Bomarc sites.

Then in late April, during a missile offloading, an airman was nearly pinned inside the MATS C-124 which airlifts Bomarcs to the sites. Riding on the loading trailer to control an emergency brake, the airman became wedged between the missile already on the trailer and the other missile waiting to be offloaded. Investigation later revealed that he shouldn't have been there in the first place. There was no Tech Order requirement for him to ride the trailer but his apparent purpose in controlling the emergency brake was to provide added insurance to the restraint chains and more rugged handbrake normally used. (See page 7 of the December 1960 issue of Aerospace Safety Magazine for a more detailed statement.)

Finally, in the miscellaneous category, another "routine" operation had gone awry. On 13 October, at the compressor building, two maintenance personnel were adjusting belt tension on the high pressure air compressor. The belt guard had been removed and the compressor switch was turned off. One of the men had started to test belt tension manually, when the compressor shaft kicked forward about ⅓ revolution and pulled his hand into a nearby pulley. Four fingers were broken and the hand was badly lacerated. The reason for this accident was found to be "no solenoid safety switch on one cylinder." Normally these solenoids act to "unload" each cylinder when the compressor is shut down, making sure—among other things—that no air pressure is present to move the compressor shaft. In this case a defective solenoid had been removed and replaced with a plug.

To prevent recurrence of this kind of accident, a directive was issued stating that compressors henceforth will have all solenoid safety switches present and functioning, as well as a positive indication (lights) that all cylinders are unloaded after compressor shutdown.

Regarding launcher malfunctions and near misses, 1960 saw too many inadvertent or "surprise" missile erections to cover each of them here in detail. We shall, however, mention two as typical.

• On 30 July one site's quiet Saturday afternoon was interrupted by the rumble of a shelter roof opening. Shortly thereafter, the shiny, pointed nose of a Bomarc missile appeared. By the time the missile was fully erect, the area was well on the way to being evacuated.

Nothing happened. The base maintenance officer and a Boeing Tech Rep arrived quickly, entered the shelter and found the ELE launch status lights in malfunction. The launch countdown time meter read zero, but a quick check showed that no power had been applied to the missile. Helium pressure was then bled off and after some manual switching the two trouble-shooters got the erector and missile down and the roof closed. Then came the standard, thorough investigation. It revealed these conditions:

LAUNCHERS

• Blue, crystalline corrosion in one of the ELE receptacles.

• Water oozing out of the plug cable.

• Shorting between two pins in the receptacle.

• A pool of water, inside the junction cabinet directly under the corroded receptacle.

The tech rep, remembering there'd been a heavy rain the night before the incident, got a fire hose and played a stream of water on the shelter roof. Sure enough, after four or five minutes a leak was observed right over the corroded receptacle. As the tech rep put it, "this leak proved to be quite a stream of water."

All ELE connectors were immediately inspected for corrosion, and roofs were inspected for leaks. An ECP was instituted to inspect periodically for roof leaks and condensation, regulate hosing-down procedures, waterproof vulnerable connectors with suitable gaskets and sealants, and to install drip pans over the ELE cabinets.

• Another type of inadvertent erection may sound at first like slapstick comedy: raising a missile with the shelter roof still closed. But all that kept the following incident from turning into the worst kind of tragedy was an alert NCOIC, who stopped the erection sequence just before the missile nose reached the roof.

On 29 September a modification team had just finished installing a restraining pin on the erector in one shelter. The NCOIC of shelters lowered the missile for them and secured the erector and shelter, following strict Tech Order procedures. He then went over to another shelter to supervise some OJT. About three minutes later, in came a member of the mod team with the interesting news that the missile was erecting and the roof was still closed. The NCOIC returned to the first shelter at top speed and when he arrived, the missile nose was about eight to ten inches from the roof. He quickly turned the erector bleed valve on the skid wide open, and the missile returned to its horizontal position as soon as pressure was bled to zero. Investigation revealed a sticky shutoff valve and a leaky control valve.

Another launcher incident proved to be more serious. On the morning of 15 August a fueled missile was erected as part of a routine MIE Check. Unknown to everyone, including the operator—since everything had been functioning normally up to the time of lowering—a launcher malfunction had kept the carriage-to-base lock locked, the boom-to-carriage lock unlocked, and the nose clamps closed. This meant that the boattail of the missile was secured in the carriage (still in launch position) while the nose of the missile was gripped tightly by the nose clamps on the boom. When the boom was lowered, the missile was snapped in two, the rupture occurring aft near the wind-restraint arms. When the boom had returned to horizontal, the nose of the missile was in a 15-degree downward attitude.

The site was evacuated immediately, except for the firefighting and safety crews, but there was no fire or fuel/oxidizer leaks. The site was reactivated, and normal defueling and a preliminary investigation were begun soon after. No one was injured.

Ogden Air Material Area and Boeing tackled the problem of preventing any future missile-bending. Ogden's fix was finally adopted: A "black box," located on the ELE junction cabinet wall in each shelter to provide a foolproof means of securing missile, erector and roof.

So much then for non-chemical accidents. Each was a "near miss"—a comforting term, and when spoken implicitly is accompanied by a sigh of relief. Before we examine the moral significance of the near miss, let's talk about the serious or fatal accident. The moral significance of the serious or fatal accident is clear enough. That someone should be killed outright or maimed for life when the killing or maiming could have been prevented is, quite simply, wrong! Our emotional reactions are likewise clear: shock, sorrow, sympathy for the next-of-kin.

But contrast these with the reactions you get after a near miss: Laughter, most likely. Relief, certainly. Occasionally a reborn and healthy respect for the operation or inanimate object which produced the incident.

Is this really enough? The difference between comedy and tragedy in the missile-erecting-roof closed situation described above was at most ten inches. The difference between presence and absence in the launch area at McGuire AFB on 7 June—in this case also the difference between life and death—could have been measured in yards. How close is close?

Close enough, certainly, to make no effective difference in our reaction. It might be useful to exercise our imagination, to visualize for a moment what could have happened had it been a hit, not a miss—instead of shrugging it off as a freak or isolated case which could never conceivably happen again.

The unpleasant fact remains that these things have happened again. A quick look at the number of inadvertent erections since the Bomarc became operational should be indication enough.

Official reactions to near misses do, fortunately, show this imaginative concern. Officially the numerical results of an incident or accident—lives lost, dollars worth of damage—have no bearing on the manhours expended in making sure it is a one-time occurrence.

Such however may not always be the unofficial reaction. Our point here is only that it should be. *Always.* There is nothing stupid about maintenance personnel. After all, they are professional technicians, closest of anybody to the equipment they maintain. They know the hardware and they respect it. Regardless of whose fault an accident was, the maintenance men concerned can contribute more than anyone else toward making block 14 stick. On the Form 122 this reads: "Specific action taken to prevent recurrence." And perhaps they can do a better job of this by asking themselves, "Suppose it had been for real?"

We've been talking about safety after the fact. Obviously a good safety program should keep these unfortunate "facts" from appearing there in the first place. So let's examine now a few "for real" accidents and see how they might have been avoided.

The hazards of potassium hydroxide (KOH) are great. One day an NCO was in the battery room, squeezing KOH from an electrolyte bottle into one of the heater cells of a missile power battery. He was following Tech Order procedures and wearing a face shield, gloves and apron—but no safety goggles. Suddenly, as he applied pressure, the spout and bottle separated, and a stream of KOH shot out from under the filling cap, striking him in one eye.

The reasons for this accident were:

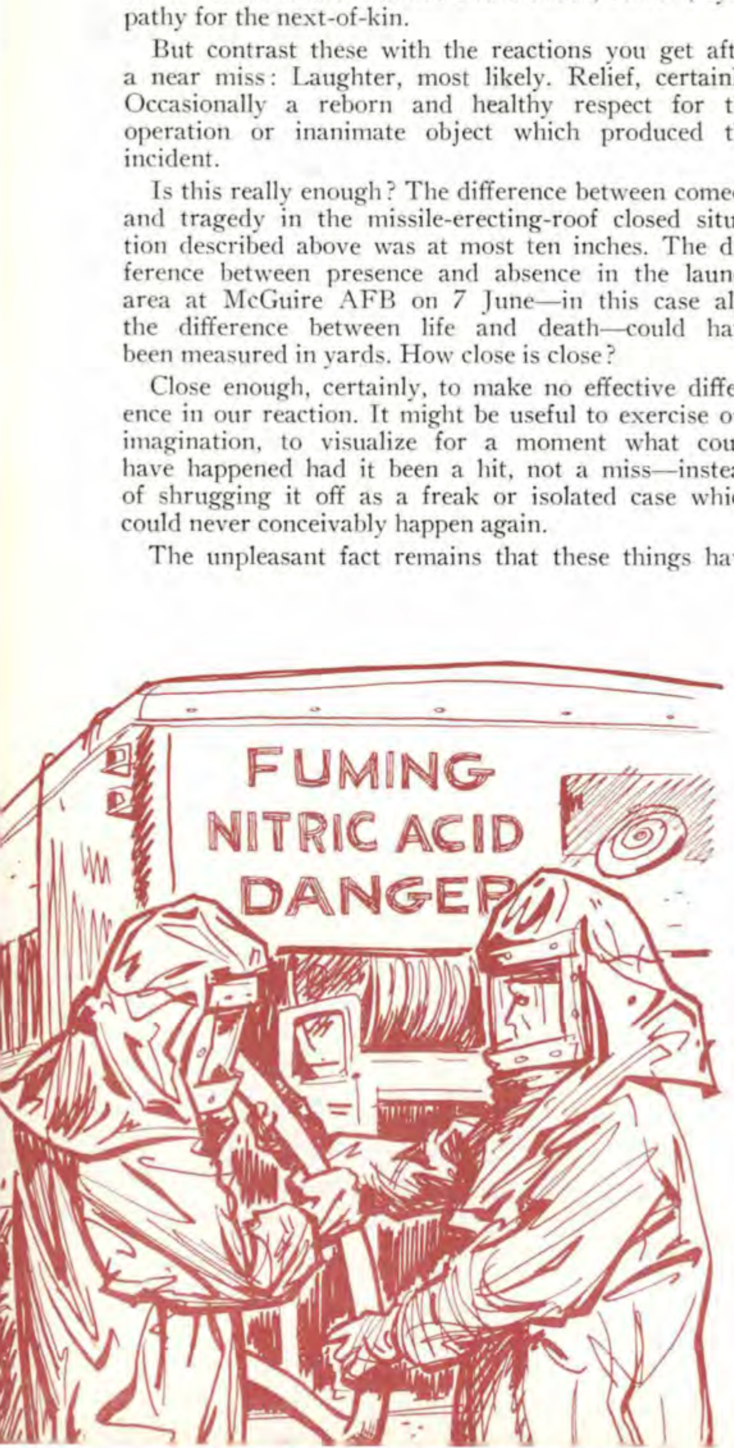
- Lack of safety goggles.
- Bad seal between bottle and filling cap.

Again, operator error and faulty hardware were interrelated. Added to this, safety goggles were not available at the time, having been back-ordered. To help prevent recurrence, a note was included in the applicable Tech Order stressing the importance of a good seal between bottle and cap. In addition, an improvement over the present filling bottle is now being designed.

At a later date another NCO was disconnecting chilled water lines from the missile at the A&M shop FCO station and was sprayed in the face and eyes with chromate solution. The cause of the accident was an abnormally high pressure in the return line of the A&M shop chilled water system, resulting from a faulty check valve.

Protective goggles were obtained immediately for personnel disconnecting the chilled water lines, and the water system was repaired by a Corps of Engineers crew.

And still another accident. During inspection and maintenance on the unloading header in the fueling area, an airman was sprayed with Inhibited Red Fuming Nitric Acid IRFNA. The airman had noted the day before that a sight gage in the unloading line was corroded. Since this gage had failed once before, he decided to keep a close daily check on it. The next day,



after loosening the loading hose plate, the airman returned to the acid building to raise detention tank pressure. This provides enough water to flush out the unloading line. Apparently the shutoff valve between this line and the detention tank was cracked slightly open. Contaminated water leaked back through the valve and mixed with a small quantity of acid still in the loop of the unloading hose. Pressure in the hose rose sharply. As the airman returned to the header, this pressure suddenly blew out the defective sight gage and the hose and sprayed him with a IRFNA/water mixture.

Procedures were instituted immediately to provide a minimum coverage—hood and gloves—for personnel making visual inspections in the area. The gage was removed from the line and a straight section of steel pipe welded in, replacing it. It was also recommended that a transparent Kel-F type shield be inserted into the line.

IRFNA fumes proved to be as dangerous as the liquid. When a flange gasket in the acid vault ruptured, 300-400 gallons of IRFNA spilled, filling the vault with acid fumes. An NCO went in to wash down the vault and he was wearing a rubber suit, gloves and boots, a protective hood and Scott Air-Pak. During the cleanup his air supply suddenly ran out and he began to breathe IRFNA fumes. He left the area immediately and was hospitalized. Symptoms were coughing, choking, tightness in the chest, difficulty in breathing. Diagnosis: "acute bronchitis from toxic fume exposure."

It was recommended that low pressure alarms be installed on the Air-Paks.

With the advantage of hindsight, anybody can say: "The KOH incident could have been prevented by checking for a tight fit on the filling bottle, and by wearing safety goggles. Or—in the first place—by recognizing that the two-thread filling cap with the anti-drip disc was potentially dangerous."

The chromated water incident could have been avoided had the faulty check valve been noticed in time, and the consequences of such a breakdown recognized.

The first IRFNA accident would never have happened had the shutoff valve been closed completely, or if the corroded sight gage had been seen as a hazard.

The second IRFNA accident could have been prevented by the simple expedient of installing a low-pressure alarm on the Scott Air-Pak.

So much for Monday morning quarterbacking. But it does raise a few valid points:

• Preventive measures would have involved fewer manhours than the work that had to be done *after* the accident.

• Safety hazards are noted continually, both by the Air Force and by the contractor. The "ounce of prevention" in each of the four accidents mentioned falls into the category of foreseeable safety maintenance.

• Periodic and close inspection figured as an important factor in each case.

Fine. But how do you foresee an accident? The answer again is "imagination." Here are a few suggestions:

First, inspection—a thorough inspection; reporting and corrective maintenance no matter how insignificant the discrepancy may seem.

Second, a complete knowledge of the system or subsystem. Only in this way are flaws, discovered by inspection, recognized for what they are: safety hazards.

Third, an acute awareness of all the hazards associated with the system. Coupled with the two suggestions above, such awareness can help develop an all-important "what if" attitude toward maintenance for safety.

In the chilled water incident, closer inspection would have revealed the faulty check valve. Knowledge of the system would have told the inspector that an abnormally high—and therefore hazardous—pressure would develop as a result. And awareness of the hazards of sodium chromate solution would have impressed upon maintenance personnel the seriousness of a potential accident.

A "what if" attitude doesn't take any time away from normal maintenance. But it does contribute an added dimension to this maintenance: the dimension of safety.

Also, familiarity breeds carelessness. No matter how well aware we may be of a safety hazard, there often develops a tendency to take the hazard for granted, to "learn to live with it." At least until someone gets hurt.

At an acid pit in one decontamination facility, for example, a fume scrubber duct runs directly over the access door to the pit. In the duct, also directly over the door, is a slip-fit type joint. Because the duct is in a cooler part of the facility, water condenses on the inside of the duct and some of the IRFNA fumes passing by dissolve in this condensatoin. The result: highly concentrated nitric acid. At this particular site, the condensed acid, leaking through the joint in the duct, managed to eat a sizeable hole in the concrete floor below. Personnel entering the pit to do maintenance work thus knew of the hazard and generally scooted past the leak, between drips. That is—until one day there was an accident. Maybe the man's timing was off, maybe he hesitated for a moment or less. Anyway he was hit on the head by a single drop of nitric acid, and as a result suffered second and third degree burns. Perhaps you can call this happening "the wages of living with" a safety hazard.

In conclusion, along with "imagination" before and after the fact belongs the highly important element of "common sense." A great deal of safety information disseminated to Air Force personnel can be boiled down to these seven words:

Know the hazards and use your head.

Information is thus critical to an intelligent safety approach. Safety research goes on unremittingly, on the part of both contractors and Air Force offices like the Deputy Inspector General for Safety. If there is ever the vaguest shadow of doubt about "the safe thing to do," maintenance people should always consult the applicable T.O., TCT.O., or safety directive. Technical representatives, safety officers, and the various safety publications are equally valuable sources of information. But the rest—common sense and imaginative maintenance—are up to you. ★

A TWO TIME

There have been 42 aircrew members who have ejected twice and two who have three ejections on record. One of the two-time losers is 1st Lt. James R. Allender, Jr., who has ejected from high performance aircraft twice within four months. We'll let him tell you of his experience. Perhaps there'll be some lessons for other pilots to ponder.

10 November 1959—how can I forget that date— was slated to be one of "those days," although I didn't know it as I prepared to take off in an F-104B with an Instructor Pilot for my last dual ride before soloing the F-104A.

Prestart, taxi and runup were normal. On takeoff, nosewheel steering was used until about 70-80 knots and then released. The first indication that all was not well came at about 130 knots with a slight momentary nosewheel shimmy. It quit, however, and did not recur until about 160 knots, just as the nosewheel was being lifted off the ground. By this time we were too far down the runway to abort. The second shimmy was much more severe, and there was just barely time enough to wonder what was causing it, when we became airborne in a normal takeoff attitude.

The landing gear lever would not come up so I hit the speed brake switch to keep the speed down. I started to ask the IP about the gear lever and discovered that the interphone was out; there appeared to be no electrical power in the cockpit.

After the generators were reset, some instrument power came back on so I depressed the override switch and the gear handle raised. With the speed brake switch placed "IN," I slowly retarded the throttle. When it could be seen that the nozzles would work, power was reduced to military. By this time the altitude was approximately 2500 feet. We continued climbing to 10,000 feet, keeping the airspeed to 260 knots and takeoff flaps down because we didn't know the landing gear position. As we neared 10,000 feet I jiggled the flap level strongly. The IP then signalled me not to raise the flaps—and I agreed—since we didn't know if power would be available to put them back down. Then he passed a note to me saying that he thought we had popped some circuit breakers because of the nosewheel shimmy, and that we would leave the takeoff flaps down and stay aloft until we burned down to a reasonable fuel weight, then land.

After about 40 minutes in the air I began to notice a slight trim change—when I let go of the stick the nose would come up. I assumed this indicated we must no longer be using pylon fuel, that some must have been burned out of the fuselage. I shook the stick to get the IP's attention, then pointed to my watch and the air base to ask if he thought it was time to land. He passed another note saying he would make the landing and that I was to pull the manual gear release when we were below 225 knots.

Shortly after he took the airplane I noticed a violent power reduction, and a check of the gages showed we had flamed out. I watched the tachometer closely as it unwound. The RPM dropped rapidly to about 64 per cent, then rose immediately to 67 where it stayed for a few seconds before unwinding toward zero. When I last noticed, it was about 15 per cent and was still dropping—rapidly.

The IP turned the aircraft toward the field for what looked like a base key to a flameout pattern. He dropped the nose sharply but the airspeed continued to drop (the gear was still down). The nose appeared to be about 30 degrees below the horizon when the aircraft stalled, snapped to the left and entered a spin. The airspeed was decreasing rapidly even with the nose 'way below the horizon. As the aircraft entered the spin, I made up my mind I would have to leave it, but waited until the IP shouted "Get Out" through his mask.

I pulled the seat D-ring immediately (downward ejection). There was a roar, and a blur in front of my face, then a small blast of air and I was tumbling and rolling in an oblique plane to the earth. Two objects floated near me but I couldn't identify them. I wasn't aware of actually separating from the seat, but knew I was no longer in it. On about the second tumble I started to reach for the parachute D-ring but the chute opened before I could reach it. There was no noticeable force experienced, either during the ejection or the opening of the chute.

After checking the parachute thoroughly and finding it properly opened and in good condition, I looked around for the IP. He was about one or two thousand feet below me and his chute looked good. I unfastened my oxygen mask and chinstrap, inflated my underarm life vest and continued to check myself over. I found my knee board down around my ankle and the contents of unzippered pockets still intact. I removed the clipboard and refastened it on my knee but decided to wait a few minutes to pull the Firewell kit release, since I was still quite a distance up.

The chute started to oscillate, which was easily stopped by grasping the front risers and slipping the chute, then abruptly releasing the risers.

The next time I saw the IP, he was in the water with his life raft inflated. I estimated I was still three or four hundred feet in the air and decided I'd better pull the Firewell kit release. As I grasped the handle and pulled—still watching the IP—I hit the water, completely unexpectedly! Naturally I went under, possibly three or four feet, but immediately came back to the surface. I couldn't find the life raft, but the Firewell kit was floating in front of me.

After pulling the handle again, with no results, I fastened the two halves of my life preserver together in front, so I wouldn't be pulled under, and started inspecting the Firewell kit. I found the lanyard to the raft and started pulling it in. When I got the raft to the surface I held on to it and pulled the lanyard next to the CO_2 bottle. The raft inflated immediately. At first I wasn't quite sure whether the raft was inverted or right side up so I decided to pull myself up on the small end and inspect the situation.

By this time an SA-16 was landing beside me so I pulled myself up on top of the inverted raft and waited to be picked up. I couldn't remove my parachute harness without deflating my life preserver, which I was not willing to do, without turning the raft over so I could get in it.

The SA-16 came up within a few minutes and picked me up from the water, then taxied over to the IP and picked him up.

This accident was attributed to materiel failure from an undetermined cause. It was proven that there were at least 1000 pounds and more probably 1500 of fuel aboard at flameout. Contributory causes were listed as materiel failure of the nosewheel shimmy damper. *(Reference Accident #1. A subsequent accident which occurred under similar circumstances revealed the primary cause of the accident to be a malfunction of the pylon pressurization valve which allowed the main fuel tank to pressurize to the extent that it would not allow fuel to flow from the aft fuselage tank to the main fuselage tank, resulting in a flameout. A Tech Order has been initiated to prevent recurrence. Ed.)*

My second ejection from an F-104 occurred on 7 March 1960. I took off under instrument conditions. About two minutes after takeoff I experienced power loss and noticed dense smoke and fumes in the cockpit, low oil level warning, and afterburner nozzle failure to the full open position. Soon the smoke was so dense it irritated my eyes. It was impossible to maintain altitude or airspeed with the power available; the AB wouldn't light so I elected to eject. At this time the aircraft was approximately 4500 feet above the ground, descending at 1500 to 2000 RPM, 170 knots IAS, and getting stall warnings from the APC system.

I reached down and grasped the ejection D-ring with both hands and pulled up. The ring seemed to travel two or three inches before the seat fired. Instead of straightening up completely, I remained slightly bent over and watched the D-ring as I pulled it. The seat came cleanly out of the bottom of the airplane with only very light forces.

After I cleared the plane, the seat started to rotate very slowly backwards and was almost inverted when I separated from it. There was no tendency for me to hang on to the seat D-ring after clearing the aircraft and I separated from the seat rather abruptly, shortly after becoming aware that I was no longer fastened in the seat by the harness.

I reached for the parachute D-ring and started to pull but found the chute already opening around me. When it did open, I was on my back, slightly head-down. The chute came up past my side and somersaulted me to an erect position. My helmet and mask were retained. I knew the oxygen mask hose was disconnected from the block on the chute because I had difficulty breathing. This was caused by the restriction at the hose connection when the aircraft oxygen hose is disconnected.

I inflated my underarm life preserver and pulled the handle on the Firewell kit. The kit released, and the raft inflated but was torn loose from the lanyard and floated away. I never saw it again. The survival pack, when it was released and dangled 20 feet below me, stopped all oscillations of the chute.

I found myself drifting northward away from the aircraft wreckage; I could see it burning a short distance away. I didn't know whether I would land in water or on dry land until I was about 200 feet from the ground; then I could see that I would float across an irrigation canal onto dry ground.

I landed on dry, flat pasture land, drifting backwards at the time of contact. I rolled backwards and slightly to the side as I hit, then rolled over on my stomach. I was being dragged slowly over the ground until I collapsed the chute by pulling on the bottom shroud lines.

I spread my chute out so it would be seen from the air and started to open the Firewell kit to remove the emergency radio, when the manager of the property showed up and took me to the farmhouse and called the base. About two hours later, when no one had come to pick me up, I called again. Finally the wife of the farm manager took me to the base.

The cause of this accident was later determined to be failure of the Number One gear case scavenge pump, resulting in rapid loss of the engine oil.

Looking back, I am reminded of that old saying about "An Ill Wind." Perhaps some of the lessons I learned will be valuable to you who've read this far.

First, I had better point out that the F-104s I got out of were equipped with downward ejection seats. The '104s are now being modified for upward ejection (Rocket Catapult) with pilot-seat separator. If you are flying either model, don't bend over like I did in my second ejection. That's a bad habit in the downward ejection and even worse in the upward ejection seat because it can result in serious back injury.

Fortunately, I had no tendency to hang on to the seat D-ring. I understand this has been a problem, however, because of the need for positive action in effecting seat separation.

As I mentioned, in regard to my first ejection, I delayed too long in releasing my Firewell kit. This could have jeopardized survival in the water. Also, I recall that I wanted to release my chute harness, having forgotten that the life raft and survival kit were attached to it.

Considering my experiences, and others I've read about, there is one thing that I consider to be of extreme importance. My decision to eject in both cases was made with ample altitude to insure success after adequate corrective action was taken.

I guess I can sum up like this: The success of ejection and post ejection survival are dependent upon complete knowledge of proper techniques and procedures. The only way to get this knowledge is by thorough training. ★

Teamwork

"I was really proud of my crew today," the Captain said, after landing. "We practice coordination constantly, but today I saw it in action." Teamwork is routine for USAF crews in the air and on the ground at Ernest Harmon AFB, Newfoundland, where SAC and AACS personnel must be ready to cope with an emergency—"weather" or no! Cool, split-second timing and coordination between the air and ground crews plus job professionalism paid off in a recent inflight emergency.

It was a routine refueling mission. The day was a typical January day at Harmon: *cold*, visibility ½ mile, gusty 28-knot winds. Captain Willis Hammack and his crew, JO-3, manned the lead KC-97 in a three-aircraft cell, taking off to refuel a B-47 that was bound nonstop to the United States. The tanker carried 66,000 pounds of fuel.

As the aircraft was breaking ground, TSgt Walder Baldasare, flight engineer, reported that No. 2 engine had lost power. It was feathered immediately, and TSgt Kenneth Brack, the boom operator, began fuel dumping operations, "almost right off the end of the runway," Captain Hammack said later.

Then as the copilot, 1st Lt. Raymond Malony, began to retract the landing gear, the No. 3 engine started to backfire, and lost almost all power. Both pilots held the heavy controls and the aircraft slowly gained altitude. As the tanker began a gradual ascent, Capt. Samuel Pennington, the Navigator, began to feed information to the pilots on their position.

At this point, the 1933rd AACS' Radar Approach Control (RAPCON) beamed its radar on the crippled plane and began "talking" it home. Because of the unique local installation, RAPCON is capable of directing precision radar approaches to either end of Harmon's runway. MSgt Howard Anderson and TSgt Daniel Rine, watching the tanker from the approach control position, directed a 180-degree turn back to the field. As the plane turned, it lost approximately 150 of its 850 feet of precious altitude. The two RAPCON sergeants watched the aircraft target as it seemingly skimmed the waves on their scope.

The plane was turned over to the feeder controller at RAPCON, A1C Harold Ellsworth, who directed corrections in altitude and azimuth to bring it into range of the precision radar manned by A1C Peyton Rolley.

Airman Rolley, the final controller, took charge of the tanker's descent and fed corrected headings to the pilot to keep the plane on a standard rate of descent and at the same time lined up with the runway centerline. At a mile and a half from touchdown, Captain Hammack saw the Harmon strip.

The tanker rolled the full length of the 10,000-foot runway since the pilots were unable to reverse thrust and because of quartering 26-knot tailwind. The only damage was a blowout of an outboard tire, believed to have been caused by the heavy braking necessary to stop the aircraft.

This is one case where the constant practice of coordination by aircrew and RAPCON controllers paid off when the emergency was for real! ★

Office of Information, Ernest Harmon AFB, Newfoundland

19  60

July-December Flight Safety Awards

456th Fighter Interceptor Squadron
Castle AFB, Calif. ADC

★

482d Fighter Interceptor Squadron
Seymour Johnson AFB, N. C. ADC

★

Air Proving Ground Center
Eglin AFB, Fla. ARDC

★

3615th Pilot Training Wing
Craig AFB, Ala. ATC

★

3500th Pilot Training Wing
Reese AFB, Tex. ATC

★

3635th Flying Training Wing
Stead AFB, Nev. ATC

★

63d Troop Carrier Wing
Donaldson AFB, S. C. MATS

★

1501st Air Transport Wing
Travis AFB, Calif. MATS

★

Air Forces Iceland
Keflavik Airport, Iceland MATS

★

6091st Reconnaissance Squadron
Yokota Air Base, Japan PACAF

★

3d Bombardment Wing
Yokota Air Base, Japan PACAF

★

Barksdale AFB, Louisiana SAC

55th Strategic Reconnaissance Wing
Forbes AFB, Kansas SAC

★

819th Air Division
Dyess AFB, Tex. SAC

★

354th Tactical Fighter Wing
Myrtle Beach AFB, S. C. TAC

★

839th Air Division
Sewart AFB, Tenn. TAC

★

522d Tactical Fighter Squadron
Cannon AFB, N. Mex. TAC

★

322d Air Division
Evreux-Fauville Air Base, France USAFE

★

47th Bombardment Wing
RAF Sculthorpe, England USAFE

★

81st Tactical Fighter Wing
RAF Bentwaters, England USAFE

★

442d Troop Carrier Wing
Richards-Gebaur AFB, Mo. USAFRes

★

452d Troop Carrier Wing
March AFB, Calif. USAFRes

★

194th Fighter Interceptor Squadron
Fresno ANG Base, Calif. ANG

★

121st Tactical Fighter Squadron
DC ANG, Andrews AFB, Washington, D.C. ANG

As a Ground Safety Officer with 19 years of full-time accident prevention experience, I have often been discouraged by the many accidents I've investigated or reviewed, that resulted from unsafe acts or unsafe conditions. In many cases they could have been prevented had better supervision been provided. By supervision, I mean having "first-line supervisors selected to direct the immediate work of others."

Often safety men have undertaken supervisory responsibilities that naturally belong to supervision. They have boasted that they have authority to shut down any operation they consider unsafe, issue orders for guarding, and to initiate changes in operating procedures. All these activities seem to have had the effect of placing accident prevention outside the responsibility of the supervisor and creating the feeling that safety is the responsibility of the safety department. In my opinion, any Accident Prevention Program built on this concept is doomed to failure.

The role of the Ground Safety Officer is to coordinate the USAF Accident Prevention Program by supplying ideas and inspiration to management, supervisors, and employees. However, the success or failure of the program is dependent to a large degree on the enthusiasm, interest, and participation of the immediate supervisor. The success of the USAF Ground Safety program has already demonstrated that its techniques are effective in reducing accidents and promoting efficiency. Furthermore, there is no limit to the progress possible, through the combined techniques of education and engineering, and the enforcement thereof by the immediate supervisor. He is a representative of management.

If we are not yet convinced that supervisors play an important role in the prevention of accidents, let's get down to the grass roots of some present and future problems of the safety program.

First, along with the old, there will be new specific problems. Some of them are routine, while others are technological and scientific. Never has the challenge to management and supervision been greater. The supervisor, in accepting his part in the safety program, must understand he has some things to learn and some things for which he alone is responsible. The supervisor must search for a method of identifying and correcting potential ground safety hazards—a plan that will serve its intended objective of controlling unsafe conditions and unsafe acts.

It has been my sad experience on several occasions to find accidents that resulted because the supervisor of the immediate operation was either unfamiliar with the hazards of the job, or he demonstrated an improper attitude by not taking preventive action against known hazards. Consequently, accidents have occurred which could have been prevented. This, in my opinion, is inexcusable, and such a person is not qualified to call himself a supervisor and should be relieved of his responsible position.

A good supervisor not only understands the hazards of his job, but he establishes procedures to insure that each worker gets thorough job instruction which includes safety instruction. He must not assume that workers understand perfectly after the initial instructions, but must constantly check and make sure they do their work just as instructed. This is a continuous job. *The success of the Accident Prevention Program depends upon it.*

Unfortunately, however, accidents do happen! A good supervisor will establish procedures for notifying him of accidents. He will accept an accident as a "RED LIGHT," meaning something went wrong with his men, materiel, process or equipment.

He should determine the reason for the accident, and then act to prevent a recurrence. This corrective action should affect everyone under his supervision. The four kinds of action available for the correction of accident-producing causes are well known, but not always practiced by supervisory personnel. They are as follows:

ENGINEERING REVISION. Includes the guarding of machines and tools, isolation of hazards, revision of procedures and processes, illumination, ventilation, color and color contrast, provision of personal protective devices, substitution of safer tools, etc., replacement and repair, and a wide variety of similar steps of a mechanical or physical nature.

EXAMPLE: Materiel handling is one of the most expensive industrial operations and it produces many injuries. However, many hazards have been removed by the installation of mechanical or automatic materials handling systems, relocation of processes or other changes which have reduced material handling by physical means.

INSTRUCTION, PERSUASION AND APPEAL. Includes training as well as instruction and reinstruction, persuasion and appeal through the motivating characteristics of persons, visual as well as oral approaches, safety education, and safety organization with all of its many activities.

EXAMPLE: This can be best illustrated by factual evidence that airmen under 25 years of age have experienced substantial reduction in private vehicle accidents since the beginning of the USAF "Driver Improvement Course." The benefits derived from this instruction could very well apply to any on-duty occupation.

PERSONNEL ADJUSTMENT. Includes selection and placement with regard to the requirements of the job and the physical and mental suitability of the worker, medical treatment, and advice.

EXAMPLE: A civilian employee 62 years old was assigned to climb a straight ladder to accomplish work on the roof of a building. While descending the ladder, he lost his balance and fell approximately 8 feet. The result was a serious injury. Investigation of the accident revealed that although he was required to climb, he had not received a physical examination during the past 10 years of his employment. A physical, plus proper placement of the employee, should he have proved physically unfit, could have prevented this accident.

DISCIPLINE. Including mild admonishment, expression of disappointment, fair insistence, statement of past record, transfer to other work, and penalties.

EXAMPLE: A lathe hand, persisted in blowing off metal chip accumulations from his machine with compressed air, although a hand brush was available for this purpose. Subsequently, after numerous attempts he succeeded in blowing chips against the side of a fellow worker's face. The supervisor said, "What am I going to do, except fire the man?" None of us wants to do that, then he added: "All men break rules occasionally." The supervisor finally agreed, although reluctantly, he could have found some way to get his men to obey instructions.

The four accident-producing causes and examples in this report were taken from: Chapter 6, Third Edition, Industrial Accident Prevention by Heinrich.

Supervisors who accept their responsibility for on-the-job accidents, often hedge on their responsibility when off-the-job safety is concerned. It should be understood that the goal of off-the-job safety is the same as for on-the-job: keeping our Air Force military and civilian personnel free from injury.

The average worker spends less than a third of his time on the job. Air Force records reveal that off-the-job injuries sustained by military personnel compared with the number of on-the-job injuries were 7849 to 2814 for 1960. In other words, regardless of where the man is hurt the Air Force loses. Losses include, but are not limited to, the following:

- Loss of time, resulting in delay.
- Damage to materiel and equipment.
- Training of new personnel to replace the injured.
- Additional work loads placed on supervision.
- Combat capability affected.
- Necessary relief personnel.
- Medical and other costs.

The Air Force, therefore, is conducting programs to better inform military and civilian personnel on points of away-from-work accident prevention. This program is promulgated, through the Installation Ground Safety Officer, by the use of films, lectures, and other means calculated to make personnel realize their need to live safety at home, at play, or while driving the freeways.

The success or failure of this program is contingent on the interest and participation of supervisors. They must stress the importance of safety in personal contacts with their personnel. In other words, "Safety is Contagious," especially when modeled by the supervisor.

In summary, let's take a closer look at the supervisor's role in Accident Prevention. You may wish to ask yourselves some questions, by utilizing the following check list. A "Yes" answer to all of the questions indicates that you are performing in a manner that is expected and demanded by the USAF.

- Do you know your accident problems?
- Do you set a good example?
- Do you teach safety? If so, do you use the Four-Point Method: (1) Preparation (2) Presentation (3) Application and (4) Testing?
- Do you promote safety by personal contact?
- Do you know and do you consult your Base Ground Safety Officer?
- Are all accidents investigated, causes determined and necessary corrective action taken?
- Have you established a safety inspection program, and is it functioning properly?
- Have job breakdowns been established for those under your supervision and when the safest method has been determined, is it made standard practice?
- Do you encourage your personnel to report unsafe conditions or acts? If so, how many reports and/or suggestions have you received in the last 30 days?
- What procedures are in effect to promote the safety of personnel?
- Do you follow AFM 32-2, "Accident Prevention Handbook," in establishing standards relating to your work?
- *Do you really believe that accidents can be prevented by supervision?*

The first-line supervisor plays a vital role in any safety program. Without his enthusiastic support and a desire to keep his shop accident-free, the whole superstructure of the safety program is meaningless. Safety is everybody's responsibility, but no program can succeed without this daily emphasis and cooperation which can be given only by the first-line supervisor. *Remember: As a supervisor, you are indeed . . .*

. . . YOUR BROTHER'S KEEPER.

Walter H. Powell, Ground Safety Officer, Bolling AFB, Washington, D.C.

Of all the components of a weapon system, the most valuable single item is "the man controlling the weapon." Consequently, it is difficult to explain the tragic results and expense of losing this one single component because of carelessness. Too often a report reads: "Pilot fatally injured while attempting to eject" or "Ballistic hoses crossed or not connected." Unfortunately the pilot or crewmember isn't around to give his personal version of what happened. Certainly no one deliberately leaves maintenance pins in the ejection seat or the hoses disconnected. Yet these mistakes recur and in too many instances are discovered after it is too late to help the persons who made 'em. But what about you? Does your Unit have an aggressive escape system safety program in effect NOW? How effective is it? Is the checklist followed and are spot inspections made, in addition to scheduled inspections? Are the pilots and other crewmembers aware of the dangers involved whenever carelessness is overlooked? Adequate directives and Tech Orders are published to prevent these mistakes from happening, therefore some other factor must be involved. This one factor has to be "complacency" regarding the ejection system. It is evidenced by careless handling of the seat when removed, use of nonstandard pins, and maintenance procedures often contrary to those published. Commanders must take an aggressive approach to insure that the personnel concerned are strongly motivated towards giving the escape system the special care it deserves—to say nothing of that special component, the man in the seat. Let's not lose him needlessly. Take a close look at your local maintenance procedures. Place yourself in that seat. Does everything look okay?

For the jocks in the F-106, the reports on record indicate that a thorough knowledge of the seat is imperative. 'Tis best you remember that you are sitting in a *one-motion system* and if you pull the handles to blow the canopy, for sure you're going right along with it! Might be a good idea to re-run your emergency procedures, especially ejection or abort procedures, so that you don't go into orbit when all you wanted to do was blow the canopy. Check the seat *before* you climb in . . . know what you're looking for . . . chances are you won't need to, but make sure you don't forget that "you're sitting in a hot seat."

Capt. Martin O. Detlie, Fighter Branch.

Like some of its predecessors—the '86, '89 and others—the Century Series aircraft has its problems too. Probably the best way to present one "potential" is to quote a letter to Lt. Col. Jackson Saunders, Fighter Branch, from Maj. Pancho Pasqualicchio.

"Just a fast note about a small problem facing us here at Andrews AFB. My job is that of Air Advisor to the 121st Tac Fighter Squadron, D. C., ANG. Our unit is now fully equipped with F-100Cs, and everyone but two of the troops has completed transition from the F-86H to the Century type, with no sweat. Now, however, a small problem has come up and while it is still local, it may soon become Air Force-wide.

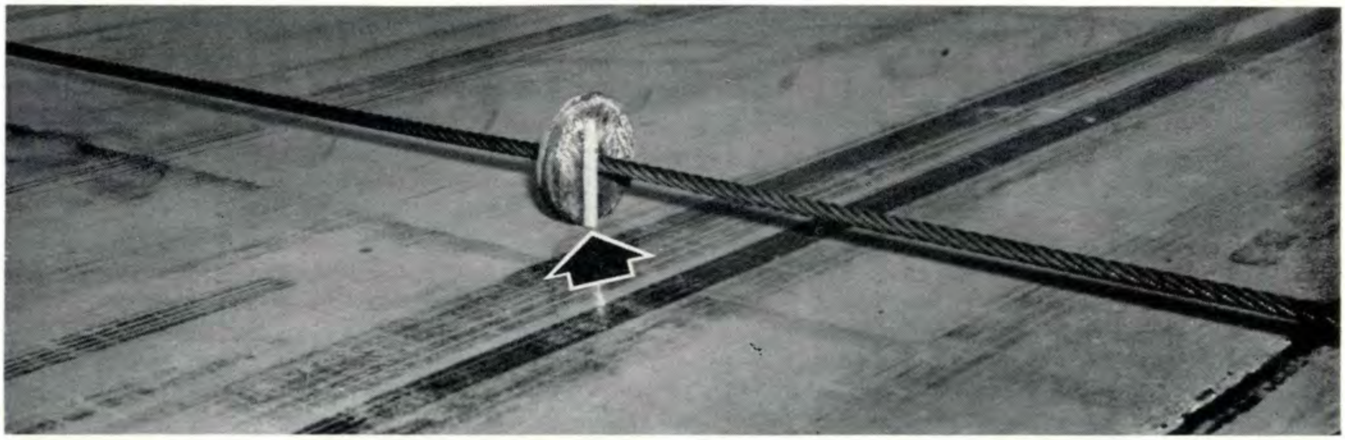
"The base here has the BAK-6 arresting barrier, in addition to the standard AF cow catcher. As you probably know, the BAK-6 is the tailhook job which (or a similar type) is to be accepted throughout the Air Force. It requires that a cable be laid across the active runway, naturally, to effect the catch. Normally this cable is left on the active runway regardless of the direction of traffic. By necessity then, when landing we touch down on, or extremely close to, this cable normally placed 500 to 700 feet from either end of the runway. On four occasions the troops have touched down directly on the cable, although—obviously—they're briefed to touch down in the first 1000 feet. The cable is stretched taut across the runway and sits about four to five inches high.

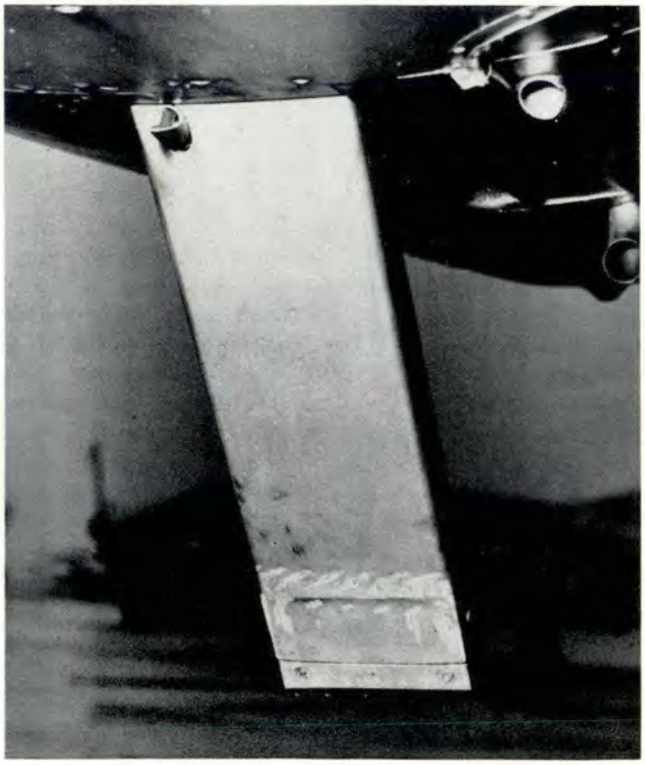
"The damage thus far has been slight in all cases, but there are some eye-opening possibilities here. We now have two F-100Cs with tailhooks installed. If a tail-low landing hits that cable, the hook in the stowed position could conceivably snag the barrier and yank the aft section of the aircraft at 150 knots. Pleasant thought, eh what?

C-NOTES

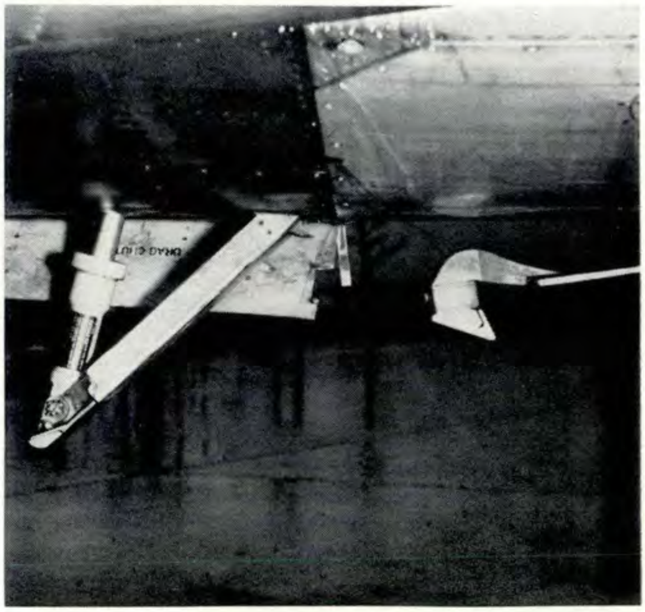
"TAC is modifying all of its F-100Ds with the tailhook so if these birds land at Langley, McGuire, or Andrews (where the BAK-6 is installed), things could be real interesting! At Andrews we have arranged a local fix by pulling the cable off the approach end of the runway during normal operations. The other day, however, someone goofed, and bingo! one of our troops hit the cable. The incident report is in the mail and an OHR was made up some weeks ago.

"In case you miss the incident report, here are a couple of pictures to give you the gist of this story. The problem may be 'cold hat,' however it has been reported to 12th AF, TAC, and the NGB FSOs." ★





Above, the cable of the BAK-6 barrier is in place. Lower left, cable marks can be seen on the F-100 tailskid. Below, F-100 hook in place. The relatively new tailhook for Century Series has caused only one major accident, an F-106. To prevent an inadvertent and unexpected catch, the F-105, '106, and '102 are soon to be modified. Still in doubt are modifications to the tailhook of the F-101, '104 and '100.



RUNWAY •

Major General John W. Carpenter, III,

SEVEN MILE

The Mojave Desert in Southern California is many things to many people, but to a pilot with trouble on his hands a 65-square mile chunk of it can be his best friend. The crewmembers of a B-52G learned this not long ago when they found themselves over Loring Air Force Base, Maine, with half of the big bird's hydraulic system out. It's a long haul from Maine to California but the aircraft flew to the Air Force Flight Test Center, Edwards AFB, and made a successful emergency landing on the rock-hard surface of Rogers Dry Lake.

The lakebed, flat as a fritter, sprawls across the Desert near Edwards. The base's big 300 feet wide by 15,000 feet long runway extends onto the lakebed for another 4½ miles, with about six miles on either side in case something goes wrong. On the lakebed are eight marked runways and a huge, 500-foot circle, marked off at various points of the compass. It serves as a compass rose and an omni-directional runway for lighter aircraft in case of excessive crosswinds on the regular runways.

The lakebed is extremely hard. It will support a B-52 at maximum gross weight, and perhaps more. Normally, the weather is very good—an average of 350 days VFR each year.

Since the Flight Test Center is primarily a research, development and test organization, it is a closed installation. However, it will go all out for any aircraft in an emergency, as indicated by the 342 emergency landings made there in 1959. This figure includes some commercially-operated aircraft.

Edwards AFB probably has the finest air traffic control setup in one place in the world. Its radar advisory unit is primarily used for anti-collision and VFR control of Flight Test activities. It is tied in directly, by repeater scopes, to the GCI network of the Air Defense Command. If necessary an aircraft can be handed from one GCI station to another until it arrives at "Gee Whiz," the call sign of the site near Edwards.

To give you an idea of what happens at Edwards in case of emergency, place yourself in the cockpit of an F-104 which has just had a flameout and is fortunate enough to be near enough to Edwards for a deadstick landing.

Your high key for a '104 is about 15,000 feet above the runway. Your rate of descent is approximately 7000 feet per minute, and you put your gear down in the flare. As you roll down the runway you begin to sweat—you have no drag chute, no brakes and no steering. With the end of the runway coming up, it is mighty comforting to know that you have another 4½ miles of smooth lakebed straight ahead and more of the same on both sides of you. That sunbaked old lakebed transforms to pure beauty about now!

Meanwhile, back on the ground, what's happening? Crash and rescue crews follow you right off

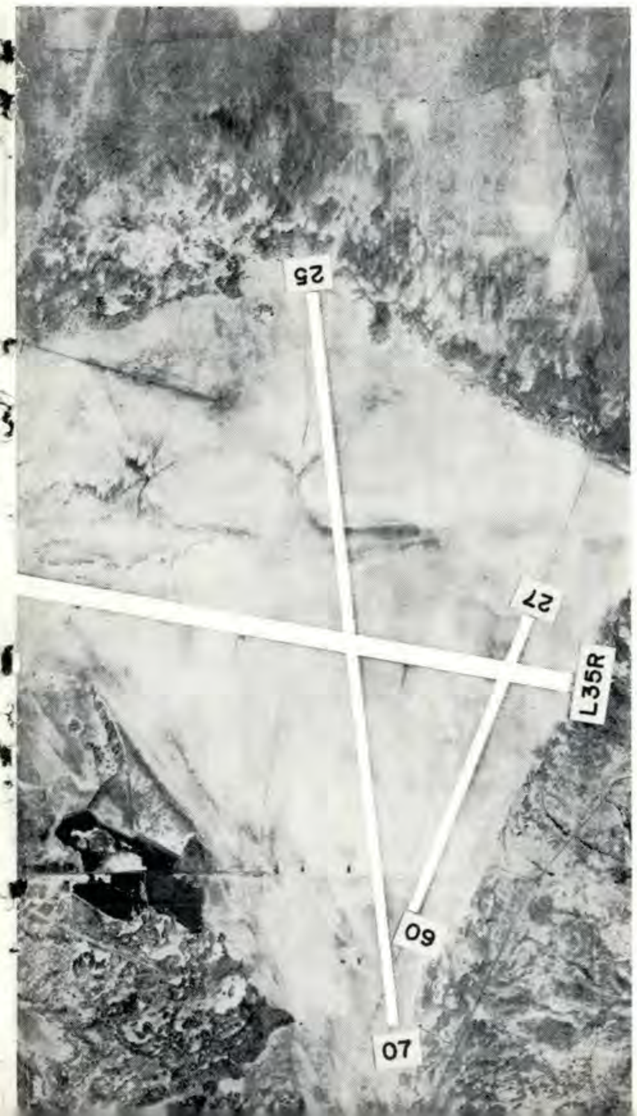
the runway in a smooth transition to the lakebed, beyond. You roll several thousand feet and because you had neither brakes nor steering you have turned nearly 180 degrees. Neither you nor the aircraft was damaged because the lakebed was available.

Here are some examples of emergencies real and planned that have taken place at Edwards during the past few years.

A B-47 over Wright-Patterson experienced hydraulic failure. He flew all the way to Edwards where, with the help of a chase plane, he got his flaperons down by emergency means, deployed his approach and drag chutes, and made a successful landing. However, he had neither brakes nor steering and the aircraft veered about 500 feet off to the right. Crash equipment was on hand, but, fortunately, it was not needed. Where else in the United States could this aircraft have landed without going off the runway?

A B-58 on maximum gross weight, three-engine takeoff blew a tire on the right gear as he cut his outboard engine. Because of loss of power he had a longer takeoff roll than usual, and all but one of the tires on the right gear on that side blew. Fortunately he did not retract his wheels or he might have had more difficulty. Flying metal from the disintegrating wheels had cut both hydraulic and fuel lines in the right wheel well.

Not all emergencies are handled on the lakebed. Each situation is evaluated by AFFTC test pilots and engineers and local aircraft contractors for a particular type aircraft. Coupled with past experience, the decision is then made whether to use the three-mile runway or the lakebed.



It was decided to land him on the main runway. He dropped his pod, jettisoned his number two and three position canopies, then his fuel. Meanwhile, groundcrews were foaming the runway. Aircrew members were given the option of bailing out but they chose to stay with the aircraft.

Immediately on touchdown, the wheels began sparking and burning. The pilot was able to get his drag chute out and his nosewheel on the runway. Then, by using the nosewheel steering and a little brake on the left, he kept the aircraft straight down the runway. The first part of the runway had been foamed very lightly with the depth increasing toward the point where the aircraft would need it most. The fire began to damp out as the bird slowed and got into thicker foam.

The airplane finally stopped between the 8000- and 9000-foot markers on the runway. The only injury was a rope burn suffered by the man in number three position during his hasty exit down the emergency escape.

All X-15 flights terminate on the lakebed, touching down at about 185 knots after gliding from a 20,000-foot minimum high key at about 300 knots indicated. It requires about 5000 feet to slide to a stop. The plane has no nosewheel steering, but usually deviates only slightly from its intended path, normally not more than 300 or 400 feet to the right or left.

The 65 square miles of lakebed has come a long way since the days before WW II, when hot rodders sometimes hit 150 mph on its wide open spaces. It is not uncommon now to see such things as an F-105 on a barrier run, making an engagement at 165 knots. Sometimes they miss, then the lakebed is a real friendly place. Other services also use the lakebed frequently. The Navy made the initial tests of the Regulus II on it before firing the missile from a submarine.

Many aircraft with real emergencies have used the lakebed; one day there were six during a four-hour period. Keep this unique safety tool in mind; it may save you some day. If you have an aircraft in distress and the only way to prevent an accident is to take it to Edwards, the base is at your service and will assist you in every way possible.

Some of its aids are:

- Anti-collision radar and emergency landing field guidance and instructions.
- Chase aircraft.
- Radio assistance from the tower by a qualified IP. (We have 56 different types of aircraft at the Flight Test Center, with instructor pilots for each.)
- Dash One Tech Orders are available, and there is telephone assistance available from all major manufacturers.
- Helicopter rescue available and on standby.
- The runway can be foamed quickly.
- Unusually good weather and well qualified crash rescue crews.
- The main lakebed runway is partially lighted for emergency night use.
- And the base wants to assist you in any emergency. ★

OPERATIONAL HAZARD REPORT

(Indicate recommendations on reverse)

ANONYMOUS	YES [ ] X NO
TO: Flying Safety Officer	FROM: AONGE, CAPT. BAUGHRUG
LOCATION OF OCCURRENCE/HAZARD: MOUNTAIN AFB	TIME OF OCCURRENCE — DATE: I MAY 61; HOUR: 1300; [ ] DAWN [X] DAY [ ] DARK [ ] DUSK

IF HAZARD OCCURRED WHILE IN AIRCRAFT, COMPLETE THE FOLLOWING:

DEPARTED FROM	DESTINATION	MISSION
MOUNTAIN AFB	MOUNTAIN AFB	LOCAL TEST

ORGANIZATION AIRCRAFT ASSIGNED	AIRCRAFT TYPE	MODEL	SERIES
	F	102	A

CLEARANCE			COMMUNICATION DIFFICULTIES	ALTITUDE	WEATHER CONDITIONS
X LOCAL	VFR DD 175	IFR DD 175	YES [ ] X NO		

CREW POSITION

X PILOT	CO-PILOT	INSTRUCTOR PILOT	NAVIGATOR	ENGINEER	OTHER (Specify)

PHASE OF FLIGHT

PRE-FLIGHT	STARTING	RUN-UP	X TAXI	TAKE OFF	CLIMB	CRUISE	DESCENT	LANDING	POST FLIGHT

DESCRIPTION OF OPERATIONAL HAZARD

While starting and taxiing an F-102 for local test, the oxygen pressure line from the aircraft liquid oxygen system to the "Firewell Kit" became disconnected, releasing extremely cold (—275°F.) pure oxygen into the fiber glass seat spacer. This chilly, gaseous substance then escaped from an inspection hole in the spacer, said hole being located directly beneath and behind the pilot's posterior. This icy blast caused no little consternation on the part of the pilot who discovered that extensive squirming and application of "Body English" would only remove the vital area four inches from the source of the discomfort. Recommendations for alleviation of this problem are:

- Seal all oxygen connections permanently. (Not recommended in case of ejection.)
- Warm the oxygen. (Not too practical.)
- Pack pilot's posterior in spun glass insulation. (Might not be too comfortable.)
- Pre-chill pilot's posterior so he won't notice it so much. (Shows promise.)
- Give all pilots a ground training course in squirming. (Handy for other emergencies.)
- Add Bunsen Burner to heat oxygen just before contact with pilot. (Not practical.)
- Award "Order of the Cool Stool" to pilots surviving this malfunction.

DATE	SIGNATURE OF REPORTING PERSON (Optional)
I MAY- 61	CAPTAIN SAM Z. BAUGHRUG