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Aerospace SAFETY

THE MAGAZINE DEVOTED TO YOUR INTERESTS IN FLIGHT

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PREFLIGHT

IN THE FEATURE article on the Military Airlift Command in the December issue, the Air Reserve was not mentioned. This was intentional since a future full length story on the Continental Air Command is planned. This was so stated in a previous issue. It should have been repeated in the MAC article but was not, due to an oversight. In the months ahead we will be gathering material on the mission and safety program of CAC for an article later this year.

* * *

THIS MONTH, ejection seats, or more precisely, egress systems, are always of interest to crews flying aircraft so equipped. Beginning on page 2, Mr. J. E. Edwards, an engineer at ASD, Wright-Patterson AFB, briefly traces the history of these systems and reports on the latest developments. Would you believe a horizon sensor to right a seat in an undesirable attitude? *Lost on the Ramp,* page 10, while not a winter story, could be because of the troubles that go with moving aircraft and line vehicles on icy flight lines. But the article applies year 'round so we recommend it. Also, *Paint Job* on page 16 has some food for thought for pilots and base engineering types. Accidents frequently are the culmination of a series of incidents. In this article, based on a real occurrence, landing on the overrun probably would have been only of minor import — an incident, although not one to be applauded. But other factors became involved and the incident grew into an accident. Read what happened and be sure a similar event doesn't occur at your base.

* * *

FRONT COVER — 438th FIS pilot, Major James G. Monk, checks the aircraft log prior to a mission out of Kincheloe AFB, Michigan. Photo by Kenneth Hackman, AAVS.

1968 New Year's Resolutions

Some Suggestions for Supervisors and Those Aspiring to Become Good Supervisors

I Will:

1. *Develop a sense of safety consciousness in myself and my coworkers.*

2. *Plan each operation as much in advance as possible, particularly those involving hazards.*

3. *Constantly search for hazardous conditions in my work area and take steps to correct them.*

4. *Thoroughly brief all newly assigned personnel on their duties and in particular the hazards involved in those duties.*

5. *Strive to make every operation a professional one by using applicable technical orders and checklists.*

6. *Insure that procedures are documented in my area of responsibility.*

7. *Not tolerate "short cuts" nor substandard performance.*

8. *Insure that accident prevention information is incorporated in applicable job performance directives.*

9. *Conduct meetings to discuss safety topics and promote prevention.*

10. *Promptly report any injury to personnel or damage to equipment, no matter how slight.*

Col Clarence H. Mills
Director of Safety, Hq AAC

EJECTION SEATS: IMPROVING THE BREED

J. C. Edwards
Aeronautical Systems Div., Wright-Patterson AFB

TODAY in Southeast Asia, in fact throughout the world, those hours and hours of routine air operation are sometimes interrupted by the moment of truth when pilots and crewmembers are forced to abandon their stricken aircraft. Resulting emotions from crewmembers who have made the decision to eject are varied and interesting.

"It was a strange feeling knowing that in a few minutes you would have to bail out."

"So then I decided to get out. At the time, I thought, 'Oh boy, too late'."

"My first feeling was one of elation. Everything had functioned perfectly, and I had no bruises or soreness."

"I recall mentally reminding myself to let go of the seat, open the seat belt, push away from the seat and pull the D-ring. I really felt rather foolish, however, because before I could make a move the action was accomplished automatically."

"My feelings on ejection into the sea are undesirable." (!)

Men who fly are absorbed by their own reasons for wanting to be in the air; when they strap the bird on, the seat is the junction between them and the machine. Only on the rare occasion when the seat is changed from a working platform to a roaring beast sending seat and man into space does it change from its primary role and become the means for emergency escape. So, let's see where we have been, where we are, and where we are going in ejection seats.

When World War I began in 1914, very few crewmembers of balloons or airplanes carried parachutes. The Germans were probably the first to appreciate that a pilot's or crewmember's life must be saved in case of emergency, and that the parachute was the means to accomplish this. By 1917, the parachute had proven itself, and both Germans and English were equipping their Air Forces with these lifesaving devices.

Getting out of the "crate" was accomplished by rolling upside down and falling out, jumping over the side or through a hatch. As speeds and G forces increased, it became obvious that successful escape required an assist to overcome the G forces and to help the crewmembers clear the aircraft structure, especially the vertical tail.

In 1944, Intelligence reported sightings of German pilots ejecting from ME-163 rocket and ME-262 jet aircraft. In 1945, a German ejection seat was recovered and shipped to Wright Field for study. The seat was constructed from laminated wood with a catapult fastened to a re-enforcing metal strip attached to the back. It is presumed that the wooden seat was the result of the metal shortage experienced by the Germans in the latter stages of World War II, but their technology in the development of their catapult provided immediate assistance to our effort.

Wright Field and Frankford Arsenal collaborated in the design of our first catapult. This device was an explosive operated system that thrust the seat/man combination up the rails mounted on the rear of the cockpit at a high initial velocity and hurled the combination from the aircraft, overcoming G forces and clearing aircraft structure. The original seat added two steps to the escape procedure after ejection, unbuckling the safety belt and pushing away from the seat before manually deploying the parachute. The complete process from initiation to an inflated canopy required 12 or more seconds to complete. On 17 Aug 1946, Sgt Larry Lambert made the first experimental live ejection from a P-61 *Black Widow* at Wright Field, Ohio. For the next year, extensive testing was conducted to prove reliability, and the first military specification describing an ejection seat was written.

The P-80 was in service with an installed ejection seat; however, since "high speed" testing had not been conducted, there was no explosive charge in the catapult, and therefore, no means of ejecting. It is interesting to recall that after the explosive charge was retrofitted, actuation of the system first blew the canopy back on its rails, requiring the pilot to duck or lose the top part of his helmet and hair to the contoured front of the canopy before the seat ejected.

High speed testing was conducted at Hamilton Field, California, using a TF-80, the forerunner of the T-33, culminating with a live test on 31 May 1949, when Capt Vince Mazza successfully ejected. Seats were now armed, and the first operational use was made by Lt R. E. Farley from an F-86, 20 miles north of Indio, California, on 29 Aug 1949. Of historical interest and certainly of great personal interest to the pilot was that it was a successful ejection.

An automatic deployment feature was added to the parachute in 1949 to improve high altitude escape survivability. Parachute canopy opening at high altitude resulted in very high opening shock (due to lack of aerodynamic forces opposing the inflation) with attending destruction of the parachute canopy and either death or severe injury to the crewmember from the extreme opening forces. An aneroid barometer was added to delay deployment to a preset safe altitude and to provide automatic deployment after a preset time below that altitude.

Early ejection experience forecast our most serious present problem. Low altitude, bad attitude, high sink rate ejections result in fatalities. Since this is a problem of altitude and time, efforts were directed to reduce time by making all required actions automatic. The automatic lap belt was added in 1954. The zero lanyard was a 1957 addition. The seat/man separator came along in 1960; and when all of these were added to the earlier developed automatic parachute, the nominal time to inflate the parachute canopy from system actuation was reduced from 12 to five seconds.

In 1954, seven years after the first military specification for an ejection seat was written, it was updated and was the last such action until the present 1967 rewrite.

In 1955, aircraft speeds had increased to the point that catapults were firing at the maximum human tolerance to onset G forces but still could not provide tail clearance. This led to research and development for a sustaining rocket to give a continuous thrust after the seat separates from the aircraft and achieves the necessary height for tail clearance. This development, using a high impulse rocket colloquially known as a "big bomb" and a slug-developed pilot chute, has resulted in our most recent modification to provide a zero-zero (zero-altitude, zero-airspeed) capability to some of our installed ejection seats. Unfortunately, this modification increases the time required from system actuation to inflated parachute and degrades the low altitude, bad attitude, high sink rate recovery capability. The only other significant milestone during this period was the definition in 1956 of the airspeed-altitude envelope for ejection seats, escape capsules, and modules, resulting in the B-58 and B-70 capsules and the F-111 crew module.

With the exception of the Martin-Baker seat installed in the F-4, all presently installed ejection seats in current operational aircraft have identical operating sequences, regardless of manufacturer, and are referred to as "conventional" seats. In each instance, the pilot has the parachute strapped to him. Upon initiation of the system, the canopy is blown, the seat is blasted up the rails leaving the aircraft, the lap belt is opened, the seat/man sepa-

rator forces the man from the seat, the pilot chute is deployed, which in turn pulls out the main chute.

The Martin-Baker seat has the chute mounted on the seat and is fastened to the crewmember's harness after he gets in the seat. After ejection, a gun deployed drogue chute stabilizes the seat, pulls the parachute out, which, during the inflation process, pulls the man from the seat.

The success rate through our total ejection experience, which is now about 3000 ejections, has remained fairly constant at around 85 per cent. This may appear to indicate a lack of progress; but when the increased performance of our modern aircraft is considered, significant progress is demonstrated by maintaining the success rate.

Low level ejections have accounted for our greatest failure rate. The number of ejections below 500 feet have gradually increased from 6 per cent to 14 per cent, with the success rate improving slightly from 21 per cent to 36 per cent.

There are a number of projects designed to upgrade our present seats. At Wright Field, work is being pushed to improve the odds for the crewmember who must eject. Since the low level, bad attitude, high sink rate situation is the statistically worse condition, major efforts are being exerted in this area. Unfortunately, as improvements occur, crewmembers seem to favor the game of "Russian Roulette" and too frequently get the loaded chamber when, through indecision or lack of training, they delay pulling the trigger. Engineering is attempting to reduce the system operating time from initiation to fully inflated parachute. But engineering has no control over the time the crewmember squanders between the emergency and the actuation of the system—and micro-seconds have made the difference between life and death.

To reduce the time for actuation to a fully inflated parachute required seat stabilization. Some of our current seats are unstable. Those with sustaining rockets can be extremely so because of the rocket thrust line alignment problem with the seat/man center of gravity variations resulting from size, weights and shapes of crewmembers combined with the amount and distribution of extra gear they may elect to wear. Aerodynamic forces acting on the seat/man combination after ejection can accentuate the instability.

There are a number of approaches to the instability problem. One of the most interesting current research and development projects at Wright Field is an attempt to qualify a vernier rocket that can sense pitch and yaw motion and position the rocket nozzle to oppose that motion and thus achieve stability.

Fortunately, stability pays off at the high end of the ejection envelope, too. Human tolerance to acceleration (G forces) is greatest in the transverse position; that is, spine or chest perpendicular to the G force. Tolerance is reduced in other stable attitudes and is worse if the body is unstable. A by-product of stability is the reduction of arm and leg injury due to flailing, since these members tend to streamline during a stabilized deceleration. The net result is an improvement in the survival/injury rate in open ejection seats at high speeds.

Another research and development effort is being directed toward qualifying a mortar deployed parachute. Our present parachute sequence is to deploy the pilot or drogue chute which pulls the parachute canopy from the pack followed by the risers. This is not a positive system. The pilot chute can be deployed in zero relative wind and fail to pull the main parachute from the pack. The stories of crewmembers manually pulling the parachute out of the pack are not old wives tales but quite factual under the zero relative wind condition, blanketing—falling face up or down. Even the slug deployed pilot chute can fail in the unstable situation if the pilot chute is deployed upwind and is carried back to become entangled with the man and/or seat.

With the mortar deployed parachute, the parachute is forcibly thrust into the air, first stretching out the risers and finally extending the parachute. This is a more positive and faster way of getting the parachute out; however, the seat/man position must be controlled and stabilized so that the parachute will not inadvertently be deployed upwind and be carried back to become entangled with the man or seat.

Currently, canopy inflation is haphazard and a function of speed. It takes longer for the canopy to fill at low speed, the most critical low altitude condition. There are two solutions currently being investigated to improve this deficiency. A ballistic device appears to provide a positive, repeatable, rapid inflation. It is approximately four inches in diameter and has small slugs attached to its periphery. These are sewn to the hem of the canopy at every other riser and blown out by a cartridge when the canopy is fully extended and the risers stretched. The second solution involves sewing a flexible rod stiffener to the hem of the canopy. This stiffener, not liking the cramped confines of the packed parachute, hastens to resume its unrestrained shape on release, thereby providing a similar fast gulp of air.

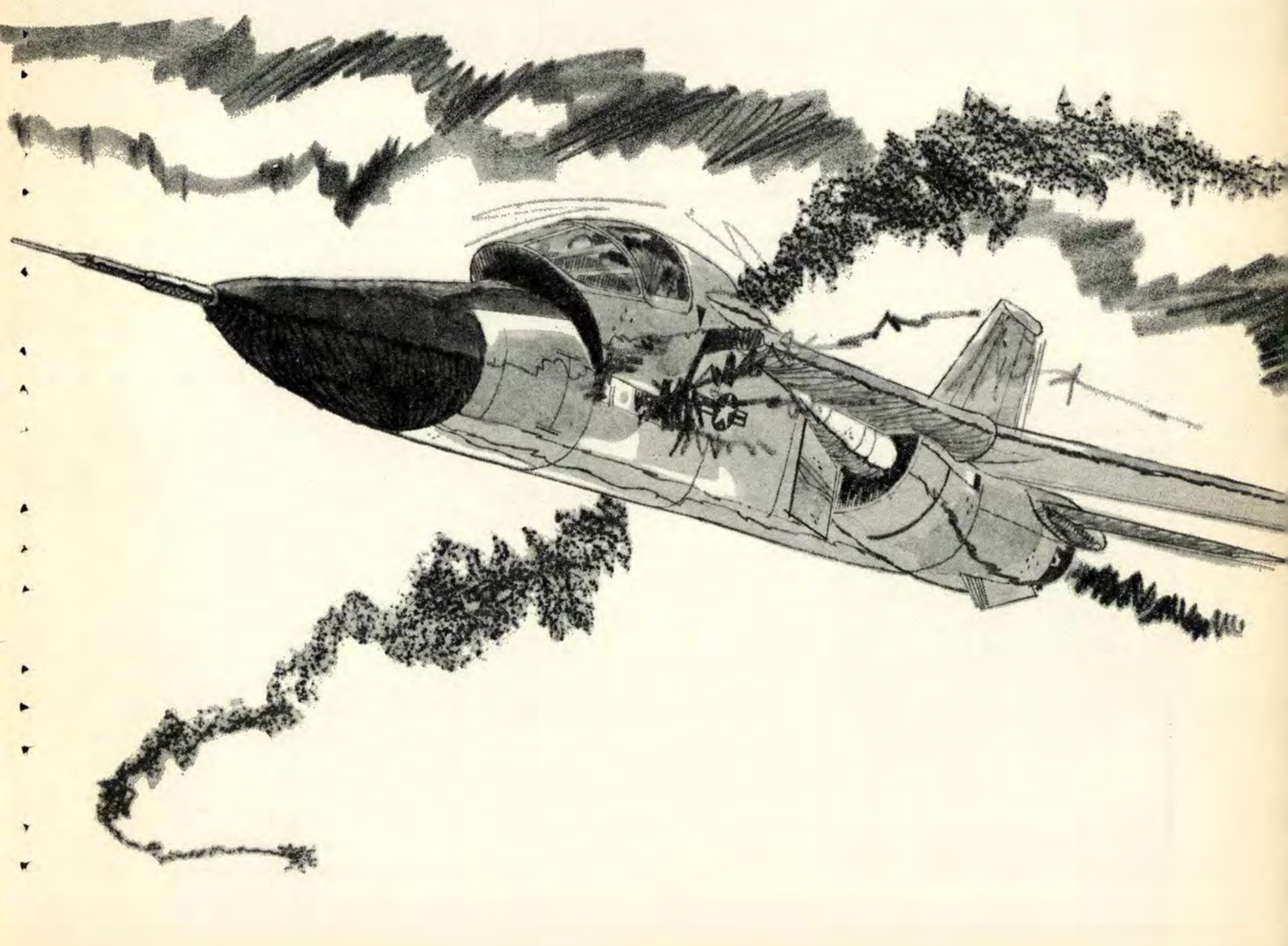
Seat/man/chute involvement can occur for several different reasons. The most positive means of preventing involvement is to pull the man from the seat with the parachute. Like most other improvements, the seat must be stabilized before this technique can be used.

Recent emphasis to improve ejection seat capabilities has resulted in the preparation of a new military specification to describe the performance required for future open seat systems. The performance envelope will be from zero to 600 knots equivalent airspeed. Low altitude escape will be improved by the requirement for safe escape at sink rates up to 10,000 feet per minute and with adverse attitudes.

To achieve these goals, minimum time from initiation to fully inflated parachute is absolutely essential and has been limited to not more than *three* seconds. Additionally the seat must be stable, the parachute must be forcibly deployed with dependency on aerodynamic inflation being undesirable, and seat/man separation achieved by pulling the man from the seat with the personnel parachute. The system will probably incorporate an automatic low and high speed sensor to permit optimum operation throughout the ejection envelope. Also, the ejection controls will be single motion to fire both the canopy and seat; restraint will be provided by a torso harness and a powered inertial reel. The survival kit must be automatically deployed and ejections will be sequenced in multi-place aircraft. Industry has been working on systems that approach these requirements.

With all the progress that has been made in aircraft and ejection seats, it is still the same old human body and brains with their ageless frailties that straps into the seat. The crewman must energize the system before it will work. Training must be complete and decision immediate. It is only too true that runway behind and sky above are forever lost in an emergency. Let us hope that the need to eject never happens to you; but if it does, add a little insurance for the wife and/or girl friend and GET OUT before lack of altitude defeats the best engineering efforts.

Believe it or not, our most far-out research project is an effort to determine if a horizon sensor to right a seat ejected from an adverse attitude is feasible. ★



Support the investigation

Lt Col Guy J. Sherrill

THE name of the game in safety is prevention of accidents. But periodically, as in any endeavor, there are also setbacks, usually well marked by a tower of smoke. It is at this point that the safety function enters upon the accident investigation phase of its mission. In order to prevent an additional similar accident it is necessary to find out exactly what caused the one at hand.

Someplace along the line the job of accident investigation has gained glamour. There is the popular picture of a team of experts, flown in from some distant point, who can make one pass through the ashes, squint sagely at a small bit of debris through their magnifying glasses, and unerringly announce the accident cause in metallurgese. Or there is the other picture of the senior officer board which calls in the surviving pilot and announces that they will give him a fair trial before the hanging. Neither picture is even remotely close to the truth. Most often the investigation is a protracted, deep searching assembly of evidence, material and human, from which a valid conclusion of cause factor may be drawn. There is nothing glamorous about scaling a rotten-rock canyon to get to a turbine wheel, or sifting through yards and yards of gumbo mud to find a loose connection, or, perhaps worst of all, sitting in unbiased judgment of a fellow pilot who has erred.

Nor is the man conducting the investigation some superhuman Sherlock Holmes having a cranial computer programmed with accident causes. He may have had a couple months of specialized training in organizing investigations, plotting wreckage distribution, and conducting accident boards, but in all likelihood he's a man with brackground and capabilities very similar to yours. In fact, you might find yourself in his shoes tomorrow. And he needs your help! Whether you're a Commander, an Ops or Maintenance Officer, NCOIC of Supply, or A3/C

Aircraft sometimes crash in very inconvenient places. Investigators may need special vehicles, boats and other equipment.

Doe, who was riding in a pickup across the end of the runway and saw the accident, you can do the Air Force a genuine service by supporting the investigation. How? Here are some examples:

One of the first requirements in many accident investigations is transportation. As a general rule this isn't a problem but occasions arise where some rather uncommon means are necessary. The helicopter is usually the most useful vehicle about, but everything from scuba gear through barges, swamp buggies, burros, and climbing spikes have been pressed into service at times. If some of this equipment is in your charge, lend it willingly.

Another prime item is communications gear. When wreckage is scattered over a wide area or exceptionally rugged terrain good radio equipment is essential. Don't make it necessary for the investigators to beg, borrow, or steal.

When it comes to finding parts there will never be a substitute for the old-fashioned walk through by bright-eyed troops. Whether called upon to direct or participate in one of these nature hikes, your cooperation can mean success or failure in determining the accident cause.

Finally, no discussion of accident investigation, no matter how cursory, could omit that one ingredient which is most valuable—knowledge. For most purposes it can be classified into the three general areas of technical expertise, awareness of conditions preceding the accident, and witness of the accident itself. These factors, more than anything else, are indispensable in ferreting out and correcting accident causes. While it may sometimes seem that revelation of facts may result in unpleasantness, the direct objective of accident board testimony and the specific non-punitive use to which it may be put definitely remove such testimony from the category of "ratting."

Find the pieces then solve the puzzle. Sometimes finding all the wreckage is a tedious, time consuming job requiring a lot of manpower. You may be called to help.

These are but some of the ways in which you, regardless of your position, can help in after-the-fact accident investigation for the sole purpose of preventing recurrence. The authority, responsibility and obligation to do so are clearly set forth in official directives. Further, the genuine concern of all Air Force personnel in accident prevention has almost always resulted in cooperation of the highest possible degree. It is our sincere hope that this short reminder may prompt the continuance of your help the next time the crash phone rings. ★

This was the last article written by Lt Col Sherrill prior to his reassignment from the Directorate of Aerospace Safety to a cockpit job in F-105s. As he has pointed out, the assistance given to accident investigators can be of enormous significance. AEROSPACE SAFETY wholeheartedly endorses his comments.

Rocky hillside yields wreckage. Helicopter may be needed in some nearly inaccessible areas.

The Needle And The Ball

Some food for thought about an old subject

Captain N. W. Moentmann
Air Proving Ground Center

EARLY in the development of aircraft instrument flying, the need for an instrument to show that the plane was turning became evident. The earliest turn performance indicators employed some type of ball in a fluid filled glass race to indicate the relationship between the angle of bank and the rate of turn, and a gyroscopically driven needle to indicate rate of turn about the vertical axis.

From the appearance of early aircraft instruments shown in the USAF instrument flying manual (AFM 51-37), it seems that the present turn and slip indicator has come down to us with very few changes. Most of us are familiar with three types of turn and slip indicators. There are two "round face" instruments (the two-minute turn and the four-minute turn types used mainly on older aircraft) and a small needle and ball built into the attitude director indicator on newer aircraft.

Judging by the small size of the display used in the new flight director systems, the importance of the T & S indicator has decreased lately. This is probably the result of improved accuracy and reliability of new attitude indicators. The problem of specifying, indicating and controlling aircraft turning performance is still with us, however, and will be for some time.

The system of specifying and indicating turning performance in our aircraft leaves something to be desired and could easily be improved.

Part of the problem is terminology. AFM 51-37, Instrument Flying, uses all of the following terms in connection with the rate of turn:

- Degrees per second—
- Single needle width—
- Double needle width—
- Four-minute turn—

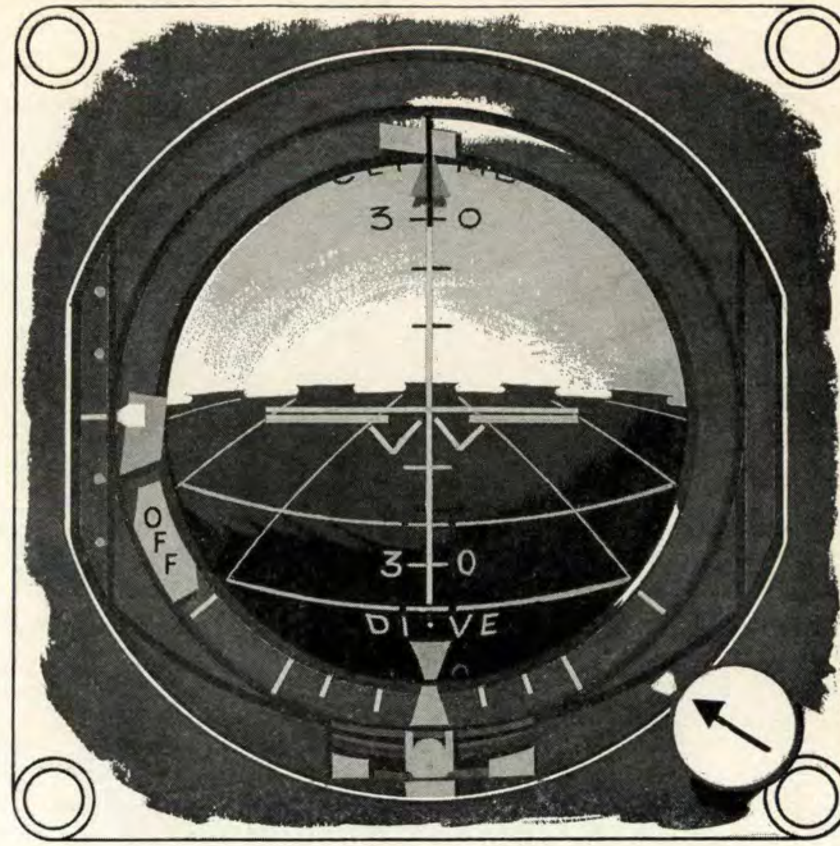
- Two-minute turn—
- Standard rate—
- Half standard rate.

This profusion of terms is needless since only the first, degrees per second, is required to completely specify rate of turn. There is an excellent chart in AFM 51-37 depicting general turning performance which relates TAS, bank angle, turn rate and radius that pretty well summarizes all that pilots need to know about turn performance.

Rate of turn is expressed on this chart in degrees per second. Both civil and military aviation would benefit by discontinuing the use of all the above terms except degrees per second in future references to rate of turn.

The second part of the problem is the instrument display of the aircraft's turn rate. As mentioned before, there are three main types of turn indicators now in common use. The old two-minute turn indicator can be dropped from discussion because it is in limited use in only older aircraft and hopefully will soon be phased out. The four-minute turn indicator is still very much with us, however, and along with the newer display associated with the flight director systems, deserves discussion.

The main failing of the four-minute turn and slip indicator is not in mechanism, but rather in the display. Notice that the markings on the face of this instrument do not enable you to determine the turn rate being indicated without having additional knowledge. That is, on the four-minute turn indicator, it is not clear whether a "four-minute turn" will be obtained with the needle displaced one needle width or aligned with the left or right index. For that matter, it is not clear that the four minutes applies to a



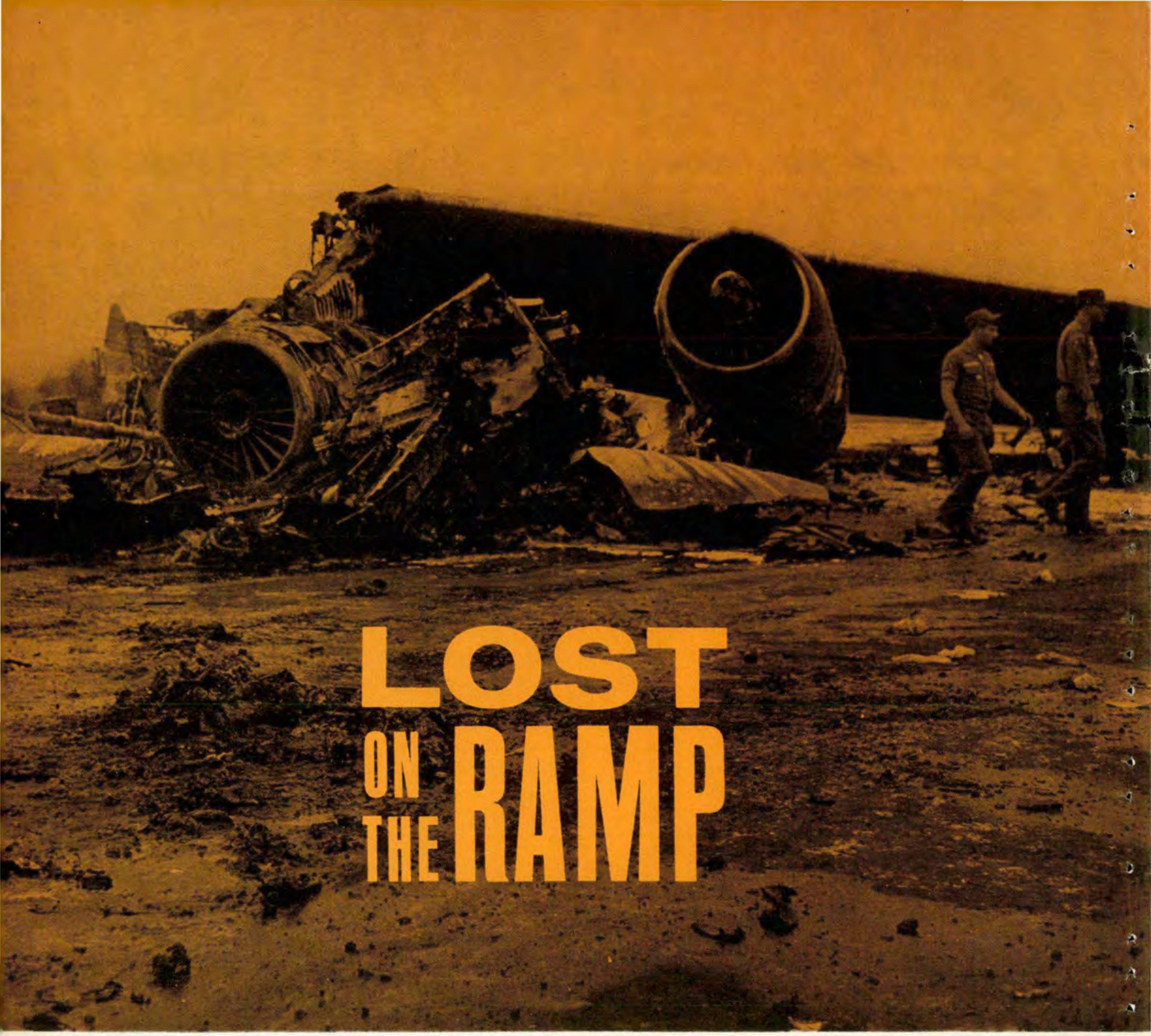
360-degree turn.

True, an instrument pilot will learn how to interpret this instrument through training and practice, but why make it so complicated? Why force the pilot to do mental gymnastics to determine his aircraft's rate of turn? Why not mark the instrument face to make immediate interpretation easy?

The suggestion here is to reconfigure the face of the indicator. Replace the nebulous "4 MIN TURN" marking with the more precise "DEG PER SEC;" put a numeral "0" on or under the center index and a numeral "3" on or under the left and right indices. Possibly add an additional left and right index with numeral "6" if the instrument mechanism will allow 6 degrees/sec turns to be indicated.

Attitude instrument flying utilizes the attitude indicator for aircraft control and supporting performance instruments to indicate that the desired aircraft performance is being obtained. The use of the attitude and vertical velocity indicators to control a rate of climb is a good example of the use of control and performance indicators. The same type of control problem confronts the pilot making a rate turn and the instruments used here are the attitude and turn and slip indicators.

Compare the information presented on the vertical velocity indicator with that presented on the turn indicator. The V.V. indicator presents information in units of feet per minute which is readily usable for quick mental computation of time to climb as well as precise control of climb (or descent) rate. The T & S indicator could be just as useful if the display made full use of the instrument's capabilities. ★



LOST ON THE RAMP

THE mission was a success, terminated with a precision GCA/ILS and a smooth landing. You turn off the runway and relax a bit, satisfied that the flight went as scheduled. The after-landing checklist is complete and you start the long taxi trip to the parking ramp. It's a familiar route you've covered many times, so there will be no sweat in getting the bird to the chocks.

The first turn toward the ramp is executed with ease. With only a quarter of a mile and two turns remaining you can bed the bird down for the night. As you drive down the last taxiway you start thinking about mama and the kids and the good, hot meal waiting for you at home. You are approaching the turn at the ramp while wondering what you will have to shoot in tomorrow's golf game to beat those sandbaggers in your Saturday foursome. Here's the turn to the ramp. You make it automatically, your mind concentrating on how to correct that slice you have developed lately. But your turn is wide, and suddenly your thoughts are interrupted by a loud crunching noise and your aircraft comes to an abrupt halt.

At first it is hard to believe. You see it, but it's like watching an incident on tv . . . something that is happening to someone else, something unreal. Then that sickening feeling inside seems to drain the strength right out of you. The right wing is almost torn off and the MD-3 power unit is lying upside down on the pavement.

You probably haven't been involved in this type accident. But a lot of jocks have. After receiving several recent reports of such mishaps, we dug out the figures for 1965 and 1966. There were 366 such accidents on record. This is past history, but the situation hasn't changed much—we are still crunching wings and engines and props against such things as maintenance stands, generators, buildings and other aircraft. Not only is the cost fantastic, but aircraft needed for important missions are out of service.

When we took a look at the total number of these mishaps—that 366—our first thought was that there are certainly a lot of careless jokers taxiing airplanes. But that is not strictly true. The cause factors break out like this: Materiel 185, Personnel 124, Undetermined 42, Miscellaneous (weather, airfield, etc.) 15.

When we are talking about the results of an accident, it doesn't make any difference what caused it. But when we get to accident prevention, the cause becomes highly important because by identifying the cause and taking corrective action we can prevent a similar one.

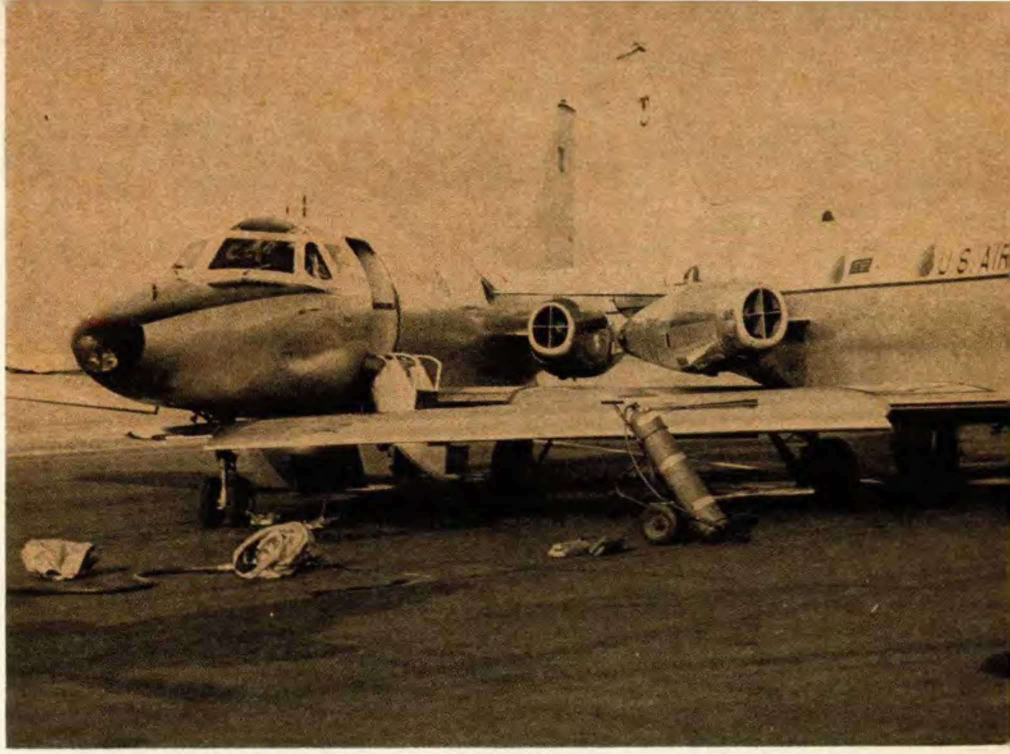
The Air Force spends millions every year to improve its aircraft and associated systems in an attempt to eliminate materiel failures. This is accomplished through research, modification programs, improved design of engines, airframes, flight controls and subsystems. We as individuals, have little control over *Materiel Failure* as an accident cause factor, except that vigorous identification and reporting of deficiencies can expedite a "fix." As for the other cause factors, *Miscellaneous* represents a variety of hazards—mostly one of a kind—that will show up from time to time to cause accidents. However, if we were to project this factor over a long period, like 10 years or more, we probably would find that some of these seldom occurring events have a long history of causing trouble. As for the *Undetermined* category, 42 of these seem like quite a few with the possibility that investigation procedures could be improved.

The one thing we can really get a handle on is the *Personnel Factor*. Of the 124 "people factor" accidents only three were attributed to lack of proficiency. The rest, while labelled in several categories, were caused by carelessness or failure to follow procedures.

It doesn't do much good to wave a finger at the guy who crumpled the wing on a power cart. He certainly didn't want it to happen. And he felt as bad about it as anybody. So, what can we do about it? First, and most obvious, is to keep reminding people who taxi airplanes—for the most part pilots—that "it can happen to you." It is a real shock, as most of us know from bitter experience, to learn that it can happen to you, regardless of whether it is an aircraft accident or inheriting a million dollars, even though the latter is not quite as probable. The idea (aside from the million bucks) is to gain this knowledge the easy way—from someone else's misfortune.

Many of these mishaps that are blamed on the pilot are not so clear cut. We may be biased but we can't help but think that often the pilot is blamed not because he had the accident but because he didn't prevent it.

We've briefed a few of the personnel factor accidents and recommend you take a look at them to see



Guaranteed to ruin your day. Taxi accidents continue to haunt the ramps and taxiways, costing many dollars, occasionally a life.

Article deals primarily with taxi accidents but wind may upend a bird not securely anchored.

Interruption in the life of a bird. It will be awhile before this one flies again.

Aircraft collide with buildings, trucks, busses, barrels, fire extinguishers—just about everything. Ground vehicles too often get in the way.

what's happening to the other guy.

• A B-52 pilot failed to clear the area and allowed aircraft to collide with power unit.

• Another B-52 pilot failed to follow taxi lines and allowed aircraft to collide with a loading van.

• During taxi - out - for - takeoff, a B-52 struck a POL truck. The pilot failed to clear the area and the POL truck was improperly parked.

• A B-57 was taxiing to the parking ramp and collided with a parked bus near the taxiway. The pilot failed to clear the area and the bus was parked too close to the taxi lane.

• A B-66 collided with a truck while taxiing to the ramp area. Again, failure to clear the area caused this accident.

• A crew chief taxied a C-47 into a concrete post. Crew chief failed to clear the area.

• A pilot was taxiing a VC-47 in a congested area without wing walker and allowed the aircraft to collide with a power unit.

• An assistant crew chief taxied a C-47 into a fork lift. Airman was not proficient in taxiing the C-47.

• A C-97 was taxiing to takeoff position and collided with a civilian aircraft. Established taxi procedures were not followed.

• A C-124 pilot was taxiing from ramp area and struck the hangar. Inattention and failure to observe taxiing procedures caused the accident.

Other factors contributing to "personnel factor" accidents are listed below in order of significance:

• Aircrew and maintenance personnel failed to clear area before and during taxi operations.

• Improper parking of vehicle and ground power equipment near taxi lanes and parking ramps.

• Failure of wing walker to observe obstacles while directing pilots during taxiing and parking of aircraft.

• Congested parking ramps.

• Failure to use wing walkers.

• Unauthorized personnel performing taxi test.

• Lack of braking capability due to low or no hydraulic pressure in aircraft system during movement of aircraft.

We could wind up this article real quick by simply stating that commanders and supervisors should take positive action to eliminate those hazards contributing to personnel factor accidents. But there's a little more to it than that. For example, why don't they have more taxi accidents at Tan Son Nhut Air Base at Saigon? The congestion on the ramps and taxiways there is fantastic and to the casual visitor it would seem that there ought to be at least one on-the-ground bash every hour on the hour.

Or, we recall one of the busiest ramps we've ever seen, where aircraft movements were almost continuous, vehicle traffic was heavy and aircraft were lined along both sides of the taxiway. Apparently there are very few taxi accidents on that ramp but the guideline down the center of the taxiway was practically obliterated, showing slightly only here and there.

According to theory, there should be many accidents under such conditions as these. That there aren't is due, we think, to extra caution on the part of the crews, who are well aware of the hazards.

Of course, wing walkers, marshallers, proper parking of flight line vehicles and equipment, good maintenance of the surface (snow and ice removal, cleanup of liquid spills), good flight line communications all contribute to reduction or even elimination of this kind of accident. Usually several factors are necessary for safe movement of aircraft: the operator—pilot or maintenance man —must be alert, marshallers and wing walkers have to do their job, and the area should be free of obstructions. Eliminate one of these and you have a potential accident.

This means that the pilot must use all of his faculties, skills and outside aids to do his share. Base engineering must eliminate all permanent obstacles, flight line personnel must be trained as to the hazards of leaving equipment parked in the wrong place and how and where to position it, both during use and when it is not being used. Drivers of fuel trucks, pickups, crew busses, heavy equipment and any other vehicle that operates on the flight line need similar training and the rules should be tightly enforced.

Put all of these together. They add up to teamwork, and that can reduce the number of flight line accidents. Not only will we save a lot of bucks, we will have a lot more of our aircraft combat-ready when needed. ★

the I.P.I.S. approach

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

Q Are Category E aircraft (those with approach speeds of 165 knots or higher), as identified in FLIP Planning, allowed to fly approaches published in low altitude terminal approach charts?

A An aircraft is authorized to fly an approach *only* when that aircraft's category is listed on the approach chart. Category E is not listed in low altitude terminal approach charts unless an operational requirement exists. In this case, Category E minima will be published in the low altitude terminal approach chart.

Category E aircraft are not allowed to use an approach chart that does not list Category E minima because: (1) Circling MDA for Category E is usually higher than for other categories because of the larger obstruction clearance area and the higher minimum altitude above airport authorized by TERPS. (2) Category E straight-in visibility minima may be greater than other categories depending upon height of the MDA (minimum descent altitude) above the airport, e.g., an MDA above airport of 501 to 625 feet requires a visibility minimum of one statute mile for Category A, B, and C aircraft and one and one-quarter miles for Category D and E aircraft. (3) Procedure turn maneuvering area provided on low altitude terminal approach charts is smaller than the procedure turn area provided on high altitude approach charts. Under adverse circumstances, e.g., unfavorable winds, slow pilot reaction, etc., Category E aircraft may exceed the procedure turn maneuvering limits provided on low altitude terminal approach charts. When Category E is listed on low altitude terminal approach charts, the larger procedure turn maneuvering area is provided.

Straight-in landing minima (MDA or DH) should always be the same for a particular approach for all category aircraft. MDA and DH are always the lowest permissible approach altitudes based upon obstruction clearance requirements.

Q Why do some low altitude terminal approach charts depict an altitude at the initial approach fix while others do not?

A The procedure turn area is comprised of an entry zone and a maneuvering zone (Figure 1). The altitude depicted at the initial approach fix (Figure 2) provides obstruction clearance in the entry zone. The depicted procedure turn altitude provides obstruction clearance in the maneuvering zone. When the procedure turn altitude will provide adequate obstruction clearance throughout both zones, the altitude at the initial approach fix may be omitted.

FIG. 1 *PROCEDURE TURN AREA*

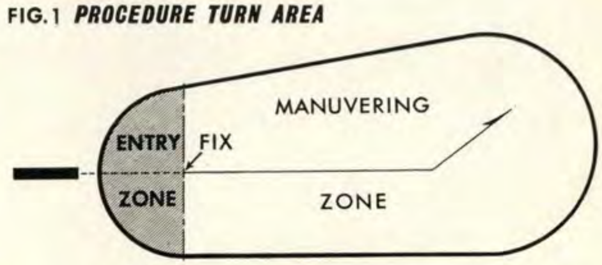
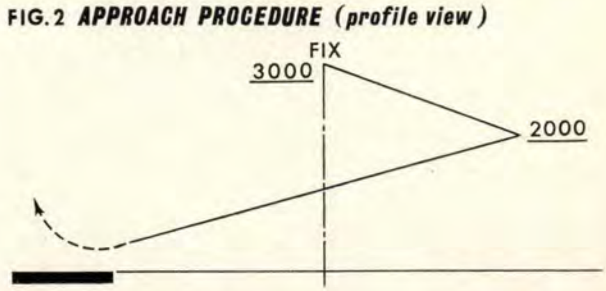


FIG. 2 *APPROACH PROCEDURE (profile view)*



Q When a radar vector departure is desired instead of a SID, how should this request be entered on the DD Form 175?

A Enter "request radar departure" in the SID "NAME AND NUMBER" block of the DD Form 175. A fix that joins the filed route of flight should be entered in the SID "TO" block. This will provide a "filed route of flight" that may be used in the event of lost communications. Every segment of the route from takeoff to landings should be specified in the DD Form 175.

The pilot who files a radar departure without specifying a fix in the "TO" block is inviting a flying violation in the event of lost communications after take off. Refer to FLIP Planning, Section II, Two-Way Radio Failure, Paragraph 3.a. (4). ★

REX RILEY'S CROSS COUNTRY NOTES

WAS IT FATE? How many gooney birds have gone flopping down the runway on their bellies is hard to say. But there must have been quite a few. (This is the iron bird, not the feathered variety.)

Add one more to the list. This aircraft was being driven by a pilot and an IP on a transition mission for takeoff and landing practice. They made it four times but number five was a bit different. It was a simulated Nr 2 engine out. The landing checklist was complete, except for gear lowering. On base, the IP called gear down and asked for a stop and go. Then he adjusted the power, which had exceeded limits, and after turning final added power to Nr 2.

Meanwhile, the RSU officer was checking a flight of two in the runup area between the parallel runways. He looked up and saw the gooney approaching the right-hand runway without gear, so he fired a flare, which arced toward the left runway, and called the C-47 on Guard. None of this did any good and the ensuing landing was on the skin.

The board called it Supervisory Factor with five contributing causes:

- IP failed to complete before-landing checklist.
- Pilot failed visually to check gear down.
- Distraction — IP made throttle adjustment at the time he anticipated, and thought, he had lowered the gear.
- Task oversaturation — pilot making his first simulated engine-out pattern and no-flap landing.
- Design deficiency — gear lights located out of pilot's normal forward field of vision.

The crew said they heard neither the transmission on Guard nor the warning horn. They did see the flare but, since it arced toward the other parallel runway, thought it was intended for someone else.

Seems like accidents sometimes are bound to happen and there's nothing that will stop them. But, we really know better, don't we?

TESTING FOR FLAMMABILITY. The Life Sciences people have asked that individuals involved in operational test and evaluation of flight clothing please refrain from giving these items the ultimate test for flammability. Seems that some characters have received flying suits made of fabric called *Nomex,* a spec for which is *fire resistant to 800°F.* Then they've applied a match flame or that of a lighter to test the material. Wood matches produce 1600°F, and the temperature from lighters may be as high as 1925°C, depending on the fuel.

Laboratories determine the fire resistance qualities of materials and they have the proper equipment for so doing. This is not the job of the individual involved in OTE. Also, these materials are designed to be resistant to flash fires, not sustained concentrated heat. So the use of a lighter "to see if it will burn" simply defeats the purpose of the test. The purpose, incidentally, is to give you better equipment. 'Nuff said.

LOW LEVEL OPERATIONS—We have been informed that there is a new gondola installation at Mammoth Mountain, one of California's busiest ski centers. The cable is approximately 220 feet above the ground and extends across a saddle between two ridges. Officials at the resort say jets frequently fly through the saddle and that one recently flew under the cable.

Mammoth Mountain is in the Sierras, about 45 miles northwest of Bishop, in Mono County. Coordinates are 119° 8′ W x 37° 42′ N, and elevation is about 11,000 feet.

NEW INSTRUMENT APPROACH PROCEDURES. The FAA has eliminated "ceiling" as one of the landing minimums. From now on visibility only will prevail. The minimum value now is expressed as "weather conditions," which will determine whether a pilot can land or takeoff during instrument conditions.

In its announcement the FAA had this to say: "Instead of 'ceiling' as a landing limit at which the pilot must have visual reference to the runway or approach lights, the new rules introduce a 'minimum descent altitude' (MDA) and 'decision height' (DH) below which flight operation without visual reference to the runway will be prohibited. The MDA will be used when the pilot does not have available an electronic glide slope to guide his approach down along a desired glide slope. The MDA will also apply in the case of pilots executing a 'circle-to-land' maneuver.

"The DH or decision height — a term already familiar to pilots preparing for Category II instrument landing qualification — is the point along the approach path where the pilot decides he has either established the necessary visual reference to continue to a landing or must execute a missed approach.

"At airports where conventional ceiling and visibility minimums are now prescribed for takeoff minimums, the new rules allow these to remain in effect until new takeoff minimums are issued. When issued, they may include ceiling minimums.

"Exceptions are made in the new rules for situations involving obstructions, other unusual terrain problems in the takeoff areas, selection of alternate airports, or other special considerations. In such situations, ceiling in combination with visibility will continue to be the determining factors in instrument procedure operation.

"The new rules implement revised procedural techniques and criteria for terminal instrument operations throughout the country. First phase of the program was introduced in September 1966, when the agency's new 'U.S. Standard for Terminal Instrument Procedures' (TERPS) was published. This handbook of guidelines for establishing or revising such procedures has also been adopted by the three U.S. military services and the U.S. Coast Guard. TERPS will apply to all civil and military procedures in the U.S. and at overseas bases under U.S. military control."

In reference to "minimum descent altitude" and "decision height," see the *IPIS Approach,* page 9, *Aerospace Safety* for August 1967.

SHOULDER HARNESS STRAPS. Lt Col Robert Stranberg, Director of Safety for the 732d Air Division at Cannon AFB, has called our attention to an item appearing in their Flying Safety Newsletter. It deals with the possibility of tying the parachute D ring to the shoulder strap in the F-100D. This could cause a pilot to become entangled with the chute and seat during the ejection.

The item, illustrated in the photo below, was aimed not only at the jocks but crew chiefs as well. They provide an extra set of eyes to detect things like this. If they are alert they can spot such discrepancies and possibly save a pilot a whole bundle of trouble.

Of course, the OPI on this item is the jock and he should be the one who will see to it that the straps are checked when he buckles in. ★

PAINT JOB

THAT'S THE KIND OF LANDING IT WAS

THE night was cold and dark but clear. In the tower a controller sat looking at the snow and barren trees then shifted his eyes to catch the lights of a T-39 descending on final approach.

Coming out of the earphones in the cockpit of the approaching aircraft was the soothing voice of the GCA final controller . . . "five miles from touchdown, cleared to land."

Both pilots were highly qualified, the man in the right seat an instructor. All was serene. There had been a bit of a flap when the hydraulic pressure did not rebuild after gear lowering. But recycling the system had brought the pressure back to normal. Probably nothing to worry about, but just to hedge his bets, the IP had suggested that the pilot land as near the end of the runway as possible. Actually, the runway was in pretty good shape. RCR was 14. The first 100 feet was covered with packed snow, but then there was a 5000-foot stretch of clear, dry pavement. Beyond that the runway was spotted with ice patches.

Now the radar controller was telling them that they were low on the glide path. "You are 20 feet below . . . 10 feet . . . on glidepath, on course."

Then, a little later, ". . . thirty feet below the glide path . . . one mile from touchdown . . . you're getting dangerously low . . . if the runway is not in sight, climb to 2000, acknowledge."

Now the IP in the aircraft replied. "We have it, we're okay. Just coming in a little flat . . . may have hydraulic problems."

Now the airplane flared, power was cut and it landed smoothly—a real paint job.

Another routine flight successfully completed? Not quite. The landing was smooth, all right, real smooth. But it wasn't on the runway. In fact, touchdown was 493 feet short of the threshold on a 1000-foot overrun. Even so, they could have got away with it if someone hadn't piled snow about two-feet deep across the overrun. When the nose gear hit that, the gear came unglued and the aircraft slid along on the strut and main gear for about 2500 feet before stopping.

The accident investigation board decided the primary cause was pilot error: the pilot deviated from a normal glide path, misjudged his approach and landed short. They listed four contributing causes, one of them concerned with the instructor's directing the pilot to deviate from a normal glide path and another rapping the IP for not taking control in time to prevent a short landing. The other two contributing causes dealt with the airfield: snowbank across the overrun, and threshold lights not visible at all angles on final approach.

Let's go back out on final and take a closer look at this approach. There wasn't any reason for either pilot to be particularly concerned. The only possible item was the hydraulic problem, which had cleared up but apparently caused enough concern for the IP to decide it would be a good idea to get on the runway near the approach end in case they had to use emergency brakes. But with 5000 feet of clear, dry pavement such a precaution was hardly necessary.

As the aircraft progressed down final, the controller kept reminding them that they were low on the glide path. This was okay, they were low on purpose. This meant, of course, that they got nothing but red on the VASI. It also meant, and this was something neither realized, that because of the snow pile, they couldn't see the threshold lights. So, when the pilot made the landing he actually thought the aircraft was on the runway. Then when he saw the snow pile he knew something was wrong but didn't know what it was.

Shortly after this landing the pilot of another aircraft was asked to fly a low approach and report when the

. . . UNTIL THEY SPOTTED THE TWO-FOOT HIGH BANK OF SNOW DIRECTLY ACROSS THEIR PATH. HOW COULD THIS HAPPEN? WHAT WENT WRONG? WHO HAD ERRED?

threshold lights became visible. This turned out to be 100 to 150 feet out.

The GCA approach was flown normally to about one mile, then the pilot went visual and dropped below the glide path. This meant that, under the circumstances, he had no landing aids left except the runway lights, good laterally but of no value in determining where to touch down.

In fact, this caused some confusion because the pilot, apparently flying both visually and by instruments, saw the lights going by, assumed he was over the runway, cut the power and landed. This surprised the IP because touchdown followed immediately after the power was reduced. Then when he saw the snow pile ahead all he could do was pull back on the yoke and hope.

We briefed this accident because winter conditions sometimes cause concern that appears to be out of proportion to the actual situation. This was one of those cases. In order to get on the runway a bit early, this crew gave away practically all landing guidance—GCA, ILS and VASI. This resulted in touchdown nearly 500 feet short of the runway. Nevertheless, the landing could have been successful, except for the snow bank.

Snow removal procedures left something to be desired. How are they now? How are they at your base? Do the snowplow drivers know the importance of clearing the overrun as well as the runway? Can the pilots at your base see the lights? In case of a short landing, will the overrun be clear? Or will an obstruction (of any kind) result in an accident? ★

Aircraft touched down smoothly on overrun, hit snowbank. Nose gear folded and aircraft slid 2500 feet along runway.

YOUR MAN AT NORTON

The men pictured on these pages are Missile Safety Officers assigned as project officers for specific missile and space systems (two of them to report at a later date). They work in the Missile and Space Systems Division of the Directorate of Aerospace Safety. Simply stated, their job is to prevent accidents. More specifically, they do this in many ways: accident investigation, analysis of accident and incident reports, preparation of summaries and briefs for use in the various safety publications. They spend a lot of time on the road visiting the field during staff visits and safety surveys and monitoring surveys conducted by major commands and numbered air forces.

Complementing these men are specialists in nearly every engineering discipline and maintenance. They and the project officers have a lot of experience and knowledge that are yours for the asking. Remember, they're here to help you and they are only a letter or a telephone call away.

MISSILES

AIR DEFENSE & TACTICAL SECTION

AFIAS-M-1B
Ext 3225, 7437, 3626

Maj Edward D. Jenkins
ADM-20, AGM-28, CIM-10B, CQM-10A

Maj Lewis C. Lemon
AIM-7D/E, AIM-9B

Maj Edward J. Fiske
AGM-12B/C, AGM-45A, CGM-13B, MQM-13A

PICTURE NOT AVAILABLE

Maj John W. Snyder
AIR-2A, AIM-4A/G, AIM-26A/B, AIM-47A, BQM-34A

SPACE SYSTEMS SECTION
AFIAS-M-1C
Ext 4233

Lt Col Nils Nelson
LV/SLV-II

Maj Russell W. Thresher, Jr
LV/SLV-III, SLV-V

Lt Col Paul S. Wood
SLV-I, Solids, Range Safety

STRATEGIC MISSILE SECTION
AFIAS-M-1A
Ext 4233, 4313

Lt Col Daniel E. Cook
Minuteman

Maj Warren G. Hoflich, Jr
Minuteman

Lt Col Raymond L. Mahynske
Minuteman

Lt Col Kearn H. Hinchman
Titan II

Maj Kenneth H. Martin
Titan II

PICTURE NOT AVAILABLE

Lt Col George J. Murphy
Minuteman

YOUR MAN AT NORTON

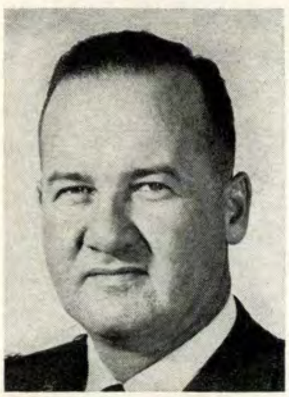
About a year and a half ago AEROSPACE SAFETY printed the names, photos and assignments of the project officers in the Flight Safety Division of the Directorate of Aerospace Safety. The idea was to give the people in the field the information as to the project officers for their type aircraft, and we added the photos on the theory that communication is a little better if you know what the man on the other end of the wire looks like.

Since then there have been many reassignments. To bring you up to date, we're repeating that feature. The assignments were accurate as of press time. The correct address is Dep IG for Insp & Safety, USAF (symbol), Norton AFB, Calif. 92409. Below each photograph are the individual's name and his aircraft assignments.

FLIGHT

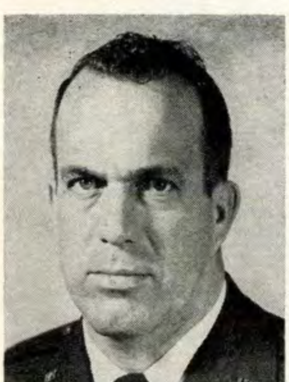
BOMBER SECTION

AFIAS-F-1A
Ext 4133, 3416



Lt Col Harold T. Stubbs
B-47, B-66

Lt Col Harold E. Brandon
B-52



Lt Col Thomas B. Reed
B-57, B-58, SR-71

TRANSPORT SECTION

AFIAS-F-1B
6284, 6258

Lt Col J. D. Oliver, Jr
C-121, C-123, C/KC-135, C/KC-97, C-140, T-39, C-137

Lt Col Paul A. Bergerot
C-124, C-119, C-118, C-7, C-46, C-47, C-54; U-3, 4, 5, 6, 7, 10, and Aero Clubs

Maj Thurman Lawrence, Jr
CH-3, H-13/19/21, H-43/53, HU-16/UH-1

Maj Everett E. Ruble
C-130, C-133, C-141

TACTICAL FIGHTER SECTION

AFIAS-F-2B
Ext 6778, 3886, 2277

Maj Raymond L. Krasovich
F4C/F4B

Maj Marshall D. Norris
F-100, F-84

Lt Col Fred A. Treyz
F-105

Lt Col R. A. Preciado
F-104

Maj Nelson Allen
F-111, F-84

Maj Robert M. Bond
F-111, F-105

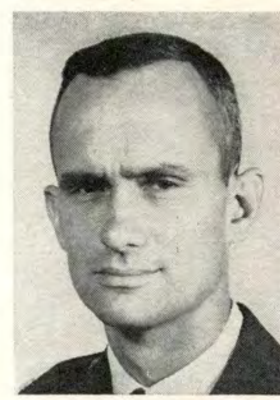
DEFENSE FIGHTER SECTION

AFIAS-F-2A
Ext 3015, 6932, 6244

Lt Col Francis J. McCarthy, Jr
F-102/106

Lt Col John F. Thornell, Jr
T-37/38, F-5, A-37, T-41

Maj Donald R. O'Connell
F-101, U-2, F-89



Maj Frank J. Tomlinson
T-28, A-1E-G, A7-D

Maj Vernon G. Knourek
T-33, F-86

Maj Edward W. Johnson
A-26, OV-10A, 0-1, 0-2

THAR SHE BLOWS

Willie Hammer, Directorate of Aerospace Safety

STORM warnings are up. All personnel are directed to take action to safeguard themselves, government property for which they are responsible, their homes, families and vehicles. Winds of hurricane force may be expected!!

How much force does a hurricane wind exert? It must be tremendous since it can drive a straw through a tree or telephone pole. Yet a wind with a speed of 70 miles per hour exerts a force of only one-tenth of a pound per square inch (psi) on the surface against which it acts. A wind of 120 miles per hour has a dynamic pressure of only 0.25 psi!

This doesn't seem to be much; we have 14.7 psi acting on our bodies at sea level. A quarter of a pound per square inch seems especially insignificant compared to the 3000 to 6000 psi pressures in some Air Force missile systems.

Perhaps we should look at it another way. A hurricane wind, with its comparatively low pressure, can produce severe damage. How much more damage can result from the high pressures in common use in the Air Force? Air Force personnel have been injured and killed, and equipment and materiel damaged by high pressure gases and liquids. Why such mishaps happen and the precautions to prevent them should be known by everyone concerned.

First, what is considered a high pressure? The American Gas Association indicates that a high pressure distribution line is one which carries gas at a pressure of more than 2 psi. The American Society of Mechanical Engineers rates a boiler which operates at more than 15 psi as a high pressure boiler. Technical Order 00-25-223 designates a low pressure system as one which operates at 0 to 500 psi; medium at 501 to 3000 psi, and high pressure at 3001 to 10,000 psi. A high pressure may, therefore, be whatever is prescribed for the expected usage. For safety purposes, a pressure hazard is one which can cause injury or damage. And as we have seen from the hurricane wind, this may be as little as a tenth of a pound per square inch.

An explosion is one source of pressure, and some of the data available from blast tests may be used to illustrate the effects of pressure. Explosions create *overpressures;* that is, pressures momentarily higher than normal atmospheric. In a steady state, we would call pressures greater than atmospheric, *gage pressures*. With an explosive overpressure of only 3 psi, an exposed 160 pound man can be picked up and thrown hard enough to crack his skull against a solid object. If the man were standing at right angles to the wind, 5 psi would be required to produce the same effect.

This illustrates another specific point: The magnitude of the unit pressure is of importance, but so is the *total* force or pressure involved. Thus, the hurricane is destructive because its wind acts over large surfaces of exposed bodies, producing tremendous total forces. Also, this force acts in one direction. The body against which it acts must, therefore, be secured to resist movement; otherwise it will be swept away.

Three factors are of principal importance when possibilities of pressure damage are considered: the unit pressure, the total force involved, and the balance of forces. Some illustrations may indicate these clearly.

• At a depth of slightly more than 32 feet of water, the pressure on the body of a scuba diver is almost 30 psi. Internal pressures maintained by his breathing equipment oppose and balance external pressures, so his body will not collapse. Externally, pressures are balanced since the water acts on his body from all directions. Scuba divers have, therefore, been able to descend as deep as 600 feet below the surface, where pressure is approximately 275 psi.

• On the other hand, an old story tells of a salvage diver who had just been dressed into a diving suit and brass helmet. He was sitting on the gunwale of a boat when it rolled and he fell overboard into 30 feet of water. Before a counter-acting pressure could be provided through the air hose to equalize the water pressure, he was squashed into the closed helmet. Computations show

that an unbalanced force of 10 to 15 tons had acted on his body.

• A high pressure gas bottle fell from a truck. The neck broke off the bottle, which then took off—a murderous projectile jet propelled by the exhausting gas. The bottle smashed through two buildings before it came to rest, luckily without injury to anyone.

• An airman, starting an aircraft engine with compressed air, was killed by a whipping pressure hose. When he connected the flexible hose, he apparently did not torque the B-nut adequately. When pressure was applied, the B-nut loosened and broke the connection. The end of the hose hit and crushed his skull.

• A thin but powerful jet of nitrogen gas amputated an airman's leg. He loosened the bolts of a flanged connection on an extremely high pressure line without making certain the system was depressurized. The flanges separated slightly and a sheet of compressed gas, originally at 6000 psi, cut through his leg. If this sounds impossible, remember that dentists have developed equipment utilizing thin, high pressure jets to cut teeth.

It is evident that care must be exercised with pressure systems. This means any system, gas or liquid. Each pressure vessel or line should be considered hazardous until it is absolutely certain that all pressure has been released. This can be done by checking with a gage connected to the container or line (be sure the gage works and that the valve to the gage is open); by opening a test cock (don't stand in front of it); or by noting that the line or equipment is already open to the atmosphere. Don't trust the beast until you are sure it is dead! Otherwise, like an annoyed camel it may spit in your eye.

And speaking of getting it in the eye, use a face shield and hard hat when working on or with any high pressure system. Keep the lines and equipment free of dirt, debris, filings or other particles which might be driven into an eye or through the skin. Dirt inside a system can be accelerated to high speeds and cause damage when the system is pressurized. Remember that a hurricane wind exerting a pressure of less than one quarter of a pound per square inch can drive a straw into a telephone pole. For the same reason, do not use compressed air to clean your clothes, equipment or work areas. Absolutely, positively, most assuredly no one should ever use it in horseplay. Nobody! Under no conditions! Nowhere! No time!!

Never bleed a high pressure line by loosening a fitting such as a flange or union. And don't use your fingers as probes to find a leak. You may find the leak and lose the fingers. Use a bit of cloth on a stick, soap and water solution, or sprays made for the purpose.

If you are using a high pressure hose or connecting one, do so only after you are certain it is restrained from whipping. It should be weighted down with sandbags at short intervals, chained, clamped or restricted by all of these. Rigid lines should be clamped too, especially at bends and fittings, since an accidental disconnect may cause even these to whip. A whipping line of any kind may tear through and break bones, metal or almost anything else with which it comes in contact. And if a line whips, don't try to grab and restrain it. Shut the valve which controls flow to the line.

Each item should be marked with either the maximum allowable pressure or pressure to be used. Do not overpressurize. Load a container, line or other equipment only to its prescribed pressure level. And remember that heat will cause the pressure in a container to rise. Keep pressurized tanks, cylinder, tires, hoses and accumulators away from sources of heat such as radiators and other space heaters, furnaces and hot process equipment, or solar radiation. Do not try to weld any type of equipment which is under pressure.

Pressure containers are designed to withstand specific maximum stresses. They are not built for unusual loads or shocks, although they all have been designed with safety factors and safety margins. Any unforeseeable load on pressurized equipment may cause it to break. Keep off high pressure equipment, especially small lines and fittings, which should not be used as steps. Do not strike any container with a tool to see if it is full or how it sounds. It may come apart and strike back. Secure vertical gas cylinders to prevent them from falling over. If laid horizontally on a smooth surface, block them to keep them from rolling. Keep them from hitting each other. A broken valve may not only cause one to take off like a rocket, but the jet may blow damaging material into people and equipment.

The total pressure exerted by a pneumatic or hydraulic actuator is often tremendous and should not be underestimated. People have been crushed and killed by pressure actuated doors. Do not stand or place any part of your body in a position where inadvertent activation may catch and mash you. If it is absolutely necessary to be in such a location, first be sure the system is depressurized; or provide blocking devices so accidentally actuated components won't catch you.

A high pressure actuating system can cause shock and vibration which may damage other equipment by its violence. Snubbing devices should be maintained in proper operating condition. Hydraulic circuits with quick opening or closing valves may be equipped with compression chambers to eliminate or minimize any compressive effect.

Use of high pressure equipment involves hazards which cause frequent and damaging mishaps in the Air Force and the aerospace industry. Don't mess around with this equipment unless you know what you're doing, or you may make a mess of yourself. ★

AEROBITS...

LIGHTNING — One mechanic was killed and three injured when lightning struck the aircraft on which they were working. The strike is one of several that have been reported in recent months; however, no one was killed or seriously injured in the other accidents. There was no damage to aircraft or equipment. The fact that all of these aircraft were properly grounded appears to have played a vital role in minimizing or preventing damage to Air Force hardware. Ground crewmen do most of the grounding, but it's still aircrew business. Look for the ground wires whenever you approach an aircraft; they are explosion and fire insurance against both small sparks and big bolts. NOTE: T.O. 00-25-212 states, when electrical storms are in the vicinity (within 3 miles) outside work should be discontinued until the danger has passed.

GO-AROUND ATTEMPT: The aircraft was scheduled for a local proficiency flight. The Instructor Pilot occupied the front seat with the pilot in the rear seat scheduled to practice hooded instrument proficiency flying. The preflight, taxi and takeoff were normal. Shortly after takeoff the pilot in the rear seat took control of the aircraft and made a practice simulated flameout (SFO) pattern. After completion of the pattern he climbed to 5500 feet, cut the power to 45 per cent, dropped the speed brakes, turned off the aileron boost and called for an SFO. The Instructor Pilot in the front seat took the controls. He bled off the excess airspeed, then set up a glide and started a right hand pattern for the field. The pattern was normal until roll-out on final approach. The gear was lowered and the pilot in the rear seat turned on the aileron boost. The Instructor Pilot lowered 20 degrees of flaps and later increased to 30 degrees. The final approach was being flown at 140 knots which was five knots below the recommended speed for the fuel load. Approximately one to one and one-half miles from the runway at 400-500 feet above the ground the Instructor Pilot realized he was too slow and advanced the power for a go-around. Although the engine acceleration was slow the gangstart system was not activated and the tip tanks with over 200 gallons of fuel were retained. As the aircraft continued to settle the Instructor Pilot retracted the flaps. Just before the aircraft contacted an approach light 1250 feet short of the runway, the pilot in the rear seat retracted the speed brakes. The aircraft hit the ground 1175 feet short of the runway. The right main gear folded aft followed by the left gear and nose gear. The aircraft slid up the approach zone and overrun area and came to a halt to the left of the runway center line. The Instructor Pilot opened the canopy electrically and both pilots evacuated the aircraft without difficulty. They were not injured in the accident, but the aircraft was destroyed.

The pilot in the rear seat stated that he was sightseeing and not monitoring the approach and should have brought up the speed brakes when the Instructor Pilot said he was going around.

The primary cause was pilot factor in that the Instructor Pilot in the front cockpit was late in starting a go-round which resulted in undershooting the runway. A contributing cause was pilot factor in that the pilot in the rear cockpit did not retract the speed brakes on the attempted go-round.

KNOW THE RUNWAY — Runway side stripes, presently authorized by AFR 91-17, do not always indicate what the term implies nor are they present on every runway. Runways called basic runways used for operations under VFR conditions do not require them; neither do instrument runways which are served by a non-visual navaid and intended for landings under instrument weather conditions. A designated All-Weather runway is the only one that does require side stripes.

Now, that All-Weather runway may be 30 feet wide, but watch out, especially you fighter jocks making a formation landing. Those runway side stripes can be located as much as 70 feet from the edge of the runway (depending on the stripe width) and meet criteria. The reg says that on runways 150 feet in width or wider, the distance between the side stripes, measured at their inside edge, shall be a constant 140 feet. If the runway is less than 150 feet wide, the side stripes shall have the maximum available distance between inside edges, but side striping may not be necessary if adequate visual contrast of the runway edge is present. This gets to be tough at night in a rain shower!

Anything being done about this situation? You bet! A recommendation is under study by concerned agencies that AFR 91-17 be changed to require edge stripes on all hard surface runways and that they be placed at the runway edge, regardless of runway width. Until that

change, keep that bird down the centerline, for "a slip on the lip may bend your ship."

Lt Col Robert D. Lutes
Directorate of Aerospace Safety

WHOA! WOE!! The C-123 was being taxied into a parking position on the ramp. As the aircraft was being maneuvered through a 270-degree turn, the copilot saw a ground observer on the ramp frantically waving his arm, signaling the pilot to stop. Before the aircraft stopped, the right wing tip struck a brick and concrete pillar which was part of the passenger terminal. The wing tip was damaged beyond repair. The pillar supporting the roof was destroyed.

• A C-141 was proceeding down the taxi lane. Marshallers were in front and on the left wing. The forward marshaller moved over to the right wing. A bus was stopped just abeam of and slightly ahead of the C-141. When the nose of the aircraft was abreast of the bus, it became apparent to the bus driver and passengers that the wing tip would not clear. The bus driver attempted to signal by flashing his headlights. The wing walkers also recognized the impending collision and attempted to signal for a stop. The pilot misinterpreted the signal as a "go ahead" signal. The aircraft continued to move and the left wing struck the bus roof top. The position of the wing walker during the critical movements was well aft of the cockpit making it difficult for the pilot to observe him.

• Three wing walkers motioned the C-130 forward. The aircraft was being taxied slowly and stopped after one of the walkers signaled. The aircraft had struck the airport terminal building.

•A C-54 was being guided into a congested parking area by the line chief. As the aircraft was making a hard turn to come around in place, the left wing tip struck an aircraft passenger loading stairway.

• Qualified crewman operating a tug was attempting to tow a C-118 out of the hangar with appropriate wing walkers being used. A 90-degree turn was prematurely commenced and the vertical stabilizer swung in the opposite direction striking the hangar.

• A "follow-me" vehicle led the C-47 to a parking area on the main ramp. The marshaller descended from his vehicle and gave a signal for a left turn. As the tail of the aircraft swung to the right, the lower right elevator struck a fire bottle standing at the edge of the ramp, bending a rib and tearing the fabric of the elevator.

These unglamorous incidents of aircraft colliding with obstacles on the airfield have been cited because of one interesting common denominator. In each incident there were wing walkers or ground marshallers being used to guide the aircraft to assure clearance from obstructions, yet the objects were struck.

Enough cannot be said about the need for proper training and supervision of ground marshallers to assure aircraft are not damaged during taxiing operations. With the ever-expanding tempo of aircraft operations there has been a parallel increase in crowded parking areas. Alertness and good judgment must be the trait of ground marshallers to insure aircraft are maneuvered safely in congested areas.

Aircrews, regardless of whether wing walkers are being used, must constantly be alert when taxiing near objects on the ramps or taxiways. If a reasonable doubt exists — whoa, or it's woe.

Harrie Riley
Directorate of Aerospace Safety

The following was provided by the 64th Tactical Airlift Wing Safety Bulletin, Sewart AFB, Tennessee:

HERKY IS NO BOMBER — It has come to our attention that a number of aircrews assigned to this organization have been conducting informal and unauthorized tests of the capability of the C-130 to perform as a tactical bomber. These tests have included the dropping of various items of equipment and aircraft components in a manner not prescribed in TACM 55-130.

Although these tests were not authorized, the results have been carefully evaluated. The type of bombing being conducted in these tests has been found unsuitable for effective tactical application, for the following reasons:

- Unpredictable ballistics of test weapons (i.e., hatches, inspection plates, dust excluders, wheel chocks, para-drop loads, etc.) preclude an acceptable degree of accuracy.
- These weapons, while highly effective against such light targets as barns and runway lights, would be ineffective against fortified military targets.

This study is considered to be completed; additional data is neither required nor desired. To preclude the accumulation of additional data, it is directed that these unauthorized tests cease immediately.

To facilitate compliance with this directive, all aircrews are advised to comply with the following procedures:

- Proper installation and security of all doors, hatches and cowlings should be CAREFULLY checked prior to flight.
- On aerial delivery missions, extreme care must be taken to preclude inadvertent loss of equipment located near open doors. All equipment normally stored in the rear of the aircraft must be CAREFULLY secured, or stored in the forward end of the cargo department.
- Flight with doors open should be minimized. As soon as practicable after completion of a drop or upon the decision for NO DROP, all doors should be closed. If a race track pattern is contemplated, doors should be reopened only when the aircraft is re-established on the inbound track to the drop zone.

UNHAPPINESS IS: Having the starring role in our next APEX BEELINE REPORT.

SPECIAL VFR OPERATION MAY CHANGE. The Federal Aviation Administration has proposed to rescind the rule which permits special VFR operation. The rule allows fixed-wing aircraft to operate in airport control zones when the visibility is as low as one mile and the pilots can remain clear of clouds. FAA bases its proposal on the continuing increase in traffic density. If it is adopted, the basic VFR minimums of three miles visibility and the requirement to remain at least 2000 feet laterally, 1000 feet above or 500 feet below all clouds will apply in all cases. Looks like the day when non-instrument rated pilots can grope their way out of control zones with one mile visibility may soon end. The growing volume of traffic has made it increasingly difficult for pilots to maintain adequate separation on a "see and avoid" (VFR) basis.

IT GETS QUIET. Earlier this winter a twin-engine jet trainer was doing airwork in the local area. The mission was completed in VFR on top conditions and the pilot entered a VOR holding pattern. While holding, flight condition went from VFR to IFR, with a significant amount of ice building up on the leading edge of the wing in one turn around the pattern. Clearance to descend was obtained as quickly as possible. When power was reduced the number one engine flamed out—number two conked out five to ten seconds later. Icing had caused the flameouts. About this time the aircraft descended out of the clouds and both engines were restarted, enabling recovery without further incident.

On the same day, in another part of the country, a single engine jet trainer made an enroute descent to 20,000 feet. Just after level-off, at 96 per cent rpm, the engine flamed out. Although in the clear at time of flameout, the aircraft had been flying in heavy precipitation with light patches of ice collecting on the leading edge of the wings. Gangstart was selected and the engine caught at 50 per cent. The pilot landed from an SFO without further difficulties. Although the definite cause of stoppage was undetermined, external icing of the fuel control was suspected.

These sharp pilots followed their T. O. and local procedures — be ready when it happens to you.

MISSILEANEA

SOMEONE — Comparison figures for Minuteman missile accidents/incidents reflect a marked decrease during the first nine months of 1967. It is evident that we are making progress toward a goal of minimum loss of resources due to mishaps. However, the decrease could have been greater since three of the recorded incidents were inexcusable and totally preventable. Personnel error was a primary or major contributing cause to each of the three. A third stage motor was damaged because *someone* failed to install the stabilizing ring adapter. Another third stage motor was damaged when *someone* failed to secure a lifting beam. A Guidance and Control (G&C) Unit was damaged when *someone* allowed the G&C adapter to slip from his hand and strike the unit. A meager amount of caution on the part of these *"someones"* would have further decreased the mishap experience by three. How many more *someones* do we have in the missile fleet? Proper techniques, adequate supervision, and strict adherence to safety criteria will prevent such mishaps.

Lt Col Thomas F. X. O'Connor
Directorate of Aerospace Safety

SPEED LIMIT

May I take exception to the statement (Rex Riley, page 19, November), "We assume that the final FAA Regulation will contain fine print which will except the hot ones."

It is my feeling that rather than "assume," USAF should "assure" that adequate provisions are made for high performance aircraft. The reduced visibility caused by aircraft attitude, the approach to, and in many cases, violation of, minimum control speed at low airspeeds and high angles of attack and the reduction of aircraft response, all make it imperative that exceptions be clearly spelled out in any FAA Regulation.

The "see and avoid" concept is an unfortunate result of non-compliance with existing regulations, such as quadrantal separation and non-use of existing services, such as VFR Radar advisories. It will be a sad commentary on the "state of our art" when the only way to aviate in all that "blue" under 10,000 msl will be the forced necessity to "see and avoid" all other aircraft, while flying with the stick in your lap. This doesn't strike me as progress.

Capt Fillmore V. Hall
Director of Safety
107 TFGp, NY ANG
Int'l Arpt, Niagara Falls
N. Y. 14306

FAA assures USAF Operations that its high performance aircraft will be excepted, and we'll continue to operate them by T.O. requirements.

BACK COVER, NOVEMBER

We would appreciate a print of the photo on the back cover of your November issue, with permission to reprint it in PRIVATE PILOT Magazine, with a safety-type article on the wisdom of making thorough preflight checks. Due credit will be given. I could find no mention in your magazine of the circumstances surrounding this interesting shot, so if you could supply a brief account of how the pilot got where he did with a chunk of concrete tied to his tail, we'd appreciate that too.

We find your magazine most interesting and all of the pilots on our staff read it with enthusiasm.

Robert N. Said, Editor
PRIVATE PILOT Magazine
Covina, California 91724

The story appeared in March '65, and the print is being mailed. Thanks for writing.

HELICOPTER TRAINING

This department conducts helicopter training for student Army Aviators and will be instructing approximately 600 students at peak periods. Request this department be added to the mailing list for *Aerospace Safety* magazine.

Maj Thomas M. Stedman, USA
Advanced Rotary Wing Trng
Aviation Safety Branch
Hunter Army Air Field, Ga 31409

You're on the list.

THERE'S ALWAYS AN ANGLE

The article, titled above, which appeared in the December issue was clearly written and well drawn but contained a somewhat misleading implication. I refer to the paragraph on page 21 which stated in part:

"The aircraft (F-4) was developed for U.S. Navy operations and all Navy carrier jet aircraft have angle of attack indicating systems. *It is only with the use of these systems that carrier operations are successful.*" (italics supplied)

As a Navy jet carrier pilot, I must object to the italicized portion of that statement. The US Navy has been operating jet aircraft from carriers "successfully" for almost 20 years; initially without benefit of angle of attack indicating systems.

The F-9 series, A-4D and A-3D (B-66), all of which I have operated from carriers, were all operated "successfully" from carriers for many years prior to being equipped with angle of attack systems. The biggest reason that carrier operations are successful is that Navy pilots are well trained and highly skilled in their craft. If the author meant to convey the idea that angle of attack indicating systems have made carrier operations safer, easier, and more precise I would agree with him.

Much as the U.S. Navy has had to follow the lead of the British Navy in such developments as the angled deck and the steam catapult, so too has the USAF followed the lead of the U.S. Navy in such developments as field arresting gear, true angle of attack indicating systems, the F-4/A-1/A-7, the SIDE WINDER, etc. Don't let it get you down, being number two makes one try harder. Ask Avis!

Kidding aside, as a squadron Aviation Safety Officer I always made it a point to have *Aerospace Safety* available for my pilots and crews. Your coverage of the total safety picture has always been outstanding. Keep it up.

LCDR David R. Ayres, USN
Engineering Div Director
NPRO, McDonnell Douglas Corp
Douglas Acft Co, Acft Div
Long Beach, Calif 90801

We're sure the author meant, as you suggest, safer, easier and more precise operations.

ACM TRAINING

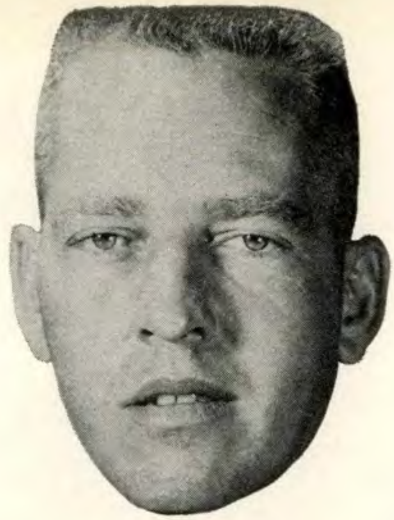
I would appreciate receiving a reproduction of the F-105/MIG-21 cover picture of the August 1967 issue of *Aerospace Safety*. This is truly a vivid picture of air-to-air contact.

Capt G. M. Thoreson, USAF, MC
3500 AF Hospital (ATC)
Reese AFB, Texas 79401

Thanks, Doc, for the kind words about the illustration. The picture is on the way.

☆ U.S. GOVERNMENT PRINTING OFFICE 1968 301-212/4

WELL DONE



CAPTAIN ROBERT A. REMEY

4453 COMBAT CREW TRAINING WING, DAVIS-MONTHAN AFB, ARIZONA

On 3 May 1966, Captain Remey was leading a flight of two T-33s when, after one hour and 15 minutes of flight, he began to detect mild engine vibrations. He was climbing at the time through 19,000 feet. He then noticed that he was unable to attain full power and the wingman observed puffs of black smoke emanating from the tail pipe. Their location was northwest of Flagstaff, Arizona. Captain Remey stated that his intention was to land at Luke AFB if the vibration and smoke did not increase. The flight headed for Luke; however, when they were five miles northwest of Prescott, Arizona, Captain Remey noticed the generator light illuminate and the hydraulic pressure drop to 750 psi. He executed electrical failure procedures, lowered the landing gear in anticipation of complete hydraulic failure and headed for Prescott Municipal Airport for recovery. The field elevation is 5042 feet and the runway length is only 6820 feet. He entered a high key for a flameout pattern and at this time engine vibration increased in severity which culminated in flameout.

A restart was accomplished; however, when the throttle was advanced above idle the vibrations became so severe that the instruments were unreadable. With the throttle at idle, Captain Remey established his pattern so as to touch down one-third the distance down the runway. A quartering tailwind of 30 knots added to his difficulties. On base leg, hydraulic pressure dropped to 500 psi and aileron control began to stiffen. He was able to overcome this condition and touched down 2800 feet from the runway threshold. Maximum braking was applied and at 80 knots he opened the canopy to help decelerate the aircraft. His efforts were successful as the aircraft stopped just short of the overrun. After deplaning, Captain Remey observed a fire in the tailpipe section which he helped to extinguish with a CO_2 bottle.

Quick and accurate analysis of this inflight emergency and his skillful and professional handling of a serious situation enabled Captain Remey to safely land his T-33. WELL DONE!

Fuel Starvation Is NO JOKE!
PLAN FOR YOUR NEEDS