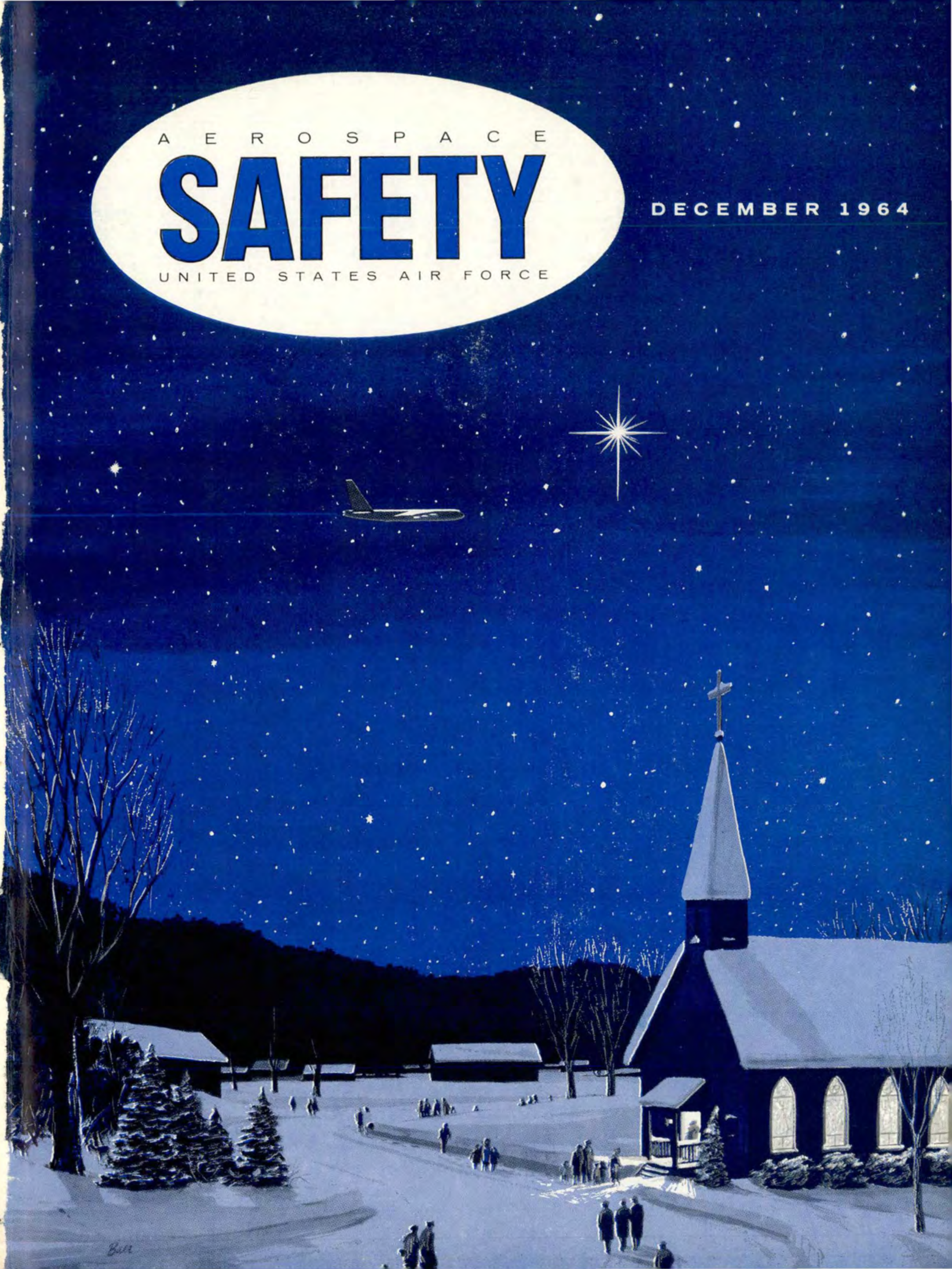
AEROSPACE

SAFETY

UNITED STATES AIR FORCE

DECEMBER 1964



A E R O S P A C E
SAFETY

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AFRP 62-1 DECEMBER 1964 VOLUME 20 NUMBER 12

FALLOUT

AFM 127-100

Publicity of the fact that AFM 127-100, dated 20 Apr 64, has superseded AFM 32-6, seems to have by-passed some very important people. The back cover of the October issue of AEROSPACE SAFETY lists AFM 32-6 as the first reference to check, regarding grounding. The article "Is Your Safety Program Effective," in the Sept-Oct 1964 MSO Kit, lists AFM 32-6 as a principal source of guidance. Also listed is AFM 127-100.

Suggest future publications be screened to eliminate reference to outdated and superseded publications. We in the field depend on your publications to keep us informed on the latest developments.

Keep up the good work.

Capt Harvey R. Searle
NSO, 1611 Air Trnsp Wg
McGuire AFB, N. J.

The Captain is correct. Explosives Safety Manual is now AFM 127-100.

COMMUNICATIONS CHATTER

Everyone complains about radio chatter—as they do the weather—but no one does anything about it. We all know we cannot control the weather. Not yet, anyway, but we can sure put our own self control on radio chatter.

When you flight plan, have the radio frequencies for departure, enroute and letdown. Departure frequencies are listed in the Enroute Supplement and SID's. Operations should have the latest changes. Enroute radio stations and discrete frequencies are in the Enroute Supplement. Arrival frequencies are in the Enroute Supplement and on the letdown plates. Monitor the controlling frequencies at all times—the controller might be working more than one frequency. You will not only hear his transmissions, but also other aircraft on your frequency. If you have to leave frequency for any reason, let the controlling agency know when you leave and when you are back on. Know which calls are mandatory. Give the required information and not a life story. Know what you are going to say before punching the mike button; write it out if you have to. If instructions are understood, there is no need for read-back, except for clearances.

If everyone cooperates, both ATC's and crewmembers' work will be safer and simpler.

Capt Allen J. Monroe
Hq Amarillo Tech Tng Ctr
Amarillo AFB, Tex

HIGHWAY SAFETY

I like the approach in the article entitled "Declare War," by Major Clifford J. Galliot (May 1964). He has a message well worth heeding. After mulling over the subject of National Driving Standards for sometime, I wrote a letter to Senator Everett Dirksen presenting these four recommendations as a proposed solution to reduce the carnage on our nation's highways:

1. Let's educate all of our licensed drivers and potential drivers on the complete responsibilities of a vehicle operator when he seats himself behind the wheel. A vehicle is a lethal weapon when improperly operated, just like a gun, and this fact must be stressed.

2. Let's physically and mentally examine our potential drivers on a yearly basis to

continued on page 28

AN EDITORIAL FORETHOUGHT ON . . .

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RESPONSIBILITY

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Ability and readiness to assume responsibility are essential traits of the military pilot, traits he must demonstrate repeatedly. Consider the interceptor pilot who scrambles in the middle of the night. He receives assistance via radio and is followed on radar, but he alone must interpret the many instruments in his cockpit and react accordingly. Or, take the bomber crew commander who is responsible for performing a long, exacting mission and for integrating the efforts of his entire crew. The 27-year-old lieutenant who commands the transoceanic flight of a transport loaded with troops faces up to a responsibility much different than if he had chosen to be a banker, a lawyer or manager of a local store. And their counterpart, a captain sitting 60 feet underground in a ballistic missile launch control room, has a responsibility that belies comparison.

For the well trained, most decisions are clear cut. But occasionally decisions that must be made in fulfilling responsibility are most difficult. A situation may be marginal and the individual in command of the aircraft or the launch control center, or possibly another commander passing directions from a remote site, may knowingly or unknowingly take a chance. If this happens often enough and supervisors fail to stop such practice, the law of averages catches up. An accident results.

Responsibility is a rare trust, and it comes as the reward for study, practice and demonstrated maturity, not necessarily in years but in proven performance.

Sometimes this responsibility reaches heights that shine as examples for all and reflect the greatest possible credit on the Air Force. Late last spring a 26-year-old Air Force pilot, desperately attempting to avoid a housing area, stayed with his fighter as it lost power after takeoff. When he had done all that was humanly possible, he ejected, but he was at ground level. He paid for this example of assumption of total responsibility with his life.

Considered in the light of dollars received for such services, the responsibility seems way out of line. But other rewards, not as definable as dollars, are much greater. The knowledge that a job has been done right is reason for just pride. The importance of making correct decisions reaches the ultimate when the penalty for mistakes can be fatal.

These real values far transcend mere monetary award. They add up to the satisfaction that comes from responsibility fulfilled. They are rarely fully appreciated except by those to whom such responsibility has been entrusted. They are given to the capable, and only after demanding apprenticeship. There are key command slots for but a few, and only those who have demonstrated the willingness and ability to accept responsibility make the grade.

The Air Force, by its very mission, opens wide the door to individual responsibility. Only the best can measure up.

Jay T. Robbins

JAY T. ROBBINS
Brigadier General, USAF
Director of Aerospace Safety

This morning when I arrived at work I was greeted by an old friend who had been assigned recently to command an F-100 wing. After a brief hello, how-are-you, he said, "My new wing has a well-established formal safety program, an effective working safety council, and a snoopy safety officer who's constantly looking for hazards around the air patch. In fact, safety-wise, the outfit looks pretty good; however, if the command were yours, what would be the first areas of concern you would attack in order to avoid accidents?"

Since all F-100 accident reports, incident reports and unsatisfactory reports flow across my desk like wine at an Italian wedding, and the safety record of the F-100 has been my main concern for eons, the question was most aptly aimed. Strangely enough, the answer as to what to do and where to start is simple; *how* to accomplish all the objectives and to maintain interest in the program is more complex and differs from wing to wing. I'm not going to try and solve all the problems, I'll simply try to point out where the least effort can provide the most immediate results.

F-100 accidents and incidents are not confined to one or two problem areas. However, the majority can be prevented or minimized by concentrating on six main accident potentials: flight control/auto pilot maintenance, gyro horizon maintenance, air-to-ground range discipline and delivery techniques, recognition of pre-stall warning and proper techniques for recovery from post-stall phenomena, weather letdown and landing procedures, and pilot pre-takeoff go-no-go instrument recording. Since pilot fatalities per major accident are directly proportionate to the proximity of flight to good old Mother Earth and since F-100 duties call for a great deal of flying near the ground, a concerted effort is necessary to insure thorough pilot knowledge of emergency procedures. This includes ejection techniques.

First things first: pilots are taking off in aircraft that poop out during the takeoff roll, shortly after breaking ground or during initial climbout. Many of these accidents can be prevented by insisting that all pilots record seven vital instrument readings during the pre-takeoff phase and the same seven recordings prior to departing the immediate area of the takeoff airfield. EGT, EPR, RPM, fuel flow, oil pressure, flight control hydraulic pressure and DC/AC output should be recorded during taxi out and immediately prior to brake release. EGT, EPR and RPM readings should be read, and must show normal indications at the acceleration check point, otherwise abort the takeoff. The last check is made as climb speed is established and includes the same readings made prior to brake release. Further, the habit of glancing at the advisory light panel at these critical moments is not universal. On many occasions, pilots have stated that they were unaware of the length of time of illumination of caution lights, especially when flying in formation or in weather.

Most pilots say that they do read all important gages prior to take off. Many do, some don't. A wing operating procedure to insure that these recordings are made, motivation to stress the importance, and complete elimination of complacency concerning fluctuating instruments and "almost normal" indications is a must. Either the recording is in the green or an abort is indicated. Not many operational commitments dictate a necessity for going with aircraft that border on sick. In addition to minimizing takeoff accidents, maintenance personnel will be provided with information that is invaluable. Some pilots may resist recording and say that reading the indications and properly reacting to them will serve the purpose. Also, they say, recording is difficult in formation or in weather. They are correct; however, proper recording establishes the habit of accurately reading each indication every time rather than scanning some of the indications some of the time.

The next area for concentration would be maintenance. Unexplained accidents involving peculiar maneuvers on the gunnery ranges, spins, stalls and wild gyrations during night and weather flying, and erroneous movements of control surfaces highlight fertile areas for maintenance efforts: proper maintenance of the autopilot flight control system, constant exercise of the autopilot and proper maintenance and handling of the gyro flight indicators. All pilot write-ups must be cleared by realistic and aggressive maintenance. Too often flight control difficulties are extremely hard to pinpoint. As a result, minor flaws found during the investigation are fixed, yet, the fix often has no direct bearing on the write-up. Consequently, the pilot's initial write-up is repeated, or, as has happened, results in an accident at a later date directly attributable to the initial write-up not being cleared. The key point on flight control maintenance is that it must be a team effort: i.e., mechanical, electrical, hydraulic, etc. Gyro instruments must be monitored constantly and when small

NGS FIRST

Maj Eugene P. Sonnenberg, Directorate of Aerospace Safety

deficiencies appear, they must be corrected. Deficient MM-3 gyros have been suspected in several recent fatal accidents. An immediate and temporary improvement is compliance with T.O. F-100-825 (Installation of Back-up Attitude Indicator). Gyro reliability is being pursued by the R & D and procurement agencies; however, improvement of attitude indicator reliability is not an overnight task.

Proper maintenance efforts concerning drag chute packing and aircraft drag chute mechanisms can also save a wing commander sleepless nights. One or two failures per one hundred landings is the present norm, any more than that dictates a new look at maintenance procedure in this area. Also, while on maintenance, I'd advise that the first task you assign to the Safety Council be a close examination of the wing technical order backlog. Flight Safety has found that the F-100 backlog is quite heavy and that quite a few T.O.'s with a safety connotation have become lost in the shuffle.

No one wants to make fatal errors, but pilots continue to make them on gunnery ranges. They are flying into the ground on the range and during simulated attack. These accidents are normally the results of trying to salvage poor passes, pressing to achieve hits or operating during marginal weather. Only through careful selection of range control officers, thorough briefing of pilots and disciplining those pilots who repeatedly foul on the ranges can these accidents be minimized. The objective is not to turn tigers into pussy cats by moving them out to a point where effective delivery results cannot be achieved. Rather, it is the improvement of delivery techniques and insistence on recognition and elimination of dangerous practices. Scores will improve and accidents will be prevented.

There is only one way to minimize accidents that result from weather: carefully schedule and use instrument practice periods, then eliminate pilots who don't meet the standards.

Stalls, spins and failure to recognize and recover from adverse yaw take a heavy toll of F-100s each year. The only way to prevent such accidents is to constantly educate pilots on F-100 pre-stall characteristics and recoveries. Repeated showings of films on these phenomena will also help.

If all pilots will remember the following two important facts, half the battle is won.

- The F-100 will not stall with a wing loading of less then one G. Applying forward stick will prevent or eliminate the stall.

- Adverse yaw will not be encountered without application of aileron. Adverse yaw is a function of angle of attack. If the airplane is at an angle of attack where adverse yaw is pronounced, then aileron effectiveness also is reduced and more effective lateral control can be achieved by using dihedral effect (sideslipping with rudder). Normal control can be regained by forward stick.

The important thing to remember is to keep the ailerons neutral and fly with the rudder under high angle of attack flight conditions. Remember that with asymmetric stores installed, some aileron will be trimmed in and neutral stick will not give you neutral ailerons. When a pilot feels he has lost control, his first reaction should be neutral ailerons and forward stick. The horizontal stabilizer is very effective, so it won't take much forward stick to reduce the angle of attack and regain normal control response. Do not confuse angle of attack and attitude. An airplane can be at a high angle of attack in any attitude – even with the nose well below the horizon. The main point to remember when the aircraft becomes momentarily uncontrollable is: don't panic! Then recover in the manner prescribed in the flight manual (permit sufficient time for aerodynamic response). Eject if recovery is not effected.

Last, but certainly not least: Emergency Procedures. Test all pilots on emergency procedures and review. Test – review, test – review!

Cockpit practice and review of emergency procedures under the eagle eyes of flight commanders, operations officers, squadron and wing commanders is a must. Schedule the reviews so that pilots have time to read the good book. Give impromptu tests to insure that pilots are retaining information. Especially check to insure that the pilots are remembering more than just the bold print memory items in the checklist. The checklist is a handy, quick reference guide, but the procedures should be studied from the Flight Manual. There is a world of knowledge there, and it can't all be in bold print.

I admit, wholeheartedly, that nothing new has been advanced here. The aim of this effort is to stimulate F-100 commanders to concentrate on current accident potential areas in the hope that some old friends can be preserved. ☆

Don't Bet On The Lady

It looked pretty good . . . not one of those desperate leaps out of a gyrating bird dead set on boring a hole in the ground. Wings were level, nose straight ahead, slight descent. He was talking to the Center and out there on the left was his wingman.

Now he was below 10,000. Time to go. He got ready, then pulled up to lose speed and ejected at about 8500 feet. From this point on things didn't go so well.

As the chute deployed his right foot got tangled in the shroud lines. Finally he got it free but the chute oscillated somewhat. He broke out under the overcast at about 5000, opened the cover on the right hand riser quick disconnect and prepared to land. He was moving over the ground quite rapidly, and when he hit he was dragged over the edge of a canyon and down the side about 400 feet. With the canopy dragging him through the snow, he tried desperately to release the risers but couldn't get a good grip on the release. Finally, near the edge of a steep cliff, the canopy caught on a tree and his slide down the hillside came to a halt. He was tangled in the shroud lines, some of them wrapped around his neck. Finally, after taking off his helmet, he managed to free himself.

Movement was difficult because of the deep snow, but he finally got a flare out of his survival kit which was lying about 10 feet away. A welcome sight was a light plane circling overhead. No problems now; they'd be out to get him pretty soon. Just get to the top of the hill, so that a pickup could be made. That, however, was easier said than done.

First, he fired the smoke flare to make it easy for the light plane pilot to spot him. It worked just fine; the pilot indicated that he had him. Now to get to the top of the hill. He put the night flare in his pocket, his SARAH beacon inside his flight suit and started climbing. Progress was slow because of the steepness of the slope and the snow. He turned back and left the SARAH with his other gear, the antenna stuck upright in the snow, and sat down to rest. He knew he had to get to the top of the hill but he couldn't see taking all the gear with him. He'd climb up, then if he wasn't picked up by dark he'd return to his survival equipment.

It took almost an hour, with frequent rests, to make the crown of the hill. Hope surged when he saw two choppers and a C-123 join his friend in the light plane. But it was almost dark now. He reached into his pocket to get the flare; it was gone! Somehow he must have lost it during that rough climb up the hill.

In the gathering darkness the rescue aircraft were having a hard time spotting him. He had no way of signaling and had to depend on the crews spotting him from the air—tough in the fading light.

Finally a crewman aboard one of the choppers saw him and he was picked up by sling and returned to base.

Within a scant two hour period this pilot ejected from his aircraft, went through a brief but harrowing experience, was rescued and returned uninjured to his base. Luck? Faultless handling of an emergency? Let's analyze a bit, but first let's say that successful as this entire operation was, disaster lurked only a breath away.

Monday morning quarterbacking is a pretty safe business. While nitpicking the performance of another we do not have to demonstrate how we would have acted. The following discussion of discrepancies and recommended actions is not for the purpose of criticizing the pilot but to help others who may find themselves in similar situations in the future.

This pilot had several things going for him and some of his actions contributed to his succesful ejection and landing.

- The aircraft was under control and he had lots of time to assess the situation and decide when to get out.
- He tightened his harness straps and lowered the visor.
- The zoom reduced airspeed to 135-140 kts and increased terrain clearance.
- He manipulated the shroud lines to control oscillation and control landing.
- The wingman and light plane pilot had him located.

There were several items however, that endangered the pilot and and hampered early rescue.

- When the emergency occurred he did not go to Guard channel (never did).
- He did not jettison external fuel tanks.
- He did not attach the zero lanyard although he was over mountainous terrain above an overcast.
- He discarded his oxygen mask during descent.
- He was unable to operate the riser quick release.
- Although he had the SARAH working, he accidentally turned it off when he placed it in the snow. It was, of course, then useless.
- Search was initially conducted about 10 miles away. The controlling agency, the light plane (VHF equipped) and the search aircraft (UHF equipped) had difficulty communicating.
- The pilot lost the night flare and left a pen flare with his other equipment which he had abandoned on the hillside. The rescue helicopter had a hard time locating him in the darkness and, in fact, was on the last pass that fuel would allow when the crew spotted him.
- Radar was unable to pick up chaff in the ejection seat.

Some of the above may not be particularly significant, may not even have had any effect upon this emergency. Nevertheless AEROSPACE SAFETY thinks they bear mention because in another situation they might mean the difference between success and failure.

To begin with, this pilot should have gone to Guard channel. During the period of the emergency, up to ejection, the Center was working nine aircraft besides this flight of two. Despite the abuse of Guard, there was a reason for it being set aside for emergencies and it should be used for that. To digress a bit, with the new URT-21 locator beacon indiscriminate use of Guard channel will be even more serious. Again, we urge pilots and controllers to stay off Guard except in a bona fide emergency. Give the guy in trouble a chance.

The movie, "Passport to Safety," which depicts ejection, descent and landing techniques and which should be on every base, advises pilots to keep their masks and helmets for protection when landing in trees and against injury if they are dragged by the canopy. The pilot in this case kept his helmet but discarded his mask. He was dragged a fair distance but apparently was lucky in that he received no reported facial injuries.

The so-called quick release has been a sore point among aircrews and personal equipment people for a long time. A new one is in the mill and some of them may be on chutes by now.

Survival equipment experts have their problems. If they put a switch on an item they have to remember that it can be turned off as well as on. A person in a survival situation may not be thinking his best and could very easily push a button the wrong way. The new URT-21 locator beacon is activated when the chute opens and will broadcast continuously. It has a switch and can be turned off if the person determines this to be wise.

Someone goofed back down the road when the military went to UHF and everybody else, including the airlines, went to VHF. There are good reasons for the use of the two different systems but search aircraft should contain both systems for more effective communication.

Although he knew he needed a flare and put one in his pocket, this pilot left a pen flare with his survival gear. Then he lost the flare he had put in his pocket. The serious thing here was that he walked off and left his equipment—the stuff that could save his life—lying on that snowy hillside. Several questions arise: Could he have found his way back to the survival kit quickly in the dark? Might he have fallen over the nearby precipice in the dark while hunting for his kit? What if a storm had moved in?

This pilot deserves praise for the things he did right. He was also lucky. If Lady Luck is on your side, fine. But don't bet your life on her. ☆

Usually, when we run across a title like the one above we expect to read an account of how some unfortunate pilot faced an impossible situation, struggled desperately up until the last moment, then bought his piece of farmland. Stories on this theme have appeared in this and other safety magazines time and again.

This one is different. The twist of title came to mind following a round table discussion among weapon systems project officers and life sciences specialists here in the Directorate of Aerospace Safety.

One of the life sciences types kicked it off with a for-example-situation he has worked out for the T-Bird. First, he related, there is a point in the flight profile during which he is dead; dead, that is, if the flame thrower that propels his airplane suddenly conks out. This interval comes between liftoff, at about 120 knots, and the time the gear is in the wells, the flaps have been sucked up and airspeed has increased to 140-145 knots. The "dead spot" lasts five to six seconds. There's not much he figures he can do. If power failure occurs at this time he's going to end up in the cabbages or whatever else might happen to be growing off the far end of the runway. He's also decided that should he lose his engine at this stage he will stay with the bird. He will probably be dead, he figures, but if he punches out he knows he'll be dead. As a member of the life sciences group, he has been well indoctrinated with the futility of low altitude, low speed ejection attempts.

An ex-transport pilot recalled how, when flying fully grossed, especially out of an island base at night, the last thing he mentally prepared himself for on the lineup check was how he would push rudder, raise a wing slightly, and clean up the airplane if an outboard quit at or just after liftoff. He had his mind conditioned so as to expect the worst that could probably happen to him at a most critical control regime. He prepared himself against surprise and to react instantly in a way that would enable him to handle the emergency.

Another pilot explained that his pet procedure along these lines was to plan every approach as a missed approach. In his mind he was planning to execute the maneuver as shown on the letdown plate, arrive at published minimums, follow Dash One missed approach procedures and continue on out on the missed approach procedure. With this conditioning he had no trouble bringing terrain into his cross check, taking over visually and landing if he broke out above minimums. Flying VFR from a good approach to touchdown is duck soup. Being mentally set for a landing, then unexpectedly having to improvise a missed approach 200 feet above the ground is one of the most critical flight situations he felt he could encounter—he wasn't going to be surprised into it.

Another member of this informal seminar chimed in at this point to tell of reading how an overseas airline has had a practice of having the first officer make the approach any time the weather is reported at or near minimums. The only thing the first officer knows how to do in this situation, so he recalled, is to fly the charted approach to minimums and execute the missed approach. As of his latest information, he reported that this airline has never had a landing accident in near-minimum weather conditions during hundreds of approaches under such circumstances. He reported that a captain of the airline said that on more than one occasion, before he could fully decide whether or not weather conditions were good enough for him to take over and land, the first officer had solved his moment of indecision by starting the go around.

Later, but on the same subject, a test pilot who had flown spin tests in the T-37 endorsed this theory. Never, he said, had he failed to bring the little trainer out of a spin when he followed the mechanical, Dash One, 5-step procedure. However, he emphasized he had drilled himself by practice and mental discipline to follow the procedure exactly—even though the Tweetie might be trying to paste him against the side of the canopy at the time.

A century series jock chimed in with the inescapable truth that, should the engine unwind between break and flare, there's only one choice, and that an immediate one —punch out!

There were other examples, but, in summary, the consensus was that any pilot could apply these same techniques to better prepare himself for critical flight conditions. All he has to do is to analyze *what are the worst things that can happen to me in this airplane?* Once he has done this (and here's an excellent place to do a little research and learn from the mistakes of others) he can devise his own mental "set" that will enable him to be best prepared should he suddenly, someday, face a critical situation. He can then do a bit of defensive driving, and do it when it counts most.

As past accidents have proven, you can wait—figuring that a dire emergency is highly improbable, and if one does occur it will probably be to the "other guy"—and face a stacked deck that you just won't quite be able to beat; or you can do a bit of planning on your own and stack the deck in your favor. ☆

FUEL SYSTEM ICING in the T-33

There are many misconceptions concerning icing of the T-33 fuel system. This article clarifies some of the apparent misunderstanding by passing on information obtained from test programs, engineering studies and other sources.

Edgar M. Gibbons, Sacramento Air Materiel Area

There are two types of fuel system icing in the T-33 that will cause a flameout. They are *external* (around and in the aneroid) and *internal* (in the filters or the main fuel control). External icing requires the least discussion so we will dispose of it first. The main fuel control aneroid protrudes into the airstream and is subjected to a coating of ice on practically every flight. This has been borne out by inflight pictures taken near Perrin AFB during a service test. These pictures show ice building up on the accessories and accessory case even when the aircraft was flying through clear air. When ice completely seals the aneroid or when moisture freezes between the wafers of the aneroid it will cause an erroneous high altitude indication. This in turn causes the fuel mixture to be leaned out to the point where it will not burn and the fire goes out. It's as simple as that.

All T-Birds have a sheet metal shield installed around the front half of the aneroid that prevents the ice from doing any damage except for those rare cases when you can see ice building up on the airframe. When this happens, such as during penetration of a thunder storm or cloud formations, the ice buildup in the plenum chamber is both heavy and rapid and a flameout can occur either at that time or from 15 to 30 minutes later when you are out in the clear and think you are home free. The solution? Whenever you encounter airframe icing do two things: first, execute that maneuver known as "getting the hell out of there," and then get ready to switch to the emergency fuel control at the first indication of a change in fuel pressure, EGT or RPM. If you flameout, hit the Gangstart switch. In either event you may end up operating on the emergency fuel control which is not subject to external icing and is almost totally immune to internal icing.

Assuming that the fuel used is not treated with the anti-icing additive, internal fuel system icing is a complex phenomenon requiring a number of variables to be present simultaneously and within rather narrow limits, in order to produce serious icing. These variables consist partially of such things as: the amount of free water in the system, principally the fuel tanks; the amount of water dissolved in the fuel, this in turn is determined by temperature and to some extent humidity; the rapidity of the lowering of the fuel temperature and the final temperature reached, which is partially a function of the duration of the flight and the outside air temperature, etc. Examination of these variables will provide answers for some of the questions about why and when icing occurs and will also upset some common misconceptions, such as, "JP-4 has an affinity for water" (compared with what?).

Free water in the fuel system comes primarily from three sources: improperly maintained fuel storage and handling equipment, rejection of dissolved water by the fuel and condensation in the fuel tanks. Good maintenance and quality control in fuel handling and servicing equipment and procedures will eliminate servicing as a water source. The dissolved water in the fuel obviously cannot be prevented from entering the fuel tanks. However, this dissolved water presents no serious problem. JP-4 does not have any natural affinity for water. However, it does contain an extremely small amount of dissolved water at all times. This water is measured in parts per million (PPM) and the amount of water that can be absorbed by the fuel is a direct function of fuel temperature.

When fuel temperature decreases water is rejected by the fuel in the form of small drops or particles which will eventually settle to the bottom of the tank if the fuel is not agitated. Assuming a full fuel load of 813 gallons at a starting temperature of 70°F (21°C) and cooled to a final temperature of -10°F (-23°C), the fuel would reject about 50 PPM by volume, or about four fluid ounces. In actual practice the amount of water would be less than half this amount since you normally would burn over half of the fuel before fuel temperature could be reduced to -10°F. The rapidity with which the fuel cools determines the size of the water particles rejected from the fuel. A fast cool-down period of one to two hours will produce particles from four to ten microns in diameter. A slow cool-down will produce particles of 15 to 40 microns in diameter. The small particles due to their size tend to pack more tightly and also tend to clog filters and screens more rapidly. The critical fuel temperature range at which icing is most probable and most severe is from +10° to -20°F (-12 to -29°C).

Water condensation in the fuel tanks is negligible during any one flight. The tiptanks are frequently suspected of producing excessive amounts of water, particularly after they are empty and an air flow can take place. This contention, however, is not borne out by the facts. A study made several years ago by one of our aeronautical engineers showed that only minute quantities of water (on the order of a tablespoonful) could be produced if the best possible conditions for condensation were present during a maximum duration flight. This low water yield for warm moist air is further substantiated by tests made by SBAMA in 1961 which showed that empty tanks filled with 18,236 gallons of sea level air at 90°F and 100 per cent humidity produced only six-tenths of a gallon of water.

In any event, if the fuel system is drained after each flight and before refueling, most of the water in the fuel system will be removed. Since the T-33 has no clearly defined sumps it is necessary to drain the water before refueling to prevent the turbulent action of the fuel from dispersing the collected water.

All of the preceding comments on icing problems presupposed that fuel treated with an anti-icing inhibitor was not used. When the anti-icing additive is used the water in the fuel and fuel system does not freeze. This is not meant to imply that normal maintenance, such as draining, is not required, because it very definitely is necessary. Contamination of the fuel system by corrosion by-products or other foreign matter has caused a majority of the flameouts that are charged to icing.

The two major sources of fuel system contamination are the fuel servicing equipment and the fuel de-icing alcohol system. Fuel servicing can be eliminated as a contamination source by merely adhering to existing directives on maintenance and operation of fuel storage and dispensing equipment. The fuel de-icing alcohol system is a horse of another color. The only sure way to eliminate this system as a contamination source is to remove it from the aircraft. This we are trying to do with T.O. 1T-33A-622 "Deactivation of the Fuel De-Icing System." However, some aircraft are still using the fuel de-icing system even though additive treated fuel is usually available. This continued use of alcohol is predicated on the premise that these aircraft will occasionally be serviced with gasoline or untreated JP-4 type fuel.

Actually the continued use of the de-icing alcohol system is much more apt to cause a flameout from fuel system contamination than from icing if the aircraft is serviced with untreated fuel.

The contamination that builds up in the de-icing alcohol system consists of a jellylike substance that spectrographic analysis shows to be about 90 per cent aluminum hydroxide. This substance is produced by electrolytic corrosion from the bi-metallic couples in the alcohol system and by the corrosive action on the aluminum tanks, lines, etc., by the water saturated alcohol. Alcohol itself is essentially non-corrosive. However alcohol, unlike JP-4, will accept and readily combine with almost unlimited amounts of water, and it is this mixture of water and alcohol that does the dirty work.

The aluminum hydroxide gel can not be drained from the system but continues to build up until it breaks loose when the alcohol pump is used. It is then injected into the fuel system at a low pressure fuel filter which readily passes the material to proceed down stream, where it can lodge in the fuel controls and the air adapter finger screens. It is at these points that contamination can disrupt the proper functioning of the engine fuel system and can cause a flameout or erratic engine operation. These malfunctions are usually attributed to icing, so the pilot uses alcohol to melt the non-existent ice. This could aggravate the situation by adding more contamination.

Fortunately, the emergency fuel control will usually continue to function in the presence of severe contamination; it might be erratic but it works enough to get you home. It is interesting to note that the fuel controls that have been used without alcohol and with fuel containing anti-icing additive show no evidence of corrosion when returned to overhaul. This is in direct contrast to the badly corroded appearance of fuel controls when alcohol has been used.

This article could continue indefinitely exploring all of the ramifications of the fuel system icing and contamination problems. However, to do so would only bore the readers by dwelling endlessly on rather irrelevant matters. So in conclusion here is some friendly advice. When fuel treated with anti-icing additive is generally used in your T-Bird, get rid of the alcohol system. And when you can see ice building up on the airframe be ready to switch to the emergency fuel control. You do these two things and ice will cease to be a problem. ☆

AIRCRAFT ICING

. . . a new look

Lloyd V. Mitchell, Hq Air Weather Service, Scott AFB, Ill

Generally speaking, airframe icing is not considered a problem for most of our high-performance jet aircraft because they are designed to operate above the icing levels. This is great! But, as they climb out or let down, these aircraft must frequently pass through conditions which are conducive to icing. Also, it is not always that these high-performance aircraft operate above the icing zone. For example, a few years ago a group of jet bombers was operating at low altitude in icing conditions. Not only did ice accumulate on the wing leading edges, it also built up on the engine nacelles, then flaked off causing considerable damage to the engines as it was ingested. One aircraft didn't make it to the runway, and others had considerable engine damage.

More recently, another jet bomber picked up a tremendous load of ice. This aircraft was mushing along in a nose-high attitude and the ice accumulated on the under side of the wing. Although this caused a considerable loss of altitude, recovery was effected before an accident occurred.

Just what are the basic conditions for airframe icing? There are two: the aircraft-surface temperature must be colder than 0°C, and liquid-water droplets at subfreezing temperatures must be present in clouds. Aeronautical engineers and meteorologists have no control over the latter condition but the engineers have done fairly well in taking care of the aircraft surfaces. In the newer aircraft, the wings are heated either by hot air or electrical current to prevent the accumulation of ice. Also, aerodynamic heating due to the speed of the vehicle may be sufficient to prevent icing. In the older aircraft, and we do still have some of them around, mechanical boots are used on the leading edges of the wings and stabilizers, and anti-icing fluids are used on the rotating surfaces such as propellers and helicopter rotor blades.

Rime, clear, or a combination of rime and clear are the types of icing which aircraft may experience in flight. Rime ice is a rough, milky, opaque ice formed by the instantaneous freezing of small supercooled droplets as they strike the aircraft. Rime occurs predominantly in stratus-type clouds. Clear ice is a glossy, clear, or translucent ice formed by the relatively slow freezing of large supercooled droplets. In contrast, clear ice is more predominant in cumulus-type clouds.

Icing occurs in various intensities, but until recently, there was no uniform set of definitions of icing intensities. Now, representatives of the Air Force, Navy, Army, Coast Guard, Weather Bureau, FAA, and NASA have agreed upon a set of intensity definitions. Light, moderate, severe, and extreme, which were used by the Air Force,

In this article a veteran Air Weather Service meteorologist gives the new definitions of icing.

have been superseded by trace, light, moderate, and heavy.

Liquid-water content of clouds and icing rates are used to determine the intensities. The icing-rate criteria are based upon the rate at which ice accumulates on a small probe. Since our aircraft do not have such a probe as part of their standard equipment, we have included some features which the aircrew will be able to recognize. The operational definitions are listed in the box on this page.

The occurrence and intensity of airframe icing depend upon many meteorological and aerodynamic factors. Temperature has a direct effect on the portion of water which freezes. Liquid-water content in the cloud is probably the most important in determining the ice-accumulation rate. The higher the liquid-water content, the greater the ice accumulation. The maximum liquid-water concentration usually occurs at a lower level in stratiform clouds than in cumuliform clouds. Within the cloud, the liquid-water content increases with altitude to a maximum value and then decreases. Droplet size also affects the icing rate. The larger the droplet size, the faster ice will accumulate. Usually, the droplet size is larger in cumuliform clouds than in stratiform clouds.

The icing rate depends to a large extent upon the collection efficiency, i.e., the fraction of the liquid water collected, of the aircraft component involved. The collection efficiency varies directly with droplet size and aircraft speed and inversely with the component size. For example, the antenna mast is a more efficient collector than the leading edge of a thick wing. Aerodynamic heating, the temperature rise resulting from compression and friction as the aircraft penetrates the air, lessens the icing hazard on high-performance aircraft at high speeds. For example, the amount of heating for an aircraft flying at 150 knots at 6000 feet is a little more than 1°C but at Mach 1.0 at 6000 feet the heating is 36°C. The amount of heating decreases with altitude. For instance, at Mach 1.0 at 30,000 feet, the aerodynamic heating is only 26°C.

The design characteristics of aircraft have a decided effect upon the occurrence and accumulation rate of icing. Therefore, since there is a great variety of aircraft models in the USAF inventory, our icing problems today are quite varied. The oldtimers are well acquainted with the icing encountered by reciprocating-engine aircraft. Ice accumulates on the wings, canopies, air scoops, propellers, and other surfaces. Also, carburetor icing may occur with free-air temperatures well above freezing when fuel is mixed with air having the proper temperature-moisture conditions.

Turbojet aircraft are usually operating above the levels where icing exists. However, these high-speed aircraft are apt to encounter airframe icing during climb, let down, approach, go-around, and low-level operation in icing conditions. Remember the instances cited earlier in this article? Jet fighters, due to design characteristics and greater speed producing more aerodynamic heating, are less susceptible to icing than are jet bombers and transports. For the same reasons, jet bombers are less susceptible than prop-driven transports.

Engine icing also occurs on and in jet engines. USAF Technical Order 1-1-469, "Operation of Aircraft with Jet Engines Under Icing Conditions — All Jet Aircraft," 25 August 1955, gives an excellent discussion on the icing of the components of a turbojet engine. Jet pilots would do well to read this T.O. periodically.

Rotary-wing aircraft are quite susceptible to icing and, therefore, are not usually operated in icing conditions. The Canadian National

Trace of Ice: Accumulation of one-half inch of ice per 80 miles on a small probe. The presence of ice on the airframe is perceptible but the rate of accretion is nearly balanced by the state of sublimation. Therefore, this is not a hazard unless encountered for an extended period of time. The use of de-icing equipment is unnecessary.

Light Icing: Accumulation of one-half inch of ice per 40 miles on a small probe. The rate of accretion is sufficient to create a hazard if flight is prolonged in these conditions but is insufficient to make immediate diversionary action necessary. The occasional use of de-icing equipment may be necessary.

Moderate Icing: Accumulation of one-half inch of ice per 20 miles on a small probe. On the airframe, the rate of accretion is excessive, making even short encounters under these conditions hazardous. Immediate diversion is necessary or use of de-icing equipment is mandatory.

Heavy Icing: Accumulation of one-half inch of ice per 10 miles or less on a small probe. Under these conditions, de-icing equipment fails to reduce or control the hazard.

Aeronautical Establishment conducted tests which showed that ice accretion of about 3/16 inch on the main rotor blades was more than enough to prevent a helicopter from maintaining height during hovering flight. Other rotor blades, control rods, and air intakes are also susceptible to icing.

As stated earlier, a basic condition required for aircraft icing is the presence of supercooled water droplets, i.e., clouds composed of liquid-water droplets which are colder than 0°C. Since liquid-water droplets are rare at temperatures colder than –40°C, aircraft icing is almost unheard of at these cold temperatures. Generally, the frequency of icing decreases rapidly with decreasing temperature and icing seldom occurs at temperatures colder than –30°C. Therefore, icing is usually restricted to 30,000 feet and below. Rime ice predominates at colder temperatures, whereas clear ice is more common at temperatures just below freezing.

Rime and mixed icing are more common in low and middle level stratiform clouds and the intensity ranges from a trace to light. The icing layer averages from 3000 to 4000 feet in thickness. On the other hand, icing in cumuliform clouds has greater vertical extent. It is usually clear and the intensity ranges from a trace in small cumulus to light to moderate in the larger cumulus clouds. The most severe icing, and it can be heavy, occurs in cumulus congestus clouds just prior to their change to cumulonimbus. In other words, icing is more severe in cumulus clouds which are building and less severe in those which are dissipating. Also, icing is generally restricted to a shallow layer near the freezing level in a dissipating thunderstorm.

Icing is more intense over high, steep, mountainous terrain than it is over low, flat terrain under apparently identical conditions. Moderate icing, usually clear, occurs in the convective clouds over mountainous terrain and is usually greater over ridges than over valleys. The windward side of mountains, particularly along coastlines in winter, are especially subject to extensive aircraft-icing zones.

Winter is the season of maximum aircraft icing! Half of the 114 aircraft accidents occurring from 1946 through 1958 in which icing was a factor occurred in the three winter months. So, you can see the timeliness of this article. Don't let this winter claim you as an icing statistic.

Also, remember that icing intensities have a new look this year. A trace of icing means just that – it is perceptible but the rate of accretion is almost balanced by sublimation; it is not considered a hazard. Light icing can be a hazard if flight is prolonged in the icing zone; however, immediate diversionary action is not necessary but occasional use of de-icing equipment may be required. Moderate icing is a hazard even during short encounters; immediate diversion is necessary or use of de-icing equipment is mandatory. Heavy icing is the uncontrollable situation; de-icing equipment fails to reduce or control the hazard. ☆

Icing is now classified as trace, light, moderate and heavy—above is heavy.

FIRST AID . . . 'til the medics arrive

Willie Hammer, Directorate of Aerospace Safety

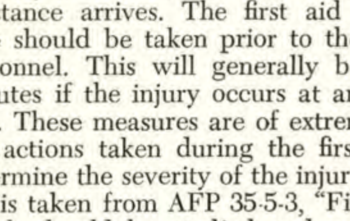
Since accidents happen and people may be injured, every airman should know what to do until medical assistance arrives. The first aid measures indicated here should be taken prior to the arrival of medical personnel. This will generally be only a matter of minutes if the injury occurs at an Air Force installation. These measures are of extreme importance since the actions taken during the first few minutes may determine the severity of the injury. Most of this material is taken from AFP 35-5-3, "First Aid for Airmen," which should be studied and consulted when more detailed information is desired.

Injuries requiring prompt action may result from one or more of the following:

- Asphyxiation or inhalation of toxic gases or liquids.
- Electrical shock.
- Corrosive burns.
- Wounds and cuts.
- Thermal burns.
- Bone fractures.

In case of an accident in which serious injury has occurred:

a. Move the injured person as little as possible. However, in cases of:



ELECTRICAL SHOCK – move him from the conductor with which he is in contact, using wooden poles or other nonconducting devices if the current cannot be shut off.

ASPHYXIATION or exposure to toxic gas – move him to fresh air, or supply him with oxygen.

ACID BURN, corrosive and cryogenic splashes – put him under an emergency shower, remove any clothing saturated with the harmful liquid, and wash off the liquid with large amounts of water.

FIRE or imminent danger from collapsing structures or possible explosion – move him to a safe area.

NOTE: USE CARE THAT YOU DO NOT BECOME A CASUALTY YOURSELF. KEEP CALM, BUT TAKE PROMPT ACTION.

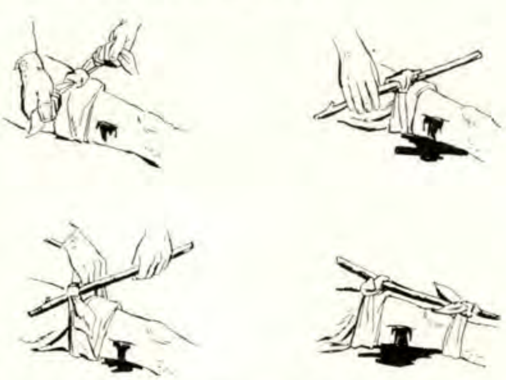
b. Check for breathing and bleeding.

ARTIFICIAL RESPIRATION. Give artificial respiration to persons whose breathing has stopped. If a pulmotor is not available, start mouth-to-mouth resuscitation immediately. Keep it up until breathing has restarted or until medical personnel take over. (Figure 1). Oxygen may be given after a person is breathing in order to reduce shock. Remember that only an in-

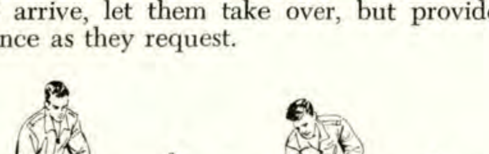
halator which will induce lung action is an adequate subsititute for artificial respiration. Ordinary respiratory protective equipment is not adequate.

BLEEDING. Stop any uncontrolled bleeding by use of a compress. Do not touch the wound or permit it to become dirty in any way. The compress may be a dressing from a first aid kit, a clean handkerchief, towel or shirt. Apply it to the wound with firm pressure.

Use a tourniquet *only* if compress pressure does not work. *Do not use it otherwise*. The tourniquet should be placed between the wound and the heart and tightened only enough to stop gushing of the blood from the wound. Keep the tourniquet tight until medical assistance arrives. (Figure 2).



ASSISTANCE. Send for medical assistance as soon as possible. Emergency measures mentioned should not be neglected in order to summon medical personnel. Send someone else if you can. After medical personnel arrive, let them take over, but provide such assistance as they request.



SHOCK. Try to prevent or to treat shock. Keep the patient quiet and warm. Make him comfortable by loosening his clothes and removing any bulky or heavy items. Protect him from chill with a coat, blanket or other covering. Move him as little as possible, and with due regard for any possibility that he might have a broken bone. If there is no head wound or broken leg, lower his head and shoulders and raise his legs. This will help increase blood flow to the brain. If there is a head wound, keep the patient lying flat with his head either raised or at least level with his body.

UNCONSCIOUSNESS. If the injured person is unconscious, but breathing, place him face down with his head turned to one side to prevent choking from vomit. Be very careful not to obstruct airways by cramping his neck. Once in a position, do not move him again. Do not try to give him a drink if he is unconscious.

FRACTURES. A person with a fracture must be handled carefully to prevent making the injury worse and increasing the shock. In an emergency, there will probably be no time to check broken bones before the injured person is moved. After he is in a safe location, move him as little as possible. A fracture may be suspected if:

- There is an inability to move a part.
- The part has an abnormal shape.
- There is pain on movement with extreme tenderness over the injury.
- Swelling and change in color of the skin.

BURNS. Burns may be due to high temperatures or cryogenic temperatures. First aid measures are the same for both. Treat the patient for shock and obtain medical assistance. Do not touch the burn or try to remove pieces of fabric which stick to the burned area. The patient may be given plenty of non alcoholic liquids provided there is no evidence of internal injuries. Cases in which injuries are minor and not emergencies may be treated at more convenient times. However, *all* injuries, no matter how minor, should receive medical attention.

INTERNAL INJURIES. In the event there appears to be internal injuries, do not give any fluids by mouth. Treat for shock and move as little as possible. Intravenous fluids should be given only by medical personnel.

All personnel should be familiar with the location of first-aid kits and emergency equipment, their contents and how to use them. Safety officers should request that medical personnel instruct airmen and officers in the use of this material and emergency first aid, providing demonstrations where advisable. All personnel should be required to practice these procedures to assure they have acquired and retain adequate knowledge and skill in these areas. ☆

Besides AFP 35-5-3 and instructions and demonstrations by medical personnel, training aids and films are available which will provide additional information. Some of these are:

AFM 160-35, Medical Airman's Manual.

FTA 458, Techniques of Air Exhaled Artificial Respiration.

TF 1-8164, First Aid, Part 2, Every Day Emergencies.

TF 1-8172, First Aid For Air Crews.

TF 1-8185, First Aid For Fractures, Introduction.

TF 1-8189, Control of Hemorrhage.

Survival experts say the first few minutes are the most critical in a survival situation! Your chances are excellent if you . . . .

PANIC NOT!

Get on the canopy release — quick.

One cold day last winter a Hill AFB photographer, pararescuemen MSgt Howard Gould and SSgt Bernard Casey, and the author plowed through waist deep snow with the idea of staging a series of pictures to illustrate what the two rescue experts feel is one of, if not the most, important aspects of survival—*not panicking*.

First, we wanted to get the point across that after landing one must get his parachute canopy collapsed. Bernie Casey agreed to be the subject. He was outfitted with the gear a T-33 pilot would probably be wearing and have with him for survival. Bernie got

Guess I'm in one piece. Now what?

Better gather up the chute, I'll need it.

This cuts the wind, now to think things over.

First, I'd better get a shelter built.

Now, what's in this survival kit?

on his face in the snow and we released the chute. The breeze quickly blossomed the canopy and our survivor started plowing up the snow with his face. He managed to turn himself onto his back where he could get to the canopy release. The chute quickly collapsed. So far, so good. But did you ever try to get to your feet in about three feet of powdery snow? It wasn't easy, but Bernie finally made it. Actually this was kind of a bonus, because we hadn't foreseen how difficult it was going to be for him to get on his feet. He was puffing pretty hard and had worked up a sweat. It was at this point that he and Sergeant Gould agreed that a lonesome survivor could wear himself out floundering around in snow, and, being already in an apprehensive state of mind, might panic. Bernie retrieved his chute and wrapped up in the canopy to get out of the wind while he took a few minutes to calm down, think through his problem and decide what to do next.

Since there was plenty of firewood available at this spot, Bernie decided the first thing to do was erect a shelter. He used the parachute canopy for this, making sure the cloth was securely fastened to a low tree with suspension line. Then he gathered firewood and got a fire going.

Now he was pretty comfortable and he could really get into the problem of surviving until help appeared. The one thing he kept constantly at his side was his survival pack — he was taking no chances on losing it in the snow. After inventorying the contents, he perused the survival manual. This served two purposes: first, there's a lot of information in the book; second, the person caught in a survival situation, where his life depends on every act he takes, is not likely to be as calm as he would be in his own living room. Reading the book gives him time to simmer down while he's refreshing his memory on the many things he learned in survival school but may have since forgotten.

(When these pictures were taken the URT-21 locator beacon was not available. Nowadays this little goodie would be beeping away to give rescuers a fix).

The radio (URC-11) was the next thing our survivor used. Although we don't show it here, a good idea would be to put the batteries under one's clothing to keep them warm.

Finally help arrives. Aircraft engines can be heard in the distance and this is a good time to get a flare ready to use, and don't forget to keep the mirror handy. Now that the chopper is in sight the smoke flare does the job.

As we said earlier, this is not intended to cover the problem of survival thoroughly, but it is designed to emphasize actions that, had they been taken in at least a half-a-dozen cases we know of, those men would still be alive today.

As a suggestion, why not clip this section out and carry it with you when you fly. ☆

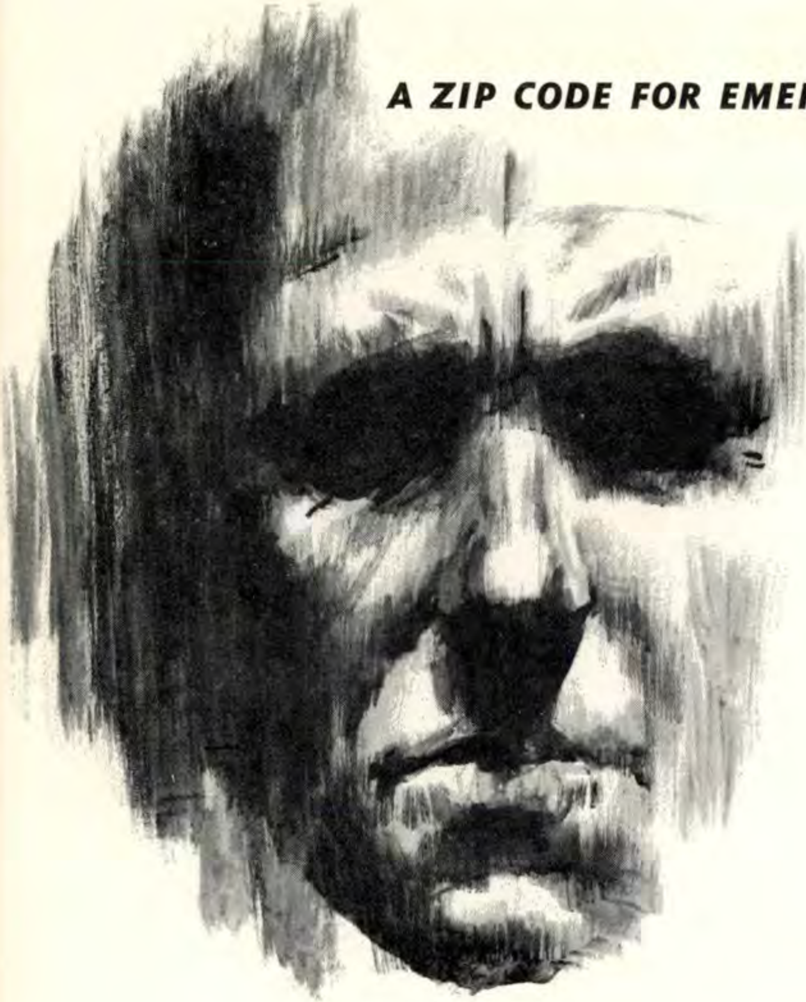
Lots of wood, I'll get a fire going.

This radio now. Fellas, I'm over here.

No rush, better see what the book says.

This ought to attract their attention.

A ZIP CODE FOR EMERGENCIES



Let's face it! The only reason that many of you are still alive is that you have never been faced with a critical emergency. Many of you have just been lucky; but how long will your luck hold out? Mine ran out when I forgot one step in an emergency procedure just like many of my friends. I forgot to change the fuel selector in my B-66 during a low altitude airstart. After I bought the farm, I had a chat with many other drivers down here and we figured out how we could survive if we had the chance again. We won't get it, of course, but you might. So take five and stay alive. Read on, MacDuff!

We figure that a critical emergency is one that requires immediate and instinctive reaction. Bold print procedures are not always critical. If your T-Bird flames out at ten thousand feet, you still have time to think a little and try a few airstarts before you leave it; but what will you do if it flames out at 300 feet after takeoff? That's what we call a critical emergency.

Loss of afterburner in the F-100 during nosewheel liftoff, opening of the T-Machine nose compartment doors during takeoff or a double flameout in an F-4C on final approach are other examples of what we would call really critical emergencies.

When you abort an F-105 at takeoff speed, there is no time to think it over; your reactions must be automatic. They will never become automatic by simply memorizing the bold print emergency procedures in the Dash One. A desk jockey down here can recite verbatim every procedure in his checklist but he bought the farm because it took him too long to spout out the steps and do them at the same time. See for yourself. Sit in a simulator or de-armed aircraft (seats and switches) and imagine that you have just lost your engine, or all of your engines, just after takeoff. At a given signal see how long it takes to accomplish your airborne abort procedure. Remember that this is not an academic situation, like the time when you took your annual written proficiency examination. You cannot mull over the next step. My buddy, Jim, used to place his students in a de-armed cockpit and time them through this procedure. Invariably they would start with their hands on their laps.

"You will be 300 feet above the ground at this time. Are you going to be flying this thing with your feet?" After the student grabbed the stick, he realized that every step would have to be accomplished with his left hand because he would be maneuvering for a landing with his right.

"The next thing they would do," explained Jim, "is look at each switch as they moved it. Scott Crossfield recommends it but not at 300 feet when you are about to crash land the bird in the nearest patch."

So now they realized that in addition to having the right hand on the stick, they had to be looking out the windshield. (See why blindfold cockpit checks make sense?) Next they would perform a few steps quickly and then stop to think about the following step. By the time they finished, it usually took 13 to 15 seconds—too long when the pressure is on and the ground is racing up to meet you.

After a few practice sessions, they could whip through it in five seconds flat but they stopped reciting each item. They just let their hands run through the whole procedure like a piano player who has learned a new piece. Now all they needed was a little practice to polish their performance and make it indelible in their minds. The only thing that was wrong was the learning process. It could have been accomplished quicker and easier by using a ZIP CODE. Here's how.

First, sit down with a cool one

in a quiet atmosphere and learn the critical items verbatim. Then get down to business. In each procedure, give every step a ZIP CODE, one word if possible but in no case more than two. For example, the first step in the B-66 Ground Abort Procedure is BOTH THROTTLES — IDLE IMMEDIATELY. Just write THROTTLES. The rest is really obvious and does not have to be written or recited. The second step is DRAG CHUTE — DEPLOY. Just write CHUTE. It's obvious that you wouldn't abort the B-66 without deploying the drag chute. Continue down the list in the same manner. You may finish with a procedure looking like this: THROTTLES CHUTE BRAKES THROTTLE BATTERY THROTTLE HATCHES GEAR FIRE.

After you have learned this ZIP CODE, go to the simulator or de-armed aircraft and practice until the whole procedure becomes an automatic reaction. Compare the times that it takes to say and perform all the steps using the full checklist and then using the CODE. You will find that without fail, your hands can beat the full checklist but you will never beat the CODE. If you don't believe me, try it. Remember the mind must act before the body in the learning process but once you have mastered the procedure, the hands act by themselves and the mind can move on to the next step —like abandoning the aircraft.

A few words of caution. Always give the same word to the same switch. Don't call them WING FLAPS one time and FLAPS the next. Think each item through carefully before you practice. If you abort on the runway in a T-Bird, you don't have to hold the stick and so both hands are free to act; for an airborne abort, only one hand is free. Be prepared for a mild shock. You will be surprised how soon the CODE will make your movements automatic. Check each switch to see which way it moves and how far. Practice the really critical procedures, the ones near the ground. Statistics prove that they are the biggest killers. There are many desk jockeys down here to prove it. ☆

THE GHOST PILOT

U & 8:20/month

Lt Col Richard R. DeLong, Directorate of Aerospace Safety

WHAT THE DEVIL DOES *this* MEAN? Well, it means there are a lot of pilots in this man's Air Force flying 100 hours a year in the so-called "proficiency flying program." This may include "U," and if so, the 100 hours breaks down to 8:20/month.

Now you can sit back and relax, because you know what it means But do you? I dare say, that half the pilots involved really *don't* know the value of the proficiency flying program other than the fact that it provides 8:20/month and 100/year.

Many pilots find a multitude of problems associated with maintaining currency and meeting annual flying requirements. The most outstanding is probably that of establishing a compatible timing arrangement betwen the people who manage the flying program and those to whom the individual is responsible in the function of his primary job assignment. The latter are his bosses (or boss), who control his time and day-to-day effort (and write his OER!). Most pilots wind up flying weekends (this irritates Mother), and/or, taking trips during the week, which requires homework (or overtime) to stay above board at the office.

Another serious problem is the uneven frequency of flights. This usually results in long periods of flying inactivity and many times necessitates a recheck in the airplane. Let's face it, after 45 days out of the cockpit, nobody is current, much less qualified!

The last, and perhaps most important, problem is that 100 to 110 hours a year just isn't enough flying time to keep a guy sharp. There is obviously no move afoot to increase the flying hours allotted for proficiency purposes. Although many will agree that more hours are required, the budget cannot afford us this additional time.

Okay, so now you say, "So what's new?" The obvious answer is, "Nothing." You are still stuck with all the problems and 8:20/month. However, there are some things you can do to help improve the situation. Here they are:

First: Make the most out of each flight. Re-study the emergency and normal procedures in the Dash-One and plan your flight well. Even if you have to go down to operations the night before, plan your flight well!

Second: Make the most of your time while flying. Practice normal and emergency procedures (even if you only go over them in your mind), practice instrument flying and make instrument approaches to every landing.

Third: Spend some time in the training section with the IP's. They're not a bad sort, really—they just fly for a living. Come to think of it, at 8:20/month, SO DO YOU!

Fourth: If you have trouble getting away from the office, talk the situation over with your boss. Ten to one he's an understanding troop who just didn't realize the problem.

Last: Study the Dash-One frequently. *FIND* TIME! Any one of us can be a stick-and-rudder expert, VFR in the local area. It's when an ornery airplane and the weather combine their efforts, that you usually get in a jam. When the palms are wet, the posterior is nervous and the adrenalin flows like prohibition beer, you might wish you had made the most of the program.

As Grandmother used to say, "If you don't feed the cows, you won't get a drop." Think about it.

P.S. Make sure your boss reads this!!! ☆

Emergencies at missile sites demand fast action. Teams of engineers and technicians are geared to move quickly when there's a

MISSILE MAYDAY

Col William J. Campbell, Chief, Titan SSM Div., SBAMA

As advanced weapon systems are developed and deployed, the need for quick logistics response becomes increasingly important, particularly where missile safety is involved. Consequently ballistic missile System Support Managers (SSMs), in coordination with the using command, found it necessary to develop realistic maintenance, supply, engineering, and transportation innovations to reduce support reaction time. However, in dealing with potential hazardous conditions which could develop at any one of a wide-spread network of bases, it became apparent that new concepts, involving precise lines of communication and teamwork, were required. While "Mayday — Mayday" is still used to identify extreme emergencies for missiles as well as for aircraft, the procedures for handling these emergencies differ considerably.

A plan which accomplishes these response objectives was initiated in support of the Titan, Atlas, and Minuteman weapon systems. The effectiveness of this planning and the high degree of intercommand coordination achieved has been repeatedly demonstrated during the past few months. A case in point concerns a potential hazardous condition which occurred at one of the HGM-25A (Titan I) bases.

On the morning of 2 July 1964, the phone rang in the home of Captain Donald Walker in San Bernardino, California. The time was 0330 hours; however, requests for engineering assistance were not uncommon this early in the day. Quickly, the problem was described and it was determined that immediate on-site technical assistance would be required at Ellsworth Air Force Base, South Dakota.

Before assembling the depot support team, only a few basic facts were known. After a fuel-only exercise with an operational re-entry vehicle installed, the SAC crew was unable to lower the launcher. Circuit breaker 19 in the launcher logic rack would "pop" each time an attempt was made to lower. Severe thunderstorms with high winds and cloud-to-ground lightning were in the area. One inch hail was forecast. It was imperative to lower the launcher and missile as soon as possible.

The team selected to accompany Captain Walker consisted of a SBAMA electronics project engineer and an American Machine and Foundry contractor's technical services representative. Departing Norton Air Force Base at 0545 by T-39 aircraft, the team arrived at Ellsworth Air Force Base at 0757. With the cooperation and support of the 44th Strategic Missile Wing and the 850th Strategic Missile Squadron, the difficulty was quickly pinpointed and corrected. Shortly after the launcher was lowered and the missile put in a "safe" condition, a severe thunderstorm, with heavy lightning and 40 to 60 knot winds, hit the missile complex. Had the technical support reaction been slower, the missile would have been exposed to the storm and may well have sustained major, perhaps catastrophic, damage.

To augment T.O. 00-25-107 support procedures for providing priority responsiveness to emergency requests, the SSM/AMA initially developed the Missile Engineer/Technician Teams (METTS) operations plan for the Titan and Atlas Weapon systems. These teams were equipped with the skills, equipment, and engineering data necessary to trouble shoot and correct those maintenance or operational difficulties beyond the combined capabilities of SAC and the appropriate geographical Air Materiel Area. Primary purpose was to provide immediate support in restoring missiles to EWO status and to correct serious safety deficiencies.

The hub of this operation is the SSM at San Bernardino Air Materiel Area who receives assistance requests from SAC or from the geographical AMA. It is his responsibility to determine the type of support to be provided and to obtain required Air Force or contractor engineering and technical assistance. During the first year of operation, this system of support proved extremely effective and prompted application to other advanced weapon systems.

Closely related to the METTs program is the Missile Potential Hazard Team concept SAC (Reg 355-3 and 4) which was developed by SAC in coordination with the missile SSMs. This regulation establishes responsibilities for directing those emergency measures and actions required to prevent or minimize damage and restore operational capability following peacetime missile potential hazardous situations. To cope with any safety problem, missile potential hazard teams are formed at Headquarters SAC, numbered Air Forces, 1st Strategic Aerospace Division, each SAC missile wing and squadron, and at the SSM/AMA.

Missile potential hazards include those situations arising during an operations or maintenance activity in which any portion of the system performs other than normal and technical data does not contain procedures for return to a safe status. Included, also, are those conditions which, although covered by technical data, could result in:

- Impending loss of life, serious injury, or entrapment of personnel.
- Impending collapse of missile silo doors, work platforms, or underground structures.
- Impending propellant dump or spills of propellants or gases.
- Impending missile explosion, silo fire, or propellant terminal fire.
- Impending damage due to wind or other weather factors.

The Missile Potential Hazard Team procedure establishes a firm communications network which permits conference tie-in with the Wing/Squadron, numbered Air Forces, SAC Headquarters, and the appropriate SSM/AMA. This "hot line" system is one of the keys to quick reaction. With AMA engineering and system technicians monitoring the call, the SSM can quickly determine the type of support to be provided and effect on-the-spot coordination with the various elements of SAC as to what system specialists or special skills are required. With SAC operational personnel available to describe the difficulty and SSM/AMA engineering and maintenance technicians also on conference call, it is frequently possible to arrive at a solution without dispatching crews, thereby solving the problem on the phone.

To augment the SSM/AMA team concept, contractor personnel are available on an open-call contract and are able to quickly respond to urgent requests for assistance. As a matter of fact, emergency support teams are frequently composed of both Air Force and contractor personnel.

With T-39 type aircraft standing by, it is possible to airlift personnel to any part of the ZI, accomplish the task, and be on the way back to the home base within a few hours. So whether the situation is LOX in the bottom of a silo, a stuck launcher, or simply inadequate technical data to cope with a safety problem, the SSM has the capability to react much more expeditiously than in the past. This, in conjunction with highly trained SAC personnel and precise inter-command coordination, will enable the Missile Squadron to recover from a potentially hazardous condition in a minimum of time. ☆

Doing what comes naturally

Anchard F. Zeller, Ph.D., Life Sciences Division

Doing what comes naturally may be fun, but not when it threatens to inadvertently separate a pilot from his faithful aircraft way up in that thin cold air. In the pilot's own words:

"There were two pilots on this X-country. I occupied the back seat on this leg. During letdown, we had to fly through tops of cumulus build-ups. In preparation for the bumps both of us tightened our safety belts. Passing through the first cloud involved sufficient turbulence to throw me upward and hit my helmet on the canopy. My hands weren't gainfully employed at the time, and in a reflex action they instinctively grabbed the seat armrests. I felt the right armrest start up, and simultaneously (also in a reflex action) tried to push it back down.

"Fortunately the armrest didn't come up far enough to fire the canopy initiator. I put the safetypins back in the two initiators, but the one for the armrest wouldn't go all the way down.

"Landing was made without incident. Maintenance returned the armrest to normal stowed position (involved rotation of the hand grip ring). Subsequent investigation confirmed that the ejection seat and canopy were correctly rigged and that the armrest had not been moved upward very far. BUT the image of what could have happened is enough to make me take positive action to prevent my hands from inadvertently grabbing the armrest handles in the future."

The human body is a fine piece of equipment with built-in features that would make an automation expert turn green with envy. How convenient it is that so much internal action is so automatic. Even such controlled activities as breathing go their life giving way without interruption when attention is diverted elsewhere. Some automatic actions, however, can produce trouble. Reflex actions were built into his system to protect man from the emergencies arising in his natural habitat. They can cause difficulties, however, in the artificial environments which he has created for himself. Responses which make man ready for physical combat make him less capable of dealing with the abstract decisions necessary for his survival in these new surroundings.

Some actions can be controlled by directive but these automatic responses do not come under that heading. Some can be managed by personal discipline and good intentions. Reflex responses are equally impervious to this approach; yet, they can be controlled. The key to their control is given many fancy names by the experts but they all come to one thing, job proficiency. Each individual must be aware of his limitations, aware of the demands of his job — and then practice, and then practice some more! Overlearning each step of the correct procedure until it becomes so automatic that it replaces the old is the key to survival. Emergency procedures particularly should be practiced to such an extent that any unanticipated event only sets off a series of corrective responses rather than producing undue emotionality. Once these things are learned, they must be repeatedly relearned. The pilot in this incident was no novice but very experienced both in aircraft driving and knowledge of human frailities. Yet, he forgot to keep his hands occupied in such a manner that inadvertent actions would not create an emergency rather than coping with one.

Don't think you know, KNOW you know, and remember — you are never too old to find that doing what comes naturally may be the wrong thing to do. ☆

FAA ADVISORIES

Bob Terneuzen, FAA Liaison Officer
Directorate of Aerospace Safety

FLIP Terminal (High Altitude) — It has recently come to mind that there is no way for controllers to determine what navigational equipment is left to a pilot who has experienced a communications failure. Yet, regardless of this, certain high altitude approach charts advise pilots that this or that plate is not to be used in the event of lost communications. In the majority of cases, a determination of this type was for the protection of departing or en route aircraft.

Reports submitted by Air Traffic Control facilities indicate that in a large number of cases it has been possible, through use of radar or emergency frequency, to control the aircraft to a landing. Consequently, through coordination with USAF and USN, it has been determined that all high altitude approach plates may be utilized in the event of two-way communications failure and the restrictive information removed from the plates.

ALLEGED VIOLATIONS — Have you ever received a "Notice of Investigation" from the FAA? Yes, I know, I didn't even have to mention this subject! However, pilots do receive these notices and I thought it might help if you understand the importance of prompt action on your part. The longer you delay, the greater you increase the chances of not finding the records and voice recordings of your flight, since the FAA normally retains these items only 30 days. Therefore, upon receipt of the letter, I would suggest you notify your commander (he may have already received a copy of this notice from the FAA) so that he may obtain the necessary facts concerning the incident. In many cases prompt action has revealed circumstances that have proven valuable in the defense of the pilot.

GCA vs. ASR — For safety's sake, understand the difference in radar approaches. The FLIP Terminal (high and low altitude) for instance, informs the pilot that radar is available at a certain base. It does not identify the type radar, i.e., Ground Controlled Approach (GCA) that furnishes elevation information as well as azimuth and distance (which we term "precision radar") or whether the base has only Airport Surveillance Radar (ASR) which provides azimuth and distance only. Of course, ASR approaches are not as precise as GCA, which means that course is not as accurate nor is elevation information available. (Recommended altitudes are provided.)

Steps have been taken to more adequately inform the pilot relative to the type radar he may expect for approach at an Air Force Base. The words "RADAR AVAILABLE" will very likely be replaced with "ASR" or "GCA AVAILABLE" on high and low altitude approach plates. In the meantime, remember that the specific radar service available at an airport is listed in the Enroute Supplement.

AIRCRAFT LANDING AID FOR PROBLEM AIRPORTS. A new component for ILS, called the Capture Effect Glide Slope (CEGS), has been developed by FAA to replace existing ILS glide slope systems at airports where terrain irregularities interfere with ILS performance. It provides the pilot with more reliable and precise guidance at problem sites, also more definite "fly up" indications at altitudes below the normal approach path.

CEGS will permit upgrading of ILS performance at specific airports leading to eventual capability of all-weather performance. Other benefits to be realized by its installation include use of these airports in minimum weather conditions which alleviates diversions, cancellations and delays. It is currently operational at Duluth and Knoxville Municipal airports (where USAF ANG units are assigned) and at Tempelhof Airport, Berlin. ☆

A little known activity in the Air Force is the ski mission being flown from Sondrestrom Field in Greenland. There are only six C-130D ski-equipped aircraft in the Air Force inventory, all assigned to the 17th Troop Carrier Squadron of the 516th Troop Carrier Wing at Dyess Air Force Base. Their basic mission is to provide resupply for personnel on the ice cap of Greenland. A second function is medical evacuation of seriously ill or injured personnel from any place in the northlands. Since practically all such missions are flown to sites which do not have landing strips, ski landings are a necessity.

When we got notice of our proposed trip to observe this mission and participate in ice cap operations, we also received a list of equipment that would be required. Arctic boots and liners, arctic mittens and liners, thermal underwear, parkas, sun goggles, iron pants, etc., were scrounged from the survival section along with arctic sleeping bags and blankets. Boy, were we prepared to rough it! Temperatures that week were sitting at about 25 below. Chill factors had to be considered — they were down around *three* just before we departed — so we got educated on the combination of low temperatures and high winds which bring on frostbite and frozen skin. *Five* is considered emergency and movements are held to a minimum.

Armed with this background, we departed a chilly Dyess (18°) for the northlands. Since we had a report of wind damage on a rudder, we detoured by way of the AMA to pick parts and stopped for the night at Loring (−12°). The next day we departed with our heavy clothes on and parkas ready. After about two hours of night flying (at 1530) we were treated to a brilliant display of northern lights.

Coming into the base, we encountered severe turbulence and gusty winds with airspeed fluctuations of 15-20 knots. We landed at midnight and stepped out — braced for our ordeal — into a 41° above temperature, chill factor zero! Some frontiersmen we were!

After checking into our nice warm Arctic Hotel accommodations and eating high on the hog at the fine mess the base provides, we sacked in. On our first mission to the resupply area the next day, the copilot reached up to pull the mike button for taxi directions only to have the control column fall back in his lap. While we were tearing up the floor, several of us thought back to the last flight up the fiord with all that turbulence and stick forces applied just before landing. Turned out that the magnesium casting connecting the stick to the elevator cables had broken in half. We got an Unsatisfactory Report off in a hurry.

Next mission went up on the cap to almost the 8000-foot level where resupply was to be accomplished and some ice cap qualifications transition was to be flown. Touchdown is similar to that for water landings. But those takeoffs! Hoo-boy!! Now I know why control columns fail. You accelerate to about 62 knots and yank (I mean pull hard, boy!) that stick back. If you're successful, the nose ski comes unglued. The best way of telling this is to check for an increase in airspeed. If you get it, then at around 72 knots you yank again and, according to the book, you become airborne. Of course, being somewhat below minimum control speed, if you lose an engine (outboard loss is especially interesting) you can plan on an immediate landing.

Runways (ha!) are no more than areas that occasionally have the snow drifts bulldozed to approximately level and portable lights generally aligned with the prevailing wind. They are no more than a designated four to five thousand foot area of the cap.

There are a few other problems involved in becoming airborne: in soft, deep or sticky snow, which we had due to the unseasonable temperatures, pulling hard doesn't necessarily unstick the nose ski. Under some configurations, 60 knots is almost unattainable. If the nose ski doesn't unglue, you don't go anywhere but off across the ice. To give you an idea, one of the old heads took some Army troops out onto the open cap a few weeks ago looking for some equipment they had put out for an experiment. He made a good open cap landing and while he was on the deck did some scouting for best takeoff direction. Some 30 minutes later with the Army team again on board, he lined up in the mile long track he had made and started his run. He could get to only 40 knots. He made a run in the opposite direction but couldn't get past 60 and could not unstick the nose ski. He made two more runs in each direction with identical results. Then he decided on JATO. Engines are never shut down on the cap so installation provided some fine chill factors. Since the direction in which he got the 60 knots was downhill the pilot made his JATO run that way. He finally got his nose off at just over 60 knots, could only accelerate to 68 and literally jerked the plane into the air.

Another little goodie involved a rescue of an Eskimo mother and

A stateside director of safety gets a look at a different kind of operation. Safety, perhaps, is relative, but the author is convinced that safety on the ice cap is spelled PRO!

The Ice Men Cometh

Lt Col Paul L. Smith, 839 Air Div (TAC), Sewart AFB, Tenn

her child on an island north of Baffin. Contact with the base was made by radio from the village where a snow strip was available. Fortunately, one of the old heads took the mission. This strip was on the coast and had a light covering of snow over the ice covered landing area. As the crew touched down and went into reverse, the skis cut through to the ice and torque began to turn the aircraft. The pilot immediately came out of reverse in 1 and 2 and finally added almost full power to them leaving 3 and 4 in reverse. After about 25 degrees of skidding left turn, the pilot regained directional control. Routine rescue! Incidentally, brakes not only are unnecessary, but use in a ski landing means buying a round for everybody on board.

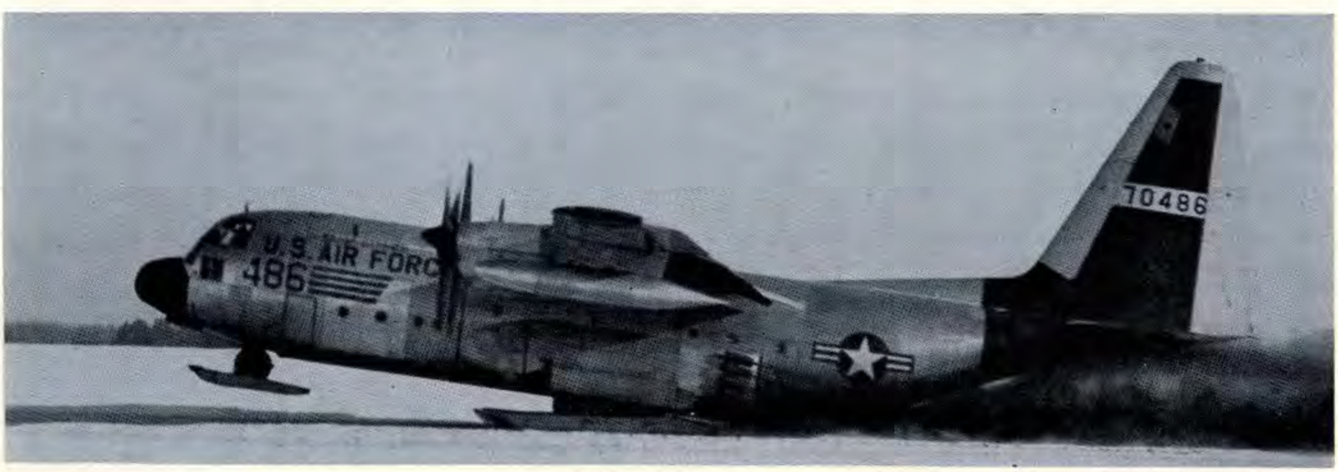
A third item of the kind which causes safety officers to totter over to the nearest wheel chair was a night takeoff at one of the cap sites. Snow was a little sticky – no JATO – and when the pilot reached the end of the runway lights, he only had 60 knots. Since crevasses are not usually found out here and the site personnel scout for them he elected to continue and get airborne after about another 2000 feet of run through the murk. Common occurrence up there!

In only eight days we could just begin to recognize the problems. The whiteout is a beaut! The snow on the cap and the clouds blend until there is no horizon. So there you are flying in the clear on instruments. You can also make your own weather. During landing on the cap, the engine vapors form into fog and can reduce visibility to practically nothing on the strip. Very disconcerting when you are trying to shoot transition. Airborne radar approaches are the rule rather than the exception and very effective because anything at all shows up on the scope. They even picked up a polar bear who was on an exact 90-degree track. Every time they would come over him, he turned north and as soon as the plane passed, zap – back to 90 degrees. Must have had a girlfriend on the east coast.

During the winter, extreme cold and short daylight hours are limiting factors. (It got all the way down to zero one night while we were there and went to 56 above, but that's not usual.) Daylight comes along about nine and it's dark by three. The sun doesn't shine on Sondrestrom in January because the base is in a fiord. Maintenance men have limited facilities and during *normal* winter weather have to face the chill factor constantly.

Crevasses in the cap can be the cause of sudden aircraft stoppage and thorough pre-landing dragging is a must. The crevasses are very much in evidence along the edges of the glacier. Parts, too, are a limiting factor with a supply line a few thousand miles long. You just don't keep a bench stock of magnesium castings at a detached site.

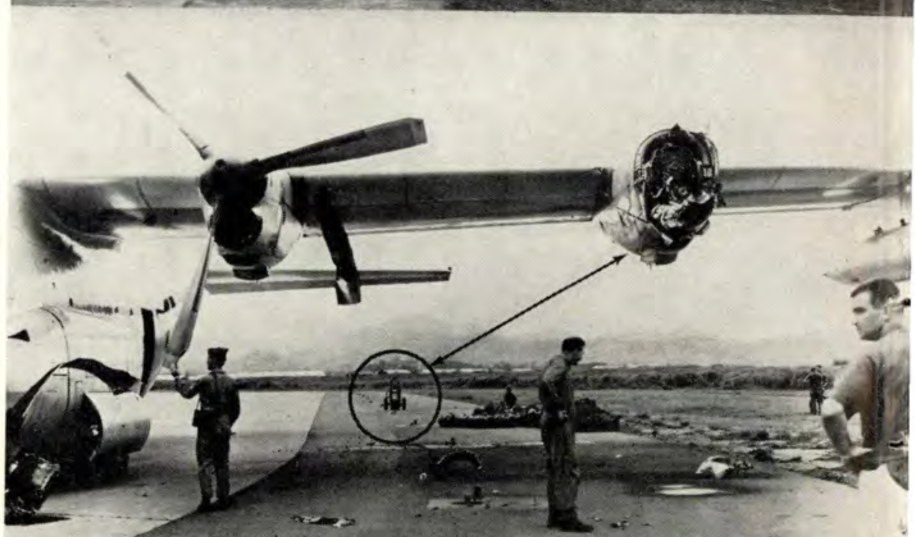
The 17th crews are among the best we've flown with. Whiteouts, radar approaches, those variable run takeoffs, etc., keep them real sharp. They don't get a lot of credit for the great job they are doing, but those boys on the glacier know them for what they are. A bunch of real pros! ☆



IT TAKES TWO TO TANGO

ONE AIRPLANE . . . . ONE OBSTACLE

Maj William M. Bailey, Jr., Directorate of Aerospace Safety



A taxi accident is unforgivable, yet take a close look at the pictures on this page. There are several ways of looking at these accidents. We MIGHT blame the guy who put that telephone pole near the taxiway and, of course, the fellow who planted, watered and nursed that tree for 25 years surely goofed. So did the airman who thoughtlessly left the fire extinguisher parked on the side of the taxiway, and the driver of the bulldozer. But, as they say, it takes two to tango!

Since the C-130 is my major concern, I took a look at the record and found that it has experienced one major taxi accident per year since 1962. Three in three years doesn't sound too unreasonable, considering the mission old Herkie is performing, but when we add up the dollars and cents plus the red faces the figure is somewhat astounding. Cost!! It turns out to average slightly under a million dollars per dance.

We have tried to figure out what causes these mishaps and why. Some of the headshrinkers say there is a built-in optical illusion, but you and I both know the only illusion that exists is complacency: complacency on the part of the pilot and complacency on the part of support personnel.

To avoid future mishaps and red faces there are two things you can do:

First, eliminate that old complacent attitude in the cockpit by taking a good look at the damage depicted in these pictures. (Incidentally, the bulldozer was hit by an aircraft other then a C-130.)

Second, consider the airfield your domain and if you spot any obstacles which may cause or contribute to a future taxi accident, report them, then make sure they are eliminated. *Insist* that support personnel provide the services of making the airfield safe for operation and you, in turn, help by *eliminating* complacency in the cockpit.

Remember, too, that the law (AFR 60-11) says that within 25 feet of an obstruction you gotta have a wing walker and within 10 feet you cut 'em and let the tug boys take over. ☆

MISSILANEA

REDUCING LEAKS IN G & C COOLING SYSTEM. Legends tell of a leak in a dyke which was plugged by the finger of a heroic Dutch lad. Conversely, Minuteman reports an "unplugging" procedure which lessens the chances for leaks.

Recent tests confirm suspicions that the carbon seal within the a-c pump of the G & C cooling system tends to become dislodged by the momentary surge in coolant pressure when the "by-pass to chiller" quick disconnect fitting is uncoupled during a-c power operation. The carbon seals are spring loaded in the impeller housing to assure water tight contact with a minimum of wear. If the seal becomes cocked or displaced, leakage will result. Seal dislocations can therefore occur to pumps undergoing Strategic Missile Support Base test bench examinations, as well as pumps in operational installations.

T.O. 21M-LGM30A-2-6 has been revised to require shutdown of a-c power to the Liquid Cooler a-c pump prior to uncoupling the "by-pass to chiller" quick disconnect. Shutdown of a-c power will automatically put the system on d-c operation. In the d-c operating stage, a flow of approximately two pounds per minute will be maintained in the "to missile" line and the flow in the "by-pass to chiller" line will be reduced from approximately 20 pounds per minute to something less than two pounds per minute. This reduced flow will permit uncoupling the quick disconnect fittings without damage to the a-c pump seals.

Minuteman Service News
Boeing Aero-Space Division

THE DIESEL ENGINE WENT – BANG! Incorrect technical data that allowed the use of improper lubricating oil caused an explosion in the crankcase of a diesel electric generator at a missile site.

The generator was purring along under a light load when, bang! The explosion blew out the crankcase access ports and threw out burning engine oil which resulted in considerable fire and smoke damage to the facility.

Damage to the diesel engine included three piston pins badly galled and five other piston pins galled to various degrees. In addition, the bearings on one of the air blowers were scored, allowing the blower vanes to rub on the case and cause the blower shaft to break.

The following sequence of events, caused by the use of the wrong oil, resulted in the mishap: The piston pin carrier bushing and piston pin deteriorated, resulting in ignition temperatures in the crank case. The failure of the blower shaft permitted combustible vapors to accumulate in the crankcase. When the wrist pin became overheated, the vapors ignited causing an internal explosion in the crankcase. Luckily, at this particular missile installation, the diesel electric generator was located in a facility remote from the silo. Had this diesel engine been in a silo, the explosion and fire probably would have resulted in the destruction of the missile and silo facility.

The present trend to standardize and reduce maintenance on diesel electric generators will surely aggravate conditions which brought about this explosion. Responsible personnel should take immediate and positive steps to assure rigid compliance with the manufacturers' maintenance requirements. Otherwise, incidents of this type will be repeated at other sites as diesels become more worn.

During the incident investigation, many maintenance requirements deficiencies were encountered. A number of these deficiencies are listed below:

- When the daily checklist was accomplished, unusual conditions were not entered on any of the maintenance forms. This caused a breakdown in the chronological maintenance history designed to insure that all deficiencies are reported and corrected.
- Maintenance Record Equipment AF Form 1317, listing periodic inspection requirements, did not include all items required by the manufacturers' data.
- The maintenance history recorded on AF Form 1167, "Daily Power Plant Operating Log (diesel-electric)," was incomplete. The log books kept by operating personnel contained a great many entries concerning problems encountered with the diesel generators which were not recorded on the official maintenance records. Many problems encountered with these engines were not brought to the attention of responsible personnel due to laxity in maintaining records.
- Operational requirements overrode maintenance. Several cases were cited where scheduled maintenance was deferred due to operational requirements.
- Conflict of technical data was revealed in that one Technical Order (T.O.) called for SAE 30, Mil Spec L-2104, oil while another T.O. containing engine requirements called for an SAE 40 oil with less than 25 parts per million (PPM) zinc present. The zinc content of the Mil Spec L-2104 oil used was found to be in excess of 1000 PPM.
- Maintenance records did not show oil changes every 2000 hours and filter changes every 1000 hours as required by the manufacturer.
- Quality control surveillance consisted of housekeeping type inspections. Hardware spot checks were not being accomplished because a power plant specialist was not assigned.

As a result of this incident, the other diesels at this base were thoroughly inspected, cleaned, and replenished with proper lubricating oil. This should help to assure that another incident will not occur to these engines.

Carl S. Norstedt
Directorate of Aerospace Safety

Aerobits

SLEEPY PEOPLE?—Here's one that, if fiction, no one would believe. The jet jock inbound in No. 2 spot after a night formation mission, doesn't remember lowering the gear. He also can't remember whether or not the unsafe lights were glaring back at him from the instrument panel or if the horn was blowing.

Down near the approach end, the mobile runway control officer, stationed where he is to watch for such things as gear up approaches, failed to notice or comprehend the meaning of the fact that the nose gear taxi light was not on during the approach. Now, in this aircraft, the nose gear taxi light will not illuminate unless the nose gear is fully extended for landing. And, because of this, the organization concerned has stipulated that the mobile control officer watch for this light as a sure sign the gear is down and locked.

But, to take care of the remote possibility that a pilot would forget to lower the gear *and* the mobile control officer would forget to check the lights, another man—the mobile control officer's assistant—is also stationed in mobile. Yup, he missed it, too.

Well now, as if this were not enough lethargy, more unbelievable events are yet to transpire. The aircraft made what was described as a "normal" touchdown and slid straight down the wet runway for 4000 feet on its pylon tanks.

Now, at last, comes the awakening.

It wouldn't taxi!

Approximately three man hours were required to jack the aircraft, drop the gear and tow the bird to a hangar. Six man hours were required to magnaflux the pylon tank racks and replace the tanks.

The man hours required to erase the chagrin on the part of those involved was not reported.

WHY SAFETY BELTS?—Auto seat belts have been getting a lot of publicity, but those in aircraft are pretty much taken for granted. The result of not using belts in either case might be serious injury or death.

Recently a transport aircraft was flying at 11,000 feet in what appeared to be stratus clouds. As letdown began, it ran into severe turbulence. Since their seat belts were not fastened, the loadmaster and passengers went flying around the aircraft. All were injured, one of them fatally.

A similar incident occurred when an aircraft was flying at what was thought to be a safe distance from a squall line. In anticipation of turbulence, the seat belt light was turned on, but only light to moderate turbulence was experienced as the aircraft passed abeam of the squall line. No radar returns were being recorded, except one buildup a considerable distance from the aircraft, so the crew began to move around. Two of them suffered broken ankles when the aircraft encountered a violent updraft.

When flying in or near clouds and frontal areas, crew and passengers should be seated with safety belts fastened, and aircraft commanders should insist on this.

Lt Col Garn H. Harward, USAFE

WEAR GLOVES—A major accident vividly portrayed the importance of wearing gloves while flying. Two crewmembers escaped the flaming wreckage. One crewmember wearing gloves received minor burns on one hand. The other crewmember was not wearing gloves. Both of his hands were burned to the extent that permanent deformation will probably result.

HOW TO BREAK TIRES—As the T-29 crew was completing the prelanding checklist, the hydraulic pressure was noted at zero, indicating a failure of the main hydraulic system. While on the base leg, the IP instructed the pilot to place the emergency air brake knob in the "HOLD" position. Upon touchdown (or shortly thereafter) all four main gear tires failed. The aircraft traveled approximately 2000 feet and rolled off the side of the runway.

The Dash One states that when the air brake knob is operated to the HOLD position there should be no braking action. Conjecture is that the system could have been activated by the knob being turned slightly beyond hold, or momentary malfunction, or by vibration on touchdown.

But, the Dash One procedure also points out that in such a situation, reversing should be used during the initial high-speed ground roll since the use of air brakes at that time may cause wheel locking and tire damage. The emergency air brake system should be reserved for final slowing and stopping of the airplane. Extreme caution is advocated when using reverse thrust on landing with loss of hydraulic brake pressure and/or hydraulic system pressure due to the loss of nosewheel steering. If only one propeller should reverse, the procedure is to close the throttles and allow the airplane to roll down the runway until the ground speed has reduced sufficiently to allow operation of the emergency air brakes without danger of wheel locking and subsequent tire damage.

IMMELMANN, "THE HARD WAY"—This T-33 was airborne on a pre-solo student transition flight. Normal airwork was accomplished and after the tips were empty, a few acrobatic maneuvers were performed. The IP then took control of the aircraft and headed for home to enter the traffic pattern. While descending through 12,000 feet, airspeed 270 KIAS, the IP ran in about ¾ full nose-down trim in order to give the student a simulated run away trim condition. He told the student to take control of the aircraft. As soon as the student shook the stick, indicating he had assumed control and stated that he had the aircraft, the IP abruptly released the back stick pressure he had been holding against the nose-down trim. The stick immediately popped from the student's grasp and the aircraft nosed over violently to a near level inverted attitude before the IP could regain control.

Recovery from this inverted flight attitude was completed at approximately 7000 feet. The front cockpit accelerometer indicated 4.5 negative G had been encountered. An emergency was not declared. The landing was executed without further incident. Subsequent overstress and aircraft alignment checks revealed no discrepancies.

ATC's "Approach to Safety"

JET BLAST AND THE BARRIER — What's the hole doing in the bottom of the wing fuel cell? Could it be from a bird strike, foreign object damage or collision with an unknown object? Well, it turned out to be the result of striking an intermediate MA-1 barrier stanchion, on approach for landing.

It happened this way. Just prior to a fighter landing, a four-engine, jet transport taxied onto the runway 400 to 500 feet in front of the barrier and made a pre-takeoff runup. The blast from the runup although the craft was past the Start-Here sign, blew the webbing free of the stanchions and allowed the stanchions to raise. Two points here to note: Don't come in too low over the end of the runway, and barrier crews must be sure to make frequent checks for raised barriers where barriers are subject to jet blasts from multi-engine aircraft.

Harrie D. Riley
Directorate of Aerospace Safety

Aerobits

LOSS OF CONTROL ON LANDING ROLL — After 1500 feet of uneventful landing roll, the pilot of a B-66 lost control and damaged a right wingtip when the aircraft veered off the runway. Everything was OK except the pilot's crosswind landing technique. The aircraft started weathervaning upon deployment of the drag chute. The chute was not jettisoned when control became marginal, and complete loss of control resulted.

Lt Col Eugene J. Budnik
Directorate of Aerospace Safety

OLD CHUTES — A B-47 being ferried to storage was landed without use of the approach chute. The aircraft then skipped 1000 feet before the pilot got it firmly on the ground. When the drag chute was deployed, it failed. Subsequently a tire blew and the aircraft rolled 1000 feet past the end of the runway.

The chute, which had seven broken shroud lines, two panels ripped completely out and five torn from top to bottom, was manufactured in 1955 and, according to the records, had been repacked last in December, 1961.

The fact that this aircraft was going into storage does not mean that it should be provided with unserviceable equipment. Failure of a drag chute can be fatal.

THUD! SOMETHING'S MISSSING—At 27,000, during cruise, the crew of the C-120 noticed a slight flutter of controls, an airspeed drop of three to six knots, then a solid "thud." The aircraft then began a series of pitchup and tuck maneuvers. Airspeed was reduced, the autopilot disengaged, an emergency declared and vectors requested to the nearest base. Landing was made at a municipal field in Kansas and the right wing outboard raft was found to be missing. ☆

FALLOUT *continued*

determine mental and physical capabilities to operate a vehicle.

3. Let's make it a mandatory requirement to install and utilize seat belts at all times; the driver in command of the vehicle could be legally required to shoulder this responsibility for compliance by occupants as is the case in aviation.

4. Let's increase our training, testing and law enforcement personnel departments to an adequate level whereby preparation for vehicle operation, maintenance and demonstration of proficiency at yearly intervals, with removal of incompetents and non-adherents from the role of licensees to be accomplished promptly and permanently when warranted.

We, in aviation, have had this type of program for many years; the railroads are very meticulous in the operation of their equipment. These programs have proven their merit without degradation of capability.

A national program is in order. Let's do something about it.

Lt Col Stephen D. Kost
92d Strat Aerosp Wg (DCOCE)
Fairchild AFB, Washington

NEAR ACCIDENT

Just though I'd drop you a note about an incident that happened to me. It did NOT occur in a military aircraft.

Let me set the scene: 5000-foot runway covered with patchy snow, landing weight 41,000 pounds, crosswind component 13 knots, GCA approach with a 4-degree glide path and transition to land on a parallel runway (GCA runway closed for repairs).

We were a little hot and a little high (sound familiar?). We used full flaps and the power was reduced to idle. The pilot was still applying pressure to the throttles against the reverse stops as we dropped in and bounced. Both engines started to go into reverse as we became airborne again. I was in the right seat, as copilot, and I hit the yoke with my knee to push the nose down when I heard the props going through flat pitch. The second contact with the ground was a little rough but no damage resulted.

The cause of the reversal was the pressure being applied against the reverse stops when the aircraft contacted the ground the first time.

This is one of those sets of circumstances that build up to an accident. I thought you might be able to prevent recurrence of this type of thing if I gave you the word.

Name withheld at writer's request.

SIXTY THREE ARRESTS

I have read the article "63 Arrests," page 25 of the October issue, and have a question regarding the chart titled "Causes of Failure to Arrest By Type of Aircraft." It shows that the speed brakes on an F-101 aircraft deflected the arresting cable. How could the cable be deflected by the speed brakes on this aircraft when they are located on both sides of the fuselage aft of the afterburners? Could this have been a misprint and meant to be the F-100 aircraft?

SSgt Robert M. Lydon
81 Org Maint Sq, Box 35
APO 755 New York, N. Y.

You're so right—it is an error. We failed to detect a typographical error in the Stat Report which we used.

★★★★★★★★★★★★★★★★★★★★★★★★★★★

CORRECTION

Chopper Zones—The color overlays on pages 14 and 15 of the November issue were inadvertently switched. We ask that readers ignore the color markings but observe the approved zone instructions: desired, acceptable, prohibited, and caution.

WELL DONE

CAPT. JAMES H. ELLIOTT

1ST AIR COMMANDO WING, HURLBURT FIELD, FLORIDA

Captain James H. Elliott has been awarded the USAF Well Done Award for the manner in which he handled an emergency while flying an A-1E. At 9000 feet, approximately 25 miles northeast of Crestview, Florida, Captain Elliott noticed smoke in the rear compartment of his aircraft; however, fire could not be detected in the hell hole by the crew chief. The pilot immediately headed for home. Approximately three minutes later, the manifold pressure dropped to 17 inches Hg. All other instruments were normal. Captain Elliott attempted to determine the nature of his problem and regain power while making a slow descent to land at Eglin Auxiliary No. 3, but soon after starting descent, oil pressure dropped to zero and all power was lost. Being near Crestview, Captain Elliott established a forced landing pattern for the new airport there. He lowered the gear at the high key, flaps on base leg and completed a successful landing. Investigation revealed that a broken oil line between the front and rear sump caused the loss of oil and subsequent engine shutdown.

Through his knowledge and skill, Captain Elliott averted a possible loss of life and saved a valuable aircraft. WELL DONE!

WOOD CHOCKS and BOMBERS

'Twas the night before Christmas
And on alert stubs
The snow was as deep
As ferris wheel hubs.
The ground crews maneuvered
The bombers around
In hopes they could find
Some fresh snow plowed ground.
The tow supervisor did find some wood chocks
To place 'hind the wheels so the ship would not rock.
But the ground, it was slippery
And chocks, they did slide
And the B-52 started downhill to ride.
Some three hundred feet
Did this bomber so go
'Til it suddenly stopped
In a ditch filled with snow.
The moral is simple
As tow crews now know.
Wood chocks won't hold bombers
A slippin' on snow!

Lt Col David J. Schmidt
Directorate of Aerospace Safety

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