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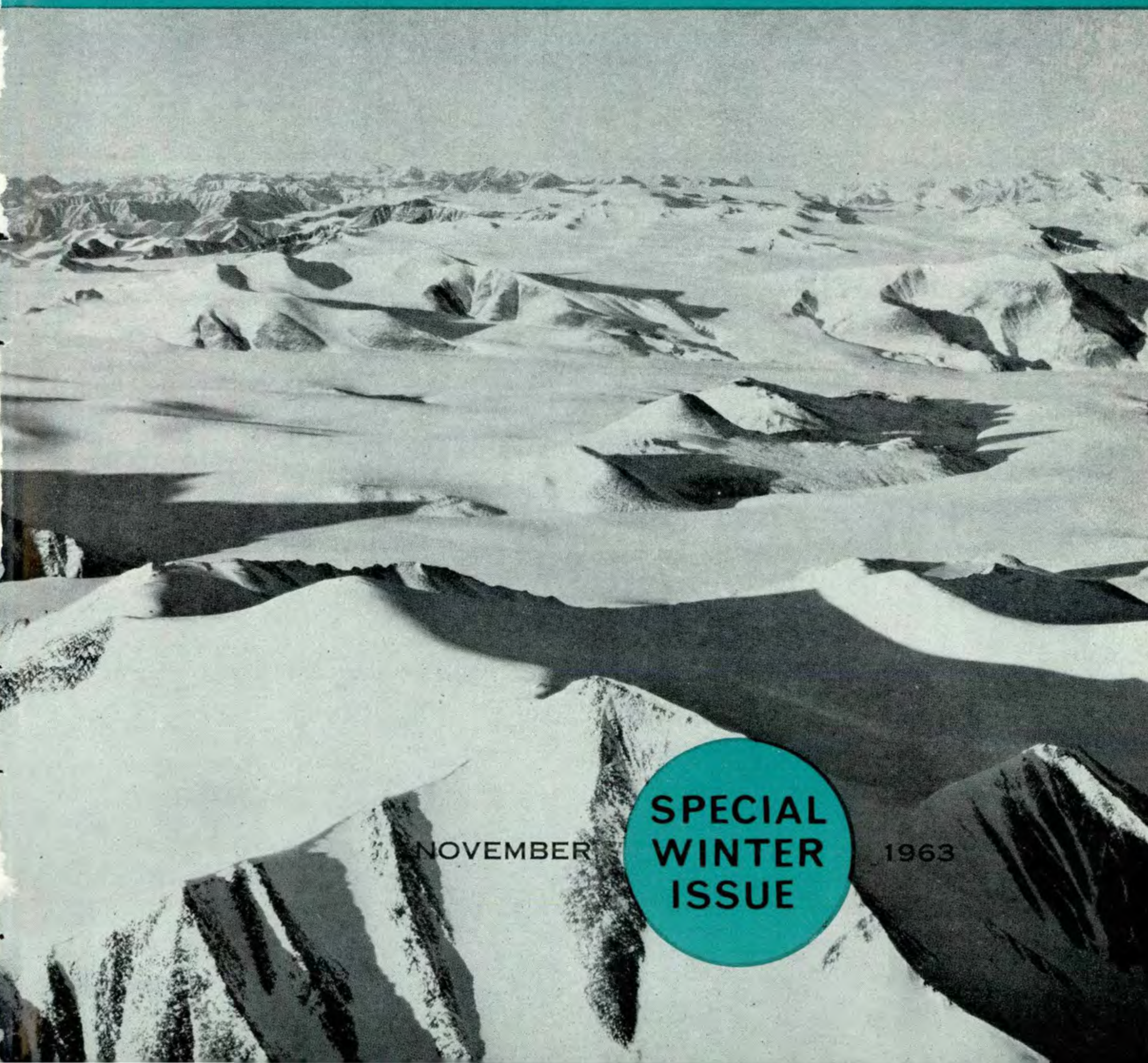
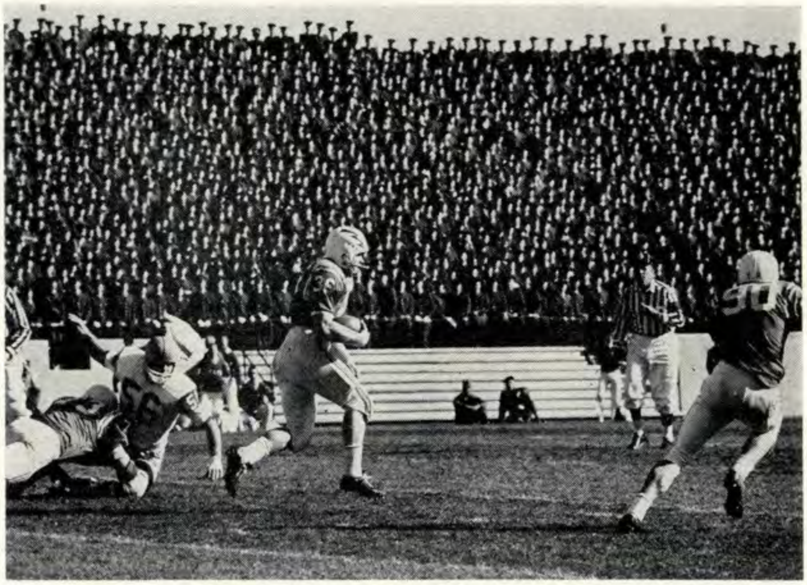
SAFETY

UNITED STATES AIR FORCE



NOVEMBER 1963

SPECIAL WINTER ISSUE



EDITORIAL

TEAMWORK

The team has marched to the one yard line. The ball is snapped to the quarterback. With perfect timing he hands it to his fullback. A hole opens off tackle. It is only open an instant, but in that instant the fullback is through, standing up. Nobody laid a hand on him. Immediately the teams relax. The fullback casually flips the ball to an official.

Spectators who were watching closely saw one of the most thrilling moments in sport.

It was made possible by teamwork.

Eleven players, thoroughly briefed on their assignments, keying off the count of the quarterback, moved as one in the split-second timing required to make the play work. Each and every man did his job and the sum total was that a hole was opened, at just the right moment, and the ball carrier was through. Touchdown!

Aerial refueling requires this same type of team work. Perfect execution, in sequence, is mandatory in a launch exercise at a missile site. Ideally, each member of a transport crew must do his job at the proper time. One of the most spectacular examples of teamwork is put on by the Thunderbirds.

In all these cases, ultimate performance is a product of training and practice. Without hours of study and plain hard work the football team would never have been able to execute the play with the perfection necessary to score. The Thunderbirds, as much as they fly in air show exhibitions, practice nearly every day.

It's even deeper than that. No team can succeed without good equipment. And a soft football isn't as serious as, for example, a sloppy throttle control. Behind the men on the field there are many more who keep the equipment in shape for them. Seldom are they recognized in degree proportionate to their contribution.

Their reward is not the cheers of the crowd, but rather the quiet satisfaction that comes from a job well done. Be it shoulder pads or oxygen masks, footballs or missiles, their contribution is necessary. Everyone can't be the ball carrier, but without every one's teamwork the ball carrier will never cross the goal. ☆ TJS

IN THIS ISSUE

FALLOUT

FACILITIES AT RESERVE BASES

The information, as given in the Rex Note on page 14 of the June issue ("Facilities at Reserve Bases"), is correct — but incomplete. Many reserve bases do not and cannot offer any transient service at any time. Quoted below is a message about the change in procedure:

"Effective 1 January 1963 the following are the hours of operation and transient services to be provided at CONAC bases. Hours of operation: CONAC bases located at Bates Fld, Ala; Bradley Fld, Conn; Dallas NAS, Tex; Davis Fld, Okla; Gen Billy Mitchell Fld, Wisc; Gtr Pittsburgh Aprt, Pa; Memphis MAP, Tenn; Minneapolis-St Paul Int'l Aprt, Minn; New Orleans NAS, La; Niagara Falls MAP, N.Y.; O'Hare Int'l Aprt, Ill; Willow Grove NAS, Pa, and Youngstown MAP, Ohio, will operate those hours required to perform the mission of the reserve unit.

"Transient Services: Reserve Units located on CONAC bases listed above will not provide transient services of any kind. Transient services at these bases will consist of those provided by the airfield operator."

I am sure that I speak for all of the above bases when I say that we would like to provide the services, but manpower spaces necessary for this service have been withdrawn. To provide any service detracts from our primary mission and uses manhours already critically short.

Lt Col Howard W. Dye, Jr
911 Trp Carr Gp, Gtr Pittsburgh Aprt, Coraopolis, Pa.

Rex's note "Facilities at Reserve Bases" was a condensation of a full length article on the subject, therefore all points could not be covered. His suggestion, "Check the Enroute Supplement," is still good advice.

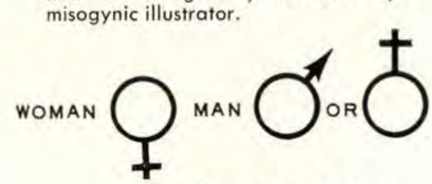
LIMITS OF MAN

For my entire Air Force career I have had the unique good fortune to be assigned as a secretary in Flight Safety, and have faithfully read your publication as a means of increasing my knowledge of an interesting and rewarding career field.

I have never failed to be impressed by the well-written, errorless, articles you publish, and therefore was surprised to note a glaring error in the article "The Limits of Man," on pages 6 and 7 of your August issue.

If this article had been entitled "The Strengths of Man," and written in this vein I could have accepted the obvious, and graciously acknowledged the compliment. Under the circumstances, however, I feel I must express my righteous indignation at your indiscriminate use of the biological symbol for "WOMAN" to illustrate an article on the obviously "weaker sex."

Suggest you take immediate action to castigate your obviously misogynic illustrator.



SSgt Mary Anne Nickless
7101 Air Base Wg
APO 332, New York, NY

Ed. Note: Some days are like this!

BRIEFING PASSENGERS

In reference to the T-33 passenger incident outlined in Aerobits, page 26 of the August issue, you state: "There is no published checklist for briefing passengers." This is erroneous. See AFM 60-33 (26 Feb 62) page 36, attachment 6.

Your rear cover poster and its slogan "absolute control prevents personnel error" well epitomizes the current Air Force and military philosophy. Indeed we are approaching an era in our military history where all personnel are trained pavlovian automatons. History shows us many military organizations which have crumbled when the umbilical cord to their high command was severed.

Capt Robert F. Beasley
192 Tac Ftr Gp, VaANG
Byrd Field, Sandston, Va

Captain Beasley is correct about the checklist. There is a passenger briefing checklist for the T-33. However, the manual has been revised and it is now on page 58, Att. 7, AFM 60-33, dated 1 April 1963.

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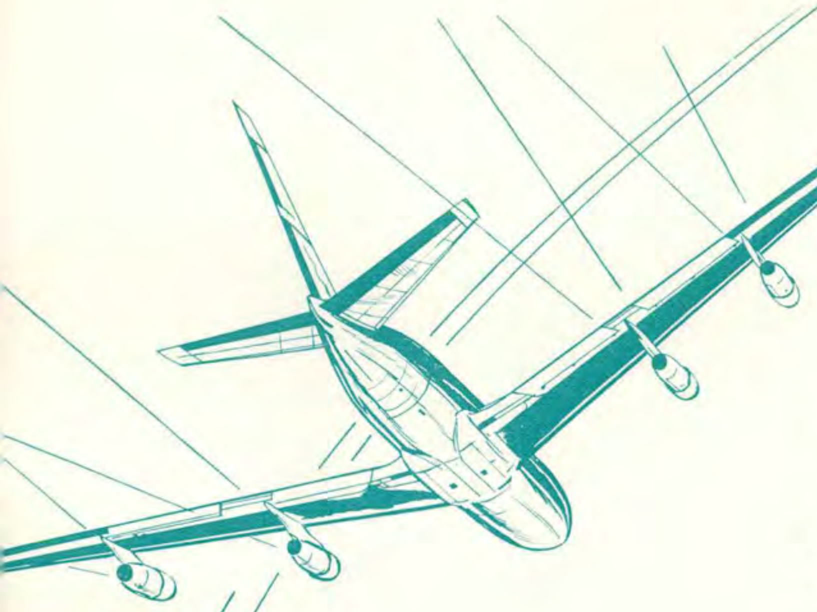


At times the air above becomes . . . .

TOO COZY!

"At this time we were level, FL 310, altimeter setting 29.92, indicated airspeed 245 knots, TAS 380 knots, heading 209 degrees. The VOR was tuned in to__VOR. About five minutes later I saw a set of aircraft lights coming directly at me from my 1130 position. The lights were closing rapidly and appeared to be level with our aircraft. I hesitated momentarily then dove the aircraft down and to the left to avoid the lights of the oncoming aircraft. The co-pilot said, 'What's wrong?' and at that point an aircraft flashed over us. All I saw was the aircraft lights and the underside metal of the wings as it passed over us." Thus reported a T-33 pilot. From the crew of a T-29, the following:

"A small, single engine aircraft passed overhead in opposite direction at approximately 5000 msl. Aircraft was observed by both pilots of the T-29. Closest vertical distance between two aircraft estimated at 200 feet . . . The T-29 was just breaking out on top of broken layer of clouds. No evasive action was possible because the maximum time other aircraft seen was five seconds. Five seconds prior to the incident the T-29 was on instruments in the clouds with no visual reference possible."

A C-123—"We were maintaining an assigned 9000 feet . . . on an IFR clearance . . . when a civilian Constellation appeared approximately one and one-half to two miles directly in front of us at exactly our altitude. We had just broken out of the clouds over____ VOR into a haze condition, with forward visibility between one and two miles. We immediately initiated a violent right descending turn. The Constellation continued to fly toward us at first, and then turned into us. . . . I estimate the miss distance as 80-100 feet. . . . My only comment was to the effect that if we had remained in the clouds it surely would have been a midair collision, as we were on exact collision course."

In 1962, 549 such incidents as these were reported to the FAA. Military aircraft were involved in 380 (44.78 per cent). This in itself is a serious problem involving all three types of aircraft operations—military, air carrier and general.

The Air Force, however, has another serious problem, that of midair collisions between associated aircraft, that is, those involved in formation or other flights in which the aircraft are in close proximity, e.g., ADC intercepts. The magnitude of this associated aircraft problem became evident during a disastrous 10 day period in August when there were five such accidents in which eight aircraft and 15 lives were lost. Three of these occurred on one day.

The problems in the two different types of accident exposure are different, but there are also some similarities. Some of the principles involved in preventing midair collisions between non-associated aircraft are the same as those for associated aircraft. Later we'll discuss these similarities.

It's a pretty dull pilot who is not concerned with the possibility of a midair collision and we don't think there are many dull pilots around the Air Force. This concern, which we all share, may be deadened however, by a number of things, some of which are cockpit saturation, fatigue, boredom, and the physiological limits of man. External forces also play a role in that other aircraft are difficult to see during certain atmospheric conditions, at some angles, from some cockpits, at high speeds.

Contrary to what one might expect that encounters classified as near misses occur mostly in high density terminal areas, this is not the case. Where, when and between whom do near misses occur? Here's how FAA Associate Administrator for Programs David D. Thomas described the statistically typical near miss at the Fourth Annual Air Force Safety Congress: "It is a Thursday, during daylight hours, with unlimited ceilings and visibility better than five miles. Our hero is flying a twin-engine reciprocating engine aircraft between 3000 and 14,000 feet at a speed in excess of 150 knots but less than 300 knots. He is flying VFR passing an en route VOR when he crosses the path of an IFR aircraft. He takes smooth evasive action, has no injuries and estimates the distance at about 500 feet. He reports the incident."

That is the statistically typical near miss. Statistics don't mean much, however, unless you understand their derivation and how they are used. For example, there were 90 reported near misses on Thursday, but there were 89 on Wednesday, 84 on Tuesday and 84 on Friday. The other three days of the week were somewhat lower.

There was no question as to time of day. Of the 549 reported near misses, 445 took place during daylight hours, 69 at night and 35 at dawn or dusk. As for the operational area, 420 were en route and 129 in terminal areas. In nearly half the cases, VOR facilities were being used.

For the past several years FAA (previously CAA) has been investigating what may be termed mechanical means of preventing midair collisions. These range from sophisticated systems to more simple devices. There is considerable controversy, however, as to the effectiveness of some of the more simple systems and even the complicated, costly devices such as the Collision Avoidance System which detects approaching aircraft, decides whether they are on a collision course and takes action to avoid the impending collision.

Some of the seemingly more simple systems include paint colors and configuration, and lighting arrangements. Considerable work in these areas has been done by the Applied Psychology Corporation under FAA contract and further studies are continuing.

As a result of some of these findings and operational experience the Air Force has decided to remove conspicuity markings from its aircraft except for those aircraft used primarily for pilot training and targets. In reaching this decision it was pointed out that the silhouette of an aircraft can be detected during en route flight as soon as conspicuity coloring.

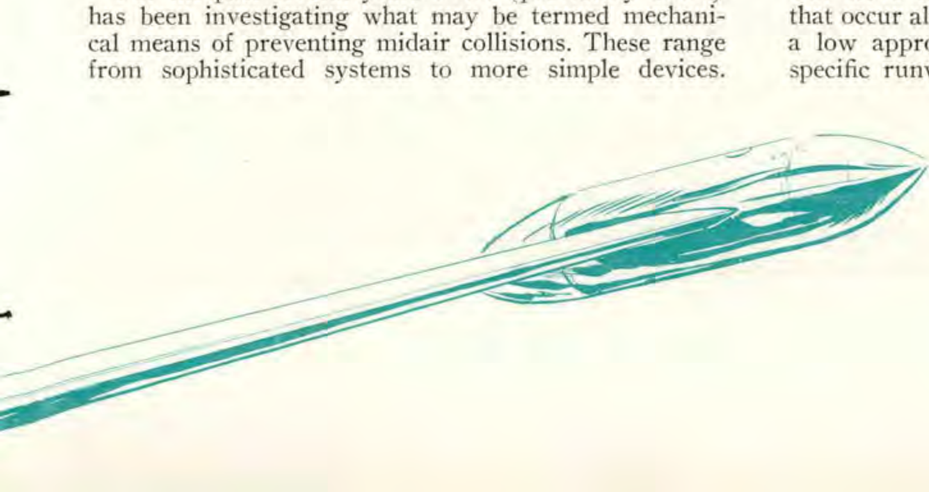
As research continues there undoubtedly will be progress toward ways of increasing aircraft visual detection. But as speeds increase and the times available between detection, evaluation and action decrease, it is obvious that more efficient methods of preventing midairs must be developed.

For the present, our best way of avoiding collisions boils down to two words: AIR DISCIPLINE. Behind these words are all the tools for preventing midair collisions or at least keeping the risk to a minimum. These include radar control, climb corridors, area positive control, terminal control, various navigation facilities, rules of the road, altitude and lateral separations by the several methods available.

But these are useless without air discipline. Flight plans must be adhered to; altitudes must be maintained; in VFR conditions, even under an IFR flight plan, pilots must keep constant outside surveillance. The latter is a problem particularly with single engine aircraft and especially in terminal areas where pilots may be operating various controls, looking at charts, changing frequencies, talking to controllers and performing the other tasks required. When there are two pilots or other flight deck personnel, one or more must be constantly eyeballing outside the cockpit.

There have been flagrant cases of pilots not reporting, some not even detecting, changes in ground speed due to wind changes. This fouls up the traffic system. Pilots are often sloppy about starting letdowns and climbs and maintaining proper rates. Even such a prosaic item as a dirty windshield may play a role in a pilot's not detecting a potential collision. Unless the relative motion is great, a pilot may find it difficult to tell the difference between a speck of dirt on the glass and an approaching aircraft.

Some recent OHRs, accident and incident reports will serve to illustrate the various kinds of problems that occur almost daily. A tanker called in and requested a low approach and was cleared by the tower to a specific runway with instructions to report five miles



TOO COZY continued

out. Another tanker was on the same runway for takeoff. Tanker Nr 2 took off but at 1000 feet spotted the other tanker coming directly at him at the same altitude from the left. Nr 2 reduced power and dove to within 200 feet of the surface to avoid a collision. Apparently the pilot of the aircraft making the low approach was confused and 180 degrees off the heading for the runway.

A civilian DC-3 flew through the gunnery pattern on a range within a restricted area where a flight of F-100s was conducting live ordnance delivery.

An accident occurred when an aircraft overflew a tanker, then pulled up and collided with the tanker.

After takeoff on a formation flight a fighter pilot closed too fast on lead. When he realized he was overshooting he throttled back and extended the speed brakes but he was now in the wing wash of the lead aircraft and was unable to get enough control response to avert wingtip damage.

At midnight, a C-124 nearly collided with a light civilian aircraft. It was later determined that the light plane had no rotating beacon or other satisfactorily visible lighting. Another factor was the inability of radar to paint the light aircraft.

A student pilot in a T-37 barely averted what would have been a tragic collision with a jet airliner flying through the student practice area.

A near miss occurred between an airliner and an F-101. The airliner was reported as on time, on course and on assigned altitude. The interceptor was on an authorized practice intercept under control of a NORAD control center. Closure rate was in excess of 800 mph. Radar did not detect the airliner until the aircraft were approximately two miles apart.

The above instances serve to indicate the complexity of the midair collision problem. Another significant factor is the mix of IFR and VFR traffic at the lower altitudes. The high flyers are in better shape. There are fewer of them, and positive control from FL 240 to FL 600 is spreading and will soon blanket most of the nation. Nevertheless, they still can't relax; there is too much traffic. Down where we mix the student flyer and his bug masher with everything else that flies, most of it VFR, a constant vigil is necessary. But Air Force pilots have become so instrument conscious that many pilots fly the gages—head in cockpit—even when the visibility is unlimited. The hazards of this need no further comment.

As stated earlier, the Air Force has the different, but related, problem of potential collisions between associated aircraft. Again much of this problem can be licked through discipline, along with, of course, adequate training. Midair accidents have actually been manufactured on the ground before the aircraft took off. Technique, skill and supervision comprise a team to prevent collisions between aircraft flying tight, planned formation. A real tragedy occurs when two or more aircraft collide while flying loose formation with a planned spread between them. This might occur when crews are accomplishing inflight training that prevents them from watching out for each other, even though they have filed a MARSA (Military Assumes Responsibility for Separation of Altitude) clearance.

There is no excuse for these accidents.

There may be a degree of hazard during practice intercepts, but this can be kept to a minimum if the pilots of both the interceptor and the target share the responsibility for avoiding a collision. It is hard to conceive of the pilot of a target aircraft not taking evasive action when it appears that a collision is imminent.

As we acquire new aircraft—both military and civilian—it is reasonable to expect improvements that will help protect the safety of both aircrews and passengers. One of these improvements concerns better design of cockpits so that pilots are not oversaturated with nonstandard arrangements, poorly located instruments, controls, and communication and navigation equipment. Accuracy and reliability of components can contribute much toward avoidance of midair collisions. Is a *really* accurate altimeter impossible? Can't the reliability of communication and navigation equipment be further increased?

Concern over the midair collision problem was evident in a seminar on the subject at the Fourth Annual Air Force Safety Congress in August. The seminar came up with 19 separate problems. Full discussion of these is not possible in the space available here, but the recommendations of the group can be presented. They are, in essence:

1. Expanded air traffic control to improve separation in terminal positive control areas.

2. Development of collision warning, autopilot evasive action and anti-collision devices.

3. Improved cockpit instrumentation—zero error and easy interpretation.

4. Classification of air traffic control career field as critical and manpower allocations made in preparation for expanded positive terminal area control.

5. Segregation of jet training and test activities within positive control areas and publication in all flight publications.

6. Improved educational techniques on traffic control systems, collision warning devices, etc.

The problems are many but not insurmountable. A technology that can place an object millions of miles out into space and then communicate with it to determine the characteristics of another world, and that plans to place men upon the moon in a very few years, certainly has the ability to make the midair collision like the Dodo bird: Extinct. ☆

HOT START

Lt Col David J. Schmidt, Directorate of Aerospace Safety

No doubt every jet pilot in the U. S. Air Force has listened to many discussions about hot starts, as well as having read articles and having heard lectures on the subject. For example, most B-47 pilots were afforded excellent briefings by SAC, GE and OCAMA engine experts early this year on the life expectancy of the J-47 engine and ways of extending or reducing it.

Apparently some of our braver "blue suit" warriors still feel they can chance takeoffs after hot starts and, because they didn't have to jump out of the bird prematurely, forget to write up the hot start.

The plain, simple fact is that we are again running into a rash of turbine blade failures. It is highly unlikely that the hot starts that caused these failures were not observed by anyone on the ten or twenty-odd previous starts. In the first eight months of this year, 22 turbine bucket failures were recorded. Bucket failure nearly always occurs some number of flights after the hot start and the innocent victim is probably a guy who conscientiously writes up *all* the squawks for his flights. Rarely is a pilot fortunate enough to have turbine buckets fly out in several directions on the same airplane on which he had a hot start several weeks or months before. Only then does he fully understand the significance of overtemperature during starting and the potentially disastrous results.

An old expression, "Get your buddies first; they least expect it," is most appropriate for the guy who is reluctant to write up a hot start. When the bucket failure does occur, it's almost impossible to point the finger at the one person who should have prevented it.

There are many reasons why pilots, and in some rare cases engine maintenance men, do not record hot starts:

They are "old hands" in the flying business who feel they would lose prestige by admitting that something so simple could happen to them.

They are relatively new pilots or aircraft commanders who feel they would be criticized and lose favor for lack of procedure proficiency if their hot start were known.

They are so completely dedicated to mission effectiveness that they flagrantly violate all principles of safety.

They are unmitigated liars who are convinced no one can prove the specific start on which the overtemp occurred.

They are pilots who deceive themselves into believing that instrument error is mostly at fault.

They are perfectly normal, upstanding individuals who, during a normal or alert start, were momentarily distracted and simply didn't see the peak temperature indication.

There is a remote possibility of an EGT gage being the culprit with no overtemperature indicated. However, in such a case, the malfunctioning gage usually exhibits other erroneous indications.

Since engine instrument systems in most jet airplanes are not presently equipped with peak temperature recording devices, we must be particularly watchful for over temperature conditions and record in the Form 781 every one that occurs.

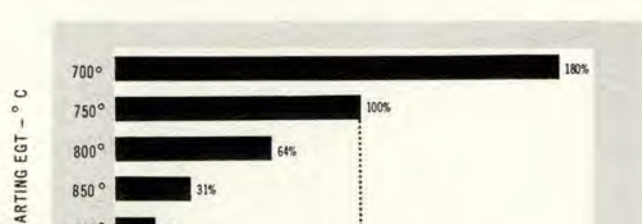
An excellent article from the 8 February 1963 issue of General Electric's *Jet Service News* was reproduced in the June issue of *Aerospace Maintenance Safety* magazine and fully covered most facets of this subject.

Normal optimum starting temperature for the J-47 engine is 750°C. This temperature is used to compute 100 per cent turbine bucket service life. For the affect of hot starts on bucket life see the accompanying chart.

Although the operating limitations of the B-47 flight manual show 950°C as maximum allowable temperature during starting only, the chart for turbine service life shows that starts at this temperature will give you only 10 per cent service life and failures can be expected early in the useful life of the engine. Conversely, if starting temperatures are held down to 700°C, this 50° reduction from optimum in peak temperature can extend the service life up to 180 per cent.

The few statistics given here apply to the J-47 engine, BUT the principles apply equally to all jet engines—none are immune. Jet engines may be likened unto race horses: a short period of peak performance and they are easily burned out.

Let's give our fellow crewmembers and ourselves a break and record what we truly believe could have been the maximum possible temperature and duration of all possible hot starts. This will give our maintenance men a legitimate reason to inspect the T-wheel *before* buckets shoot out from the engine like 20mm projectiles. ☆



YAW'N HUNDREDS

Adverse Yaw, a phenomenon of some sweptwing aircraft, can be successfully managed if the pilot understands it and knows what to do about it. This article, based on the material in the Air Force movie "Adverse Yaw in the F-100" and a booklet developed by North American Aviation and TAC experts, explains and recommends action for countering this peculiar characteristic.

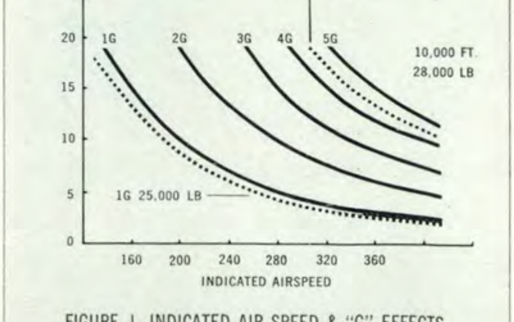


FIGURE 1. INDICATED AIR SPEED & "G" EFFECTS

The day is warm and clear, except for the light haze lying over the dun-colored desert. Visibility is good as the flight prepares to turn on to the targets below. Lead checks the panels and okays the gunnery run to his two wingmen.

In the F-100 on his right is a young lieutenant, short on experience but considered to be long on judgment and technique. No problem with a sharp lad like that.

The lieutenant confirms the panel and starts his turn for the pass. "Watch it," he tells himself, "a little tighter, gotta' make this a good one. Still a little wide, tighten 'er a bit. What in the . . .?" The fighter suddenly snaps back in the other direction and over the top. "More stick, no good . . . Feed in some rudder . . . What's the matter with the controls? Oh, oh, I've bought it!"

Lead looks back helplessly as he calls frantically, "Neutralize your controls."

The accident investigation board could come up with only one finding: Pilot factor due to the pilot's lack of knowledge of the low speed characteristics of the F-100.

The first Century Fighter has been around for a few years now, about ten. Sad experience has taught, however, that no aircraft can be taken for granted. We still have some crazy things happen to the Goon.

The young lieutenant was a victim of progress. When the swept wing was introduced in aircraft as a means of achieving the performance desired, it brought with it some flight characteristics that, like women, are not necessarily dangerous but can be if they're not understood.

The swept wing of the '100 requires the aircraft to achieve a higher angle of attack in order to produce the same lift as a straight-wing airplane.

At low speed this means that you will have to have a greater angle of attack when pulling G than at high speeds. Figure 1 illustrates this and that weight also affects the angle of attack.

Control response under high angle of attack conditions changes. The roll effect of aileron drops at higher angles of attack. At the same time, adverse yaw increases rapidly. Meanwhile the yaw that the rudder can correct declines to the point where the ailerons produce as much adverse yaw as the rudder can correct. At high angles of attack, sideslipping produces more rolling moment than the ailerons. Now the most effective way to roll is by the use of rudder. This is known as *dihedral effect*.

All airplanes that roll have a tendency to yaw opposite a roll. The downgoing wing has an increased angle of attack, which has the effect of tilting the lift vector forward. The upgoing wing reacts to the opposite. This results in yaw away from the roll. Remember, too, the down aileron has more drag than the up aileron and is more effective in contributing to the roll. These factors lend to adverse yaw being a major factor during high angle of attack in the '100.

When entering a high G turn, the usual tendency in the F-100 is to be slipping (ball low). Because of dihedral effect, the airplane tends to roll out. This is counteracted with bottom aileron. As angle of attack increases, this aileron deflection begins to produce yaw in the opposite direction (adverse yaw) which increases the slip, increasing the tendency to roll out. As this situation builds up it is possible to roll against a considerable amount of aileron deflection.

With variations in pilot technique, it is also possible that a particular airplane will roll under in a high angle of attack turn. Smooth coordinated flying with extra attention to sideslip will minimize the effects of this characteristic. When the airplane begins to respond in this way, it is a warning that the angle of attack is reaching a critically high value, and a slight forward stick movement to reduce this angle of attack will restore good control.

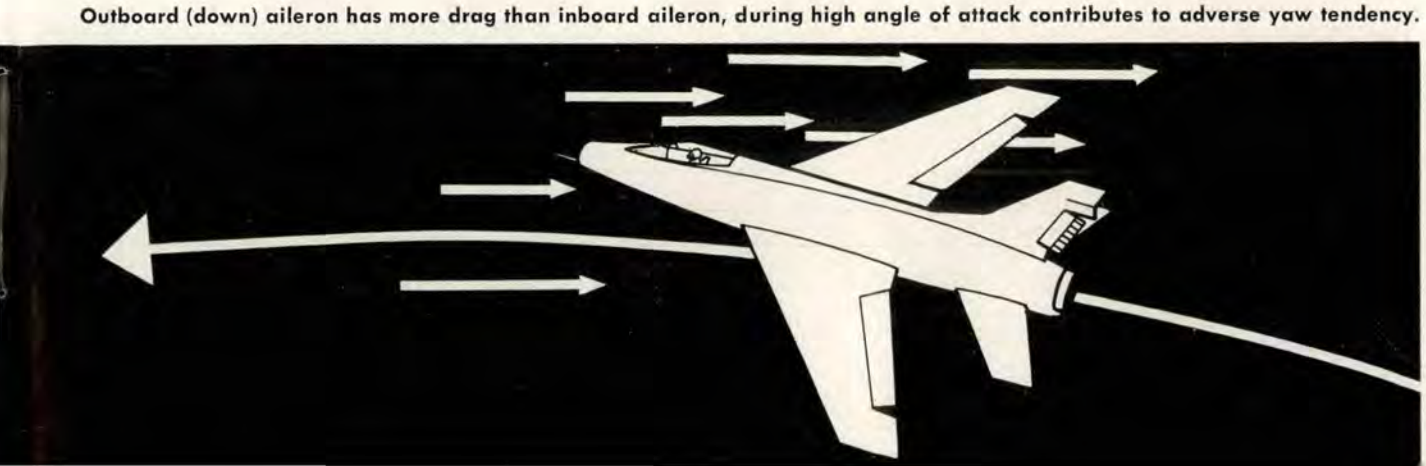
Not all F-100 pilots have flown the bird into the area where yaw becomes a problem. But there have been 11 accidents in the past year that indicate pilots may have got into the adverse yaw zone and didn't know what to do about it.

If the airplane rolls over the top it will very likely go into a near vertical spiral. This is a high angle of attack which may be mistaken for a spin. However, in contrast to a spin, which is rapid and oscillating, the spiral will be smooth, slower and without oscillation. Airspeed will increase slowly. Release back pressure or, if necessary, add a little forward pressure. The idea is to obtain neutral horizontal stabilizer and you can get this by use of the TRIM FOR TAKEOFF button.

To recap: High angle of attack, high G turns are conducive to roll and adverse yaw. Weight increases the angle of attack as does low speed. The aircraft will begin to turn and then roll toward the greatest drag—usually toward the down aileron and over the top.

Immediately reduce back pressure to decrease the angle of attack, or neutralize the stick to reduce aileron forces. Don't use opposite aileron or you may get into a spin. ☆

Outboard (down) aileron has more drag than inboard aileron, during high angle of attack contributes to adverse yaw tendency.



EEDs: Use Care

Maj Richard P. Berry, Directorate of Aerospace Safety

Electro-explosive devices (EEDs) are, by design, sensitive and therefore inherently hazardous. Since they are made of explosive material, most of them can be initiated by severe shock, extreme heat, and all of them can be fired by a specific amount of electrical energy. Nevertheless, they have been safely used by earth-moving companies and the mining and petroleum industries for many years. The comparatively few EEDs accidents were generally caused by complacency or lack of knowledge.

The Air Force used EEDs to ignite explosive bolts, bolt cutters, and destruct packages. However, design specifications limit their use in the Air Force and require that EEDs be used only when other techniques cannot technically or economically accomplish the desired function.

The Missile Safety Division, DTIG, recently analyzed the causes of all missile mishaps (incidents and accidents) from January, 1962, through May, 1963, which resulted in or were caused by the inadvertent firing of missile system pyrotechnics. The primary causes of the 58 malfunctions during the period are shown in Figure 1.

In Figure 2, the 58 malfunctions are categorized according to type of missile and primary cause.

It is interesting to observe that in only *four* of the 58 cases, inadvertent firings were suspected to have been caused by the phenomenon erroneously called *stray voltage.* It is also important to note that none of these malfunctions has been attributed to corrosion; however, several have been caused by moisture between electrical conductors and water in connectors. Almost all have been directly caused by short circuiting of power to the EEDs. One of the objectives of this review was to learn if similar malfunctions or failures were occurring in a single organization or on the same weapon system. No such trend or organization has been indicated.

Even though there have been relatively few incidents attributed to design deficiency, it is believed that ordnance subsystem design is a profitable area for safety improvement. Through proper design engineering, the ordnance subsystems of missiles can be effectively isolated and electromagnetically shielded from all undesirable energy sources—possibly even man!

As shown below, the number one known cause factor for inadvertent firings or pyrotechnics has been personnel error. And, just as in the case of accidents in industry, the cause of the personnel error has been complacency or lack of knowledge. Eliminate the complacency and make sure the personnel are fully trained and the result will be a reduction in the personnel errors. ☆

Fig. 1

Personnel Error	41.4%
Design Deficiency	1.7%
Materiel Failure	13.8%
Unknown Causes	43.1%

Fig. 2

Type of Missile	SM	TM	IM	FFAR	GAM	GAR
Nr of Malfunctions	25	2	1	—	30	—
Personnel Error	52%	50%	100%	—	30%	—
Design Deficiency	4%	—	—	—	—	—
Materiel Failure	12%	50%	—	—	13%	—
Unknown Causes	32%	—	—	—	57%	—

MISSILANEA

WATCH OUT BELOW!! It was just another routine AIR-2A (MB-1-T) firing mission against a Q-2 Drone target. The rocket to be expended that day would add another digit to the many hundreds fired in like manner over water and land ranges. All the other AIR-2As had performed as expected. Why did this one have to be different?

The crew of the F-101 zeroed in on target. At the proper point in space and time, the aircraft's fire control system automatically launched the huge rocket. A few milliseconds after ignition of the solid propellant engine, the motor exploded. Fragments of the rocket penetrated the underside of the F-101, rupturing fuel, hydraulic and electric lines. The pilot made a valiant effort to return the aircraft to the airfield. Shortly after the mishap, however, the aircraft caught fire and the pilot and radar intercept officer (RIO) were forced to eject. The pilot received burns during ejection, but landed with only minor injury. The RIO's seat became entangled in the chute's shroud lines during descent and upon impact with the ground, he wrenched his leg. The aircraft was destroyed.

What caused this solid propellant rocket motor to explode after launch and prior to burn out? Possibilities are:

- A crack or cracks in the propellant grain.
- Voids in the propellant.
- Bonding failure of the propellant grain to the motor liner or case.
- Decomposition or molecular change of propellant due to age, temperature, moisture, or other stimuli.
- Sudden extreme shock of the motor propellant.
- Extreme low or high temperature of the propellant grain at firing time.

Voids or bonding failures are difficult if not impossible to detect in the field. Cracks can be detected when proper inspection techniques are followed. Extreme temperatures can be avoided by heating or cooling the weapon prior to takeoff. Environmental control and observance of shelf-life criteria will prevent decomposition of the propellant grain.

The most probable cause of the rocket motor explosion was a crack or cracks in the propellant grain.

Personnel handling AIR-2As can prevent cracks in the grain by treating the motors with respect due any explosive. No bumps, jars or other sudden shocks can be tolerated. Let tender, loving care be the byword. If cracks are present in the grain, find them, regardless of cause. Each AIR-2A motor *must* be examined using procedures specified in Tech Order 11A11-9-1. This inspection should be performed with the attitude that a crack *is present* and the inspector *must* find it. If the inspector cannot find a crack, only then should the motor be classed as "OK to Fire." Missile/flight safety officers and supervisors can prevent a recurrence of this type mishap if the above attitude toward motor grain inspection is properly instilled.

Lt Col Randall L. Earl, Directorate of Aerospace Safety

PERSONNEL ERROR continues to be a major cause of air launch missile mishaps. The following two incidents will serve to illustrate why continuing emphasis must be placed on eliminating this factor.

AIM-4C (GAR-2A). During an armament turnaround exercise approved checklist procedures were being observed for installing the missile. The "B" man was at the rear of the missile, the "C" man in front and the crew chief in his proper position at the midsection. The missile was placed forward of the launcher for installation. Aft and center lugs were engaged on the launcher and the "T" handle was pulled while the "C" man pushed the missile aft. The "T" handle was then returned to the forward position and the "B" and "C" men checked for security. The crew chief verified that the "T" handle had gone forward and assumed that the missile was in the locked position. Actually it was two and one-half inches forward of the locked position. After a power-on stray voltage check was made, the "C" man removed the guidance unit covers and the "B" man retracted the launcher. Result: the glass cover on the guidance unit struck the vortex generator and broke.

As a result of this mishap the crew chief was removed from certified status, reprimanded and given additional training.

AIM-4A (GAR-1D). Three missiles were damaged when the three forward rails on an F-102 were extended pneumatically without snubbing air. During uploading, prior to retracting the launchers, the crew discovered that there was no snubbing air. Loading was discontinued and the weapons release maintenance crew was notified of the malfunction. While waiting for maintenance, the loading crew retracted the launchers manually and followed the trouble shooting procedure outlined in TO 1F-102A-12. A substitute armament control relay box was connected electrically in the system and checks indicated the problem had been eliminated.

The crew then obtained a new armament control relay box from base supply and installed it in the aircraft. The armament technician then started reset procedures. Power was applied and the reset circuit breaker was closed, the launcher switches were moved to the UP position. The forward launchers extended without snubbing air, causing one hook on the front and one on the rear launcher to break which allowed the missile on Nr 2 rail to strike the loading ramp and receive major damage. Launcher Nr 2 was severely damaged as well as the actuating cylinders and link locks on Nr 1, 2 and 3 rails.

Although the specific cause was undetermined, this accident was tagged personnel error in that the crew failed to follow written procedures which required download of the missiles prior to replacement of the armament control relay box. As a result of this mishap the unit now requires that whenever a malfunction of the armament system exists all weapons will be downloaded and selector valves disconnected before investigating the malfunction. ☆

TACAN REFRESHER

Based on article by Maj James H. Hughes, NY ANG

TACAN is a short-range navigation system which supplies continuous, accurate slant range distance and bearing information. TACAN provides an infinite number of courses to, or from, the TACAN facility, and, with DME (an integral part of TACAN), you are furnished continuous slant-range distance information from the facility.

The ground equipment consists of receiver-transponder combination and a rotating type antenna for transmission of bearing and distance information. The TACAN ground equipment, or stations, is commonly referred to as "beacons." The beacon identifies itself aurally in code every 30 seconds.

Depending upon altitude and range coverage protection required, beacons operating on the same channel are separated by distances that will insure against co-channel interference. If an aircraft is in a position to receive two stations on the same frequency, the strongest signal will predominate.

DME is an electronic system which measures distance from an aircraft to a station on the ground. Basically, it operates by transmitting a signal to the ground station which, in turn, replies. The time taken to exchange these signals is measured accurately, and from this and the known speed of the radio wave the distance is automatically computed. This is then indicated to the pilot in nautical miles on a circular dial-needle pointer instrument or an odometer presentation.

DME measures the distance directly from the airplane to the ground DME facility. This is commonly referred to as slant range distance. The difference between a measured distance on the surface and the DME slant range distance is smallest at low altitude and long range. It increases as the range decreases and altitude increases. The difference is greatest when an aircraft is directly over the ground facility, at which time the DME receiver actually will display altitude in nautical miles *above* the station. Generally, the slant range surface distance is negligible if the aircraft is one mile or more from the navaid (ground station) for each 1000 feet of altitude above the elevation of the navaid.

VORTAC consists of a VOR plus a TACAN facility. It provides course and distance information to military aircraft equipped with TACAN receivers and the same information to civil aircraft using VOR and DME receivers.

The equipment is designed to serve out to a range of 195 nautical miles at high altitudes. At lower altitudes, the distance at which a station can be received is reduced considerably. The class of the ground facility also enters into the picture.

VOR and VORTAC facilities are divided into three classes—H (high altitude), M (medium altitude), and L (low altitude)—and the FAA says the class H facility has a "normally anticipated interference—free distance service of 156.31 nautical miles," at a "normally anticipated altitude service of from 30,000 to 75,000 feet MSL"

The Class M figures are 78.16 nautical miles and from 15,000 to 30,000 MSL, with the Class L at 39.08 nautical miles and up to 15,000 feet MSL. An H-VOR or VORTAC facility is capable of providing M and L service volume and M facility additionally provides L service volume. An attempt to use a reading obtained beyond the interference-free distance may result in an erroneous indication because of the interference of other stations operating on the same channel.

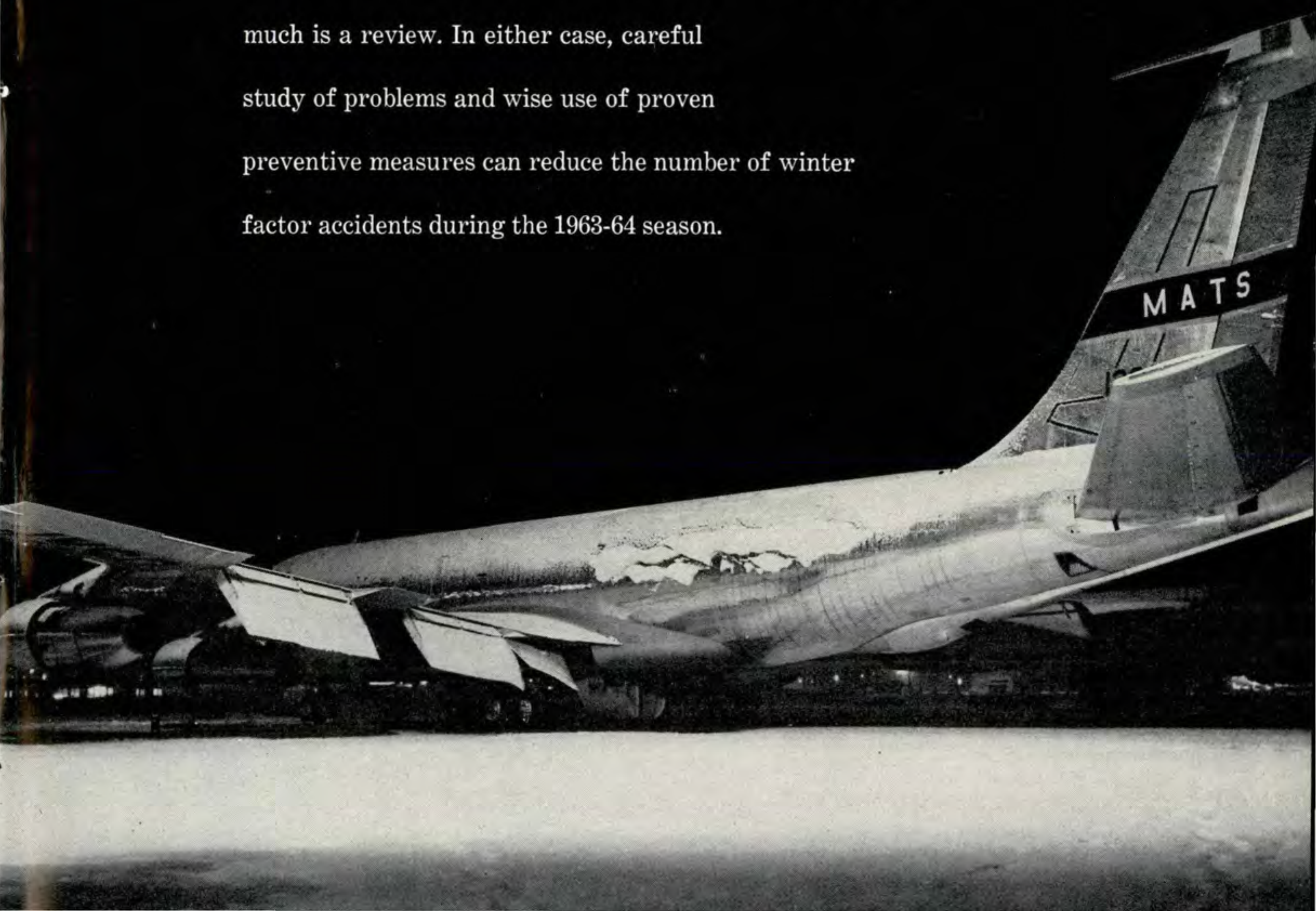
One hazard of the equipment is that occasionally TACAN will "lock-on" to a false bearing which will be 40 degrees or a multiple of 40 degrees in error. These errors can be on either side of the correct bearing. When the TACAN "lock-on" is a false bearing, switching to another channel and then back to the desired channel, or turning the set off and then back on will recycle the search mode. This will most probably result in a correct "lock-on." This deficiency does not affect the DME display provided by the TACAN equipment.

- When using TACAN, cross check for false "lock-on" with ground radar, airborne radar, VOR, dead reckoning or other available means. *These cross checks are especially important when switching channels or when turning the set on.*
- If a false "lock-on" is suspected, switch to another channel, check it for correct bearing and then switch back to the desired channel.
- Check for correct "lock-on."
- If false "lock-on" is still suspected, turn set OFF and then ON.
- Recheck for correct "lock-on."
- If false "lock-on" persists, use other equipment or aids available.

If, during an emergency, the size and direction of error can be determined, TACAN can be used if compensation is made for the error in TACAN bearing. ☆

WINTER

Starting on this page and continuing for 11 pages is a special section devoted to winter operations. This material, from field units, industry and files of the Directorate of Aerospace Safety, is designed to highlight major safety problems facing the Air Force at the start of another winter season. Some of the information is new; much is a review. In either case, careful study of problems and wise use of proven preventive measures can reduce the number of winter factor accidents during the 1963-64 season.



TSgt Charles E. Steinwachs, Survival Training School, Edwards AFB, Calif

Should you ever face a cold weather survival situation, and this is a possibility for everyone in the Air Force, here is information for your knowledge storehouse . . . .

Arctic Survival

The prospect of survival at temperatures down to 50 degrees below zero, loneliness, almost continual darkness, the ever-present possibility of frozen limbs, lack of food, adequate clothing and shelter — these are among the foreboding and awesome aspects of survival in the far north that come to the mind of the uninitiated.

This picture is not true. Life there is no longer to be dreaded, even by the "Cheechako." Extensive operations in this area have robbed the Arctic of most of its dangers and terrors. Man has learned how to survive; he can, if he applies this knowledge. With initiative, knowledge and proper equipment he can survive almost indefinitely.

But indefinite survival is not the requirement. Experience has proven that the elapsed time before a man is located in the Arctic averages five days. This isn't long, insofar as survival capability is concerned, but it is much too long if basic survival techniques are not understood and applied. It is too long if it is not remembered that one effect of extreme cold is mental. The possibility of mental breakdown is always present. Although known now by many, the case of the flyer who parachuted safely, set up an effective camp, started his campfire, then committed suicide with his .45, is still a classic example of mental breakdown that can be suffered through loneliness and excruciating cold. His body was found by a rescue party 24 hours later.

About 50 per cent of the personnel involved in survival incidents will be injured, either by parachute descent or by crash landing. These injuries will range from fractured skulls, broken arms and legs to sprains, hemorrhage and shock. Too many times, attempts are made to set broken bones by non-medical personnel. This is not only unnecessary but definitely harmful. The limb should be immobilized through the application of splints. This, of course, presents an additional problem in the extreme cold—the problem of retarded circulation and inevitable frostbite. In this case, the use of a sleeping bag and a warm fire cannot be over-emphasized.

Shock cases will be prevalent and the sleeping bag can again be useful. In most cases of shock, additional water will be required. Obtain this by melting snow. Never give the victim unmelted snow; it contains little water and will only make him more thirsty and consequently much more miserable. Chapped and sore lips, faces and tongues will result from eating or sucking snow and ice. This will increase thirst and bring on parched and burning throats.

If you have nothing in which to melt snow, look around for a rock that is flat and has a depression in it. Heat the rock and pile snow on it. This will make a fairly efficient kettle.

Frostbite and frozen limbs usually result from carelessness, lack of knowledge or loss of the will to survive. Proper clothing is a big factor here. Too often aircrews are inadequately clothed for the kind of country they are flying over. As a result they sometimes find themselves wearing summer clothing in an arctic survival situation.

The arctic parka is an excellent piece of equipment, however you should wear some kind of headgear to get maximum effectiveness from the hood. Another important item is footwear. Leather shoes or boots will be almost useless in below-freezing temperatures. The thermal boot and arctic mukluk are both good, but I prefer the mukluk. It is made of canvas and under it wear two pairs of heavy socks. While the thermal boot is good, it is made of rubber, and perspiration, therefore, cannot escape. As long as you are warm you are okay, but when your activity stops or slows appreciably body heat drops and that moisture will get cold and mighty uncomfortable.

Mittens are better than gloves and the leather mitten with wool insert is very good. Remember, wool should not be worn as an outside garment. Snow sticks to it and may melt from the heat of your body or

when you get close to a fire. Your clothing can get wet this way and then may refreeze. Nylon or a similar material is better as an outer garment.

One of the problems we have is that pilots, and other crewmen in lightweight clothing, fly over areas of the United States where winter temperatures and weather conditions can be every bit as bad as in the arctic. Something happens and they have a crash landing or bailout. What then? One thing they probably have is a parachute and this may be their salvation. In survival school we teach many ways to use the parachute. Here are some of them.

- Sleeping bag.
- Boots and mittens.
- Headgear and scarf.
- Shelter.

Snow blindness may be a problem. Again the chute can be valuable. Cut slits in a piece of two-inch webbing to fit over the eyes and tie it around your head to make snow goggles. Or, use a flat piece of wood hollowed out on the side next to the eyes. Cut a couple of slits in it and tie it on your head. Snow blindness is temporary. Should it occur, heat packs will help but complete darkness is required, probably for two or more days.

Now let's imagine a crew down in the Arctic or an arctic-like area in mid-winter. First thing to do is start a fire. I've watched students in survival school pack in to a campsite. They're warm and perspiring so they have their parka hoods back and coats open letting the heat escape. They chop wood and begin constructing shelters. Then they find their fingers are getting cold and the idea occurs to start a fire. They've got matches but can't hold onto them because their fingers get too cold. So get a fire going first thing.

There may be exceptions to the above. Obviously, if it is raining, or a wet snow is falling, if there is sleet or a high wind, then you may have to fashion some sort of shelter first.

Usually firewood is not a problem. Once a fire is started you can use damp wood if necessary; it will burn. Standing dead trees make good firewood because they are usually dry. Fallen trees freeze in the fall and may be very damp. When burned they will produce a lot of smoke.

One problem with an open fire which I'm sure every one has experienced is that a great deal of heat is radiated into the cold atmosphere. The trick is to build a reflector. Make it out of trees, or logs or aircraft parts which you stack up on one side of the fire. Place it opposite your shelter and it will reflect heat back toward you and you can be fairly comfortable. If your

continued on next page

One Man's Experience

Here is the account of a young aircraft commander who ejected over the north woods in the middle of winter. This pilot was called a "survival nut" by his contemporaries and by his own admission. In this case, it really paid off, as he had to spend over 18 hours in —20 to —30°F temperature in snow deep enough that a man would sink up to his armpits without snowshoes. The para-medic who rescued him stated that he had never seen a man better prepared. As he describes it, "The way he was set up, he could have survived indefinitely" (in spite of his injuries). Let's hear the man's own story, quoted directly from his ejection questionnaire:

"Skimmed over the top of the ridge and apparent speed over the ground was so fast (estimated 40-50 mph) that I forgot to pull my visor down over my face and instinctively threw my right arm across my eyes as I went into the three tops with the right side of my body leading the way.

"Found myself suspended in my harness 25 to 30 feet above ground and unable to reach any tree. Sat in harness momentarily to gather my thoughts and checked my watch, noticed it was 1530 local and also noticed blood running down my left wrist out of my shell leather glove. Both hands very numb from cold. Breathing hard and discovered oxygen mask still fastened and bail out bottle not actuated, so unhooked mask. Decided I should deploy my survival kit before attempting to get down to the ground and pulled quick release, but kit would not deploy. Looked down at kit and noticed that zipper was broken open about one inch and inserted fingers into zipper and pulled it open and survival kit and life raft fell into snow. Noticed raft sank into snow about three inches, could not see survival kit, but checked seat and found it was not inside.

"Wind began to make me oscillate and I aggravated oscillation until I could reach a tree about five inches in diameter. Grasped tree and attempted to open harness quick releases but was unsuccessful due to cold hands. Eventually opened all three normal harness releases using sides of hands, as fingers were numb, and slid down tree to about one foot above snow level and then let go. Was surprised to find snow about five feet deep and unable to stand as left leg was completely numb and useless.

"Crawled through snow to where life raft was lying about 15 feet away, inflated raft, turned it upside down, got up on top of it and brushed snow off clothing and out of boots. Found survival kit buried in about five feet of snow under the raft and attached by the line. Opened survival kit, put iodine on torn left index finger, wrapped finger in compress and then put woolen stockings on both hands to warm them. Put on the woolen face mask under helmet and cut oxygen mask away from helmet. Inventoried survival kit and put all

continued on next page

Arctic Survival CONTINUED

shelter is made from a parachute, or you are using a sleeping bag, be careful especially with coniferous (pine, spruce) wood. It will spit a lot of sparks for five or six feet. If there are several people one should remain awake at all times as a fire guard.

Shelters are not hard to build, especially if you have your parachute. Make a parateepee, a leanto, bend some willow bows over to form arches and drape the canopy over that. Igloos are impracticable, but you can build the walls, then stretch your parachute canopy over the walls. If the snow is deep, dig down below the walls. This will provide very good wind protection. Don't lie on the bare ground. Place plenty of boughs on the ground and place your sleeping bag on top of them, or roll up in your parachute and lie on them. They'll make good insulation. Remember: it's just as important to have protection underneath as on top, and also that deep snow is an excellent insulator.

The extreme cold will force the survivor to spend much of his time in a closed shelter. Severe headaches may be experienced due to toxic fumes from stoves and fires. These headaches should disappear after a short time outside. The most common firewood found in the north, spruce, will also cause swollen and inflamed eyes.

One of the major problems will be progressive weakness resulting from limited rations. Fatigue will set in quickly, so that work will have to be limited to short periods at a time. All attempts to work in the extreme cold and strong winds require great expenditures of energy. Walking in deep snow or againist a strong wind will completely exhaust an individual. Even breathing in the cold climate will seem to require a greater effort than usual.

One Man's Experience CONTINUED

freezeable items, radio, flashlight, water, food, matches and signal mirror under thermal underwear to keep them warm. Opened sleeping bag and placed one half of the hard plastic container in the snow to the left of life raft while inventorying the rest of survival kit. Raft shifted and bumped plastic cover of sleeping bag and raft was punctured, deflating completely.

"Ate one lump of sugar and crawled into sleeping bag in an attempt to warm up and to think situation over. Used plastic covers from sleeping bag and survival kit as windbreak for my head. Lay in bag for about an hour until relatively warm and in complete possession of all my faculties and noted left ankle beginning to pain considerably. Rechecked survival kit for some type of pain killer and found exotic medicines for malaria, etc., etc., but nothing of apparent value to me.

"Got out of sleeping bag and dug trench in snow about 18 inches deep and seven feet long. Placed deflated raft in trench, lay sleeping bag on top of raft and climbed back into bag. Constructed windbreak of snow all along upwind side of trench to keep strong winds from striking me directly. Again reviewed contents of survival kit and pockets to insure complete familiarity with all items available.

"Darkness occurred an hour and a half after bailout, and approximately three and a half hours after bailout could see and hear a helicopter, a KC-97 and a KC-135 flying obvious search patterns in the area. All aircraft flew directly overhead several times, with landing lights from KC-97 illuminating area where I lay into daylight conditions. Attempted to contact using URC-11 but was unsuccessful although static could be heard in receive position and I was fairly certain that battery was good since I could hear code transmissions from transmitter. (Note: He had kept both radio and battery warm next to his skin since opening the kit.) No voice contact possible and attempted to attract attention using flashlight and signal mirror combination, with no success.

"Tried to get to large pine tree about 40 feet away to burn it for signaling purposes, but left leg pained badly and I fell. Succeeded in doing nothing except getting cold, covered with snow and partially exhausted, so cleaned snow off, got back into bag feeling that crash area was probably pinpointed and that rescue could reasonably be expected next day if weather held good.

"Remained in sleeping bag for the rest of the night with isolated attempts to make voice contacts with numerous aircraft which crossed general area at various altitudes for next couple of hours. No success with voice contacts using URC-11. Sweat out weather all night long with little or no sleep and felt quite disheartened about three A.M. when sky became overcast and it began to sleet. Sleet stopped in about an hour and skies began to clear again and at daylight noticed that only scattered clouds were visible and felt chances of being picked up were good.

"During the night I had filled plastic canteen with snow and attempted to melt it by placing it between my legs in sleeping bag, but was successful in melting only approximately one-half cup of water in five or six attempts. Was conscious of being very thirsty but didn't want to eat snow to slack thirst for fear of lowering body temperature when cold was so intense anyway. Decided during the night that I would not eat any of my rations next day, or drink my can of water because I felt food was not an important factor for a day or so and figured I would melt snow next day for water.

If you've gone down with the aircraft, with certain exceptions, don't leave it. Individuals are hard for searchers to spot. If your position were known, or even your flight route, searchers have a good chance of finding the aircraft soon. So stay with it unless you KNOW you can make it to an inhabited place. But don't stay in the airplane. It will be like a refrigerator.

One of the hazards of extremely cold weather is frostbite. Unless you are alone, use the buddy system. Check each other every so often, especially around the nose, cheeks, ears and under the eyes. Sometimes small yellowish or white spots will appear. This area must be warmed immediately. Use a hot pack, if you have it, or a warm hand. Don't massage frostbitten flesh. You can make a hot pack in many ways but an easy way is to heat stones in a fire and wrap them in parachute cloth. Incidentally, your feet may get cold and damp. Don't try to change socks or massage your toes without first starting a fire.

Food may appear to be a big problem. But this problem can be solved. If you have a firearm—good. Chances are you won't. Then what? We've been teaching the use of traps and snares for years. We take students in to the high Sierras in wintertime and they make out just fine. The person who finds himself in a real survival situation can do as well if he'll remember what he's learned, doesn't panic, and gets on with the job. This is assuming there are more than one person or that a lone survivor is not immobilized by serious injury.

Survival under almost any conditions is possible. All it really takes is a little knowledge, common sense and the will to make use of both. Others have done it and so can you. ☆

Wanted to conserve rations in the event I wasn't picked up for a few days.

"At daybreak I ate second cube of sugar and gathered as many twigs as I could without leaving bag to have material for signal fire. Augmented fire material with strips of rubber from flaps on life raft and waited for sounds of aircraft.

"Used instruction booklet in survival kit as insulation for one hip while lying in sleeping bag during the night. Proved very effective. Combination of woolen face mask and helmet was effective enough so that I drew sleeping bag up tight around my neck and kept head out of bag all night long. Very cold and painful night. Later found temperatures were minus 30 degrees.

"About eight A.M. saw light civilian aircraft and T-33 in area. Again attempted contact using URC-11 and signal mirror, with apparently no success. Saw a C-54 and realized it must be a rescue aircraft and lit my small fire and continued using signal mirror when aircraft were in sight. Saw a helicopter pass approximately 200 yards to my left and on the other side of the ridge that I was lying on and feared my chute had not been seen in the tree tops. Might add that wind was terribly strong all night long and I could hear my chute being dragged through the trees and was afraid it might either be blown away or down to the ground. Actually it was only moved about 20 feet from its original position and remained quite visible.

"About nine-thirty helicopter returned to general area that I was lying in and I used signal mirror again. Became apparent that my chute and mirror had been seen and copter hovered about 50 yards away and paramedic was lowered through the trees on a cable. The sergeant plowed through the snow up the hill to my position and told me to relax that everything was under control. Gave me a shot of morphine, and I asked him to open my can of water and I drank it. He splinted my left leg and dragged me and my raft down the hill to a spot where the trees were thinnest and basket was lowered. I was loaded in the basket and hoisted to the

helicopter. About three feet below the copter the basket began spinning violently and I was half afraid I would be thrown out, but my fears were quieted when two men in copter steadied basket and I was drawn in to the interior of the helicopter.

"Suggestion: I feel that some sort of reliable radio must be developed for use in similar circumstances.

"I believe that flares should be a basic part of any survival kit. I would strongly recommend that if space is such a problem that ordinary flares cannot be included that cartridge flares for the twenty two hornet be included.

"I should think that some sort of ration with a high energy content is available and would taste somewhat more pleasant. When the helicopter began hovering in my area I opened one of the packages of food that I kept in my flying suit and started to eat it. I believe it was labeled cereal. It was the most unpalatable food I have ever tasted, and I have eaten pemmican and many other strange types of food. The nearest thing I can think of to describe the taste of the package that I opened is to call it a sour sawdust taste.

"I feel that items which are utilized strictly for rescue purposes, the radio, flares, etc., are extremely important to an individual who is down in any friendly territory.

"I believe that the inclusion of the sleeping bag in the kit is the most important single item that insured my survival, since my parachute was unavailable to me for use as insulation." ☆

Memories of Last Winter

It won't be long now until the kids will be building snow men, the car won't be as easy to start, the sniffles will be commonplace, the steps will be icy, mother will be upset at those who don't wipe their feet, fuel bills will be higher—these and many more sure signs will herald the coming of winter.

And those of us who receive a small additional stipend for flying will find that we will have to be a little more alert if we are to stay out of winter weather type trouble during the next few months. Snowflakes may be pretty fluttering down outside the picture window, but not so when that window is the curved glass of the aircraft windshield and we're wondering why the strobe beacon lights don't show up.

Maybe it would help a little if we went through the files of les miserables for last winter. We find that problems encountered were about the same as they've always been—wind gusts, visibility, turbulence, ice, lightning, snow and wet runways.

ICE

A flight of three F-84s departed for a midwestern base. The pilots were briefed on severe weather, but icing was not forecast. After 15 minutes in clouds at 39,000 feet all three experienced power loss and one aircraft flamed out during the subsequent descent to a lower altitude. The pilot ejected when restarts were unsuccessful.

During practice GCA approaches with weather 1600 broken, visibility 20 miles and temperature 20 degrees a B-47 suffered compressor blade damage to four engines due to ice ingestion.

An F-102 skidded off the taxiway due to melted ice and ineffective braking action. At the time, the temperature was 36 degrees. Successive flights had taxied out prior to the accident, melting the top surface of the ice.

LIGHTNING

A C-47 flew into an unforecast thunderstorm and was struck by lightning. Damage required replacement of the left elevator and rudder.

An F-104, on climbout, entered a thunderstorm and received a lightning strike. All radios became inoperative and several electrical systems were damaged.

The C-118 was flying at 17,000 feet on solid instruments with light precipitation and light turbulence. No buildups were observed by center radar or the aircraft radar. Forecast had been for ontop flight conditions in the area. The trailing edge of the rudder was damaged when lightning struck the aircraft.

A T-33 was struck by lightning while on an instrument approach. The aircraft was in clouds at the time and had been in a precipitation area for several minutes. Damage to the vertical stabilizer required 92 manhours repair.

While radar was being used to vector around thunderstorms a C-124 was struck by lightning, resulting in minor damage to the nose of the aircraft.

Power was interrupted on three engines when another C-124 was struck by lightning. The aircraft was at 10,000 feet, cruising through multi-layered strato-cumulus at the time. The pilot lost 3500 feet while engines were being returned to normal operation.

While circumnavigating thunderstorms at 7000 feet a C-130 was struck by lightning. The strike occurred on the right pylon fuel tank, causing explosion of residual fuel.

WIND GUSTS

An H-19 was blown on to its side by wind gusts which reached 63 knots. The aircraft had been tied down by a three-fourths inch tiedown rope which broke at the tiedown ring under force of the wind.

The right tip gear tire of a B-52 blew out on takeoff roll. Wind at the time was 60 degrees off runway heading, 21 knots with gusts to 28.

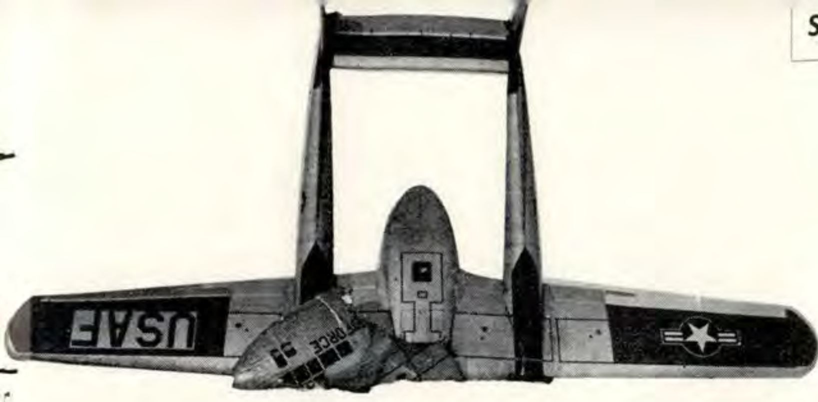
The C-47 pilot lost directional control during landing and got a wing tip. Weather was reported as 2000 scattered, 3000 broken, 20 miles visibility with wind northwest 13, gusts to 24.

Another C-47 received damage to the elevator hinges with the gust locks installed. The incident occurred during the early morning when winds were recorded as 20 knots with gusts to 38.

A B-52 ran off the runway during landing. Weather at the time was 500 scattered, 800 broken, with rain showers and a crosswind varying from 70 to 90 degrees off runway heading. Wind speed was 18 knots, gusting to 26.

Twelve hours after the above incident another B-52 ran off the runway while landing at another base in the same state. Weather was 1300 scattered, 4000 overcast, visibility five miles in light rain. Wind was 100 degrees off runway heading at 14 knots with gusts to 22. Contributing factors listed included: tire inflation for heavy takeoff weight, smooth ice grip tires and a wet runway.

An F-102 crashed after the pilot had ejected due to loss of aileron control. The pilot attempted a



landing without aileron control, but strong, gusty winds prohibited a safe landing.

An L-19 overturned during landing transition. Weather was clear, with only a four knot wind, but weather was listed as contributing due to the landing being made downwind.

A B-47 crashed during an attempted go-around. The right wingtip dragged due to a gust of wind in a critical phase of the landing. Pilot action resulted in over-correction. Wind was 60 degrees off runway heading at 17 knots with gusts to 23.

Both props of a C-47 were damaged when the tail rose during runup in a crosswind.

VISIBILITY

An F-100 porpoised during an emergency landing and the nose gear failed. The pilot had encountered rain showers on the final approach of a flameout pattern which contributed to a poor approach and a bad landing.

An H-43 rolled on its side after an emergency landing on an ice cap. The pilot suffered spatial disorientation due to a white out and was attempting to land until visibility improved.

An F-102 flew through tree tops one and three-fourths miles from touchdown on a GCA attempt. The pilot pulled up and successfully ejected. Weather forecast for this flight was 2000 scattered, 4000 broken and visibility three miles in haze. A weather advisory indicated that fog was forming and the pilot was recalled to base. Weather rapidly deteriorated during penetration, becoming 50 feet scattered, 200 broken and 0.3 in fog. Weather observations and pireps were not passed to the pilot during penetration.

A T-33 crashed three-fourths mile short of touchdown during a GCA. Weather deteriorated rapidly during penetration and was reported to the pilot as cloud base 150 feet with visibility 300 meters. Primary cause was listed as pilot factor, with a rapid change of weather conditions as a contributing cause.

A T-33 crashed after the pilots ejected due to fuel exhaustion. Two ADF approaches and a low visibility approach had been attempted, unsuccessfully because of the low visibility. Weather was 400 broken, 0.4 in rain with temperature and dew point at 43 degrees. Existing weather was lower than forecast and lower than reported to the pilot prior to penetration. Primary cause was attributed to an inaccurate letdown plate. Inaccurate weather reporting was listed as a contributing cause in that weather was below minimums.

An F-100 crashed east of the base with weather conditions of 900 overcast, one mile visibility in light snow, rain and fog. The pilot had previously diverted because of icy runways. Most probable cause was attributed to inadvertent entry into the clouds (tops 3500) and striking the ground during instrument recovery.

TURBULENCE

A C-47 encountered turbulence during a flight to permit passengers to inspect a ground facility. Minor injuries were sustained by passengers. They had been briefed on rough air, but had left their seats to obtain a better view.

A B-47, at 35,000, experienced turbulence sufficient to pop rivets on the vertical stabilizer. Weather was clear and turbulence had not been forecast.

Two crewmembers of a C-119 were injured when clear air turbulence was experienced during a search mission.

A B-52 encountered clear air turbulence at 33,000 feet during cruise with the autopilot on. Descent was made, with increased buffet and fishtail, until control was regained at 20,000 feet. Flight was over western mountains with a strong jet stream in the area.

An F-102 lost tip tanks due to a combination of turbulence and jet wash. The pilot was executing a tail intercept at the time.

A jet bomber struck tops of trees during a GCA. Weather was indefinite 400 feet obscuration with visibility one half mile in snow and blowing snow, wind north at 18 knots with gusts to 24 knots. Primary cause was severe turbulence associated with wind shear.

Another aircraft became uncontrollable and crashed after loss of the vertical stabilizer. The pilot had descended from 42,000 feet due to turbulence and was level at 34,000 feet in smooth air for less than one minute prior to encountering severe

Memories *continued*

turbulence and structural failure. The crew had been briefed to expect moderate to possibly severe turbulence on the lee side of the Rockies. Penetration of a mountain wave was listed as the cause of the turbulence. Weather was clear, visibility 20 miles and strong winds existed at all levels perpendicular to the mountain range.

In a similar type accident another airplane was lost when the vertical stabilizer failed as the pilot attempted to climb to avoid turbulence on a low level route. Light to moderate turbulence had been experienced and the climb was initiated when turbulence increased as the mountains were approached. Winds across the summit were over 50 knots and structural failure occurred in an area of probable severe turbulence associated with a mountain wave.

An upper electrical access door was lost from a B-47 during a jolt of severe turbulence. The aircraft was in clouds at 15,000 feet at the time.

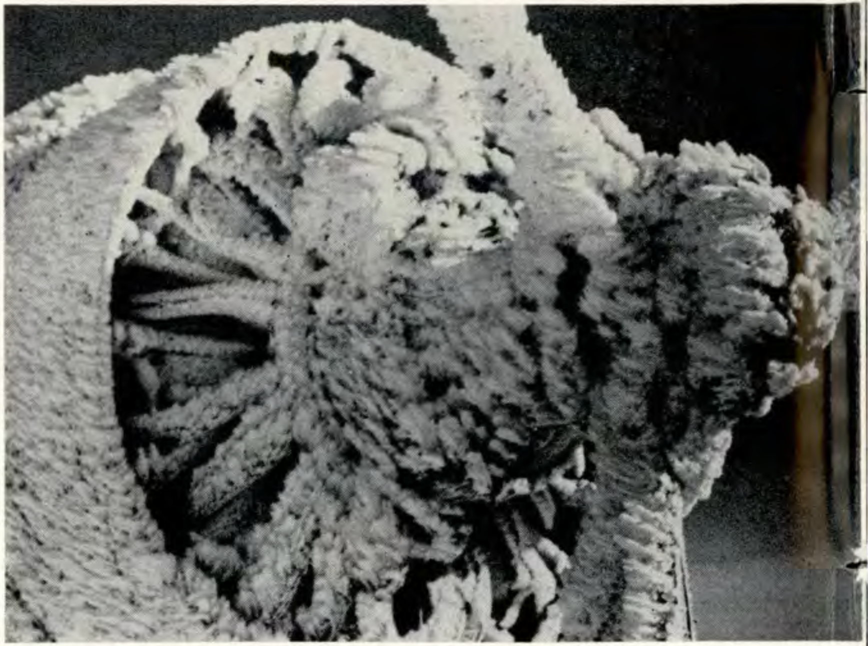
Fuselage skin was damaged and rivets popped on a B-52 that encountered a sudden, severe downdraft when thin cirrus clouds were entered at 35,000 feet. Control of the aircraft was difficult and the airspeed dropped. Climb was made to 37,000 and the flight continued with light turbulence.

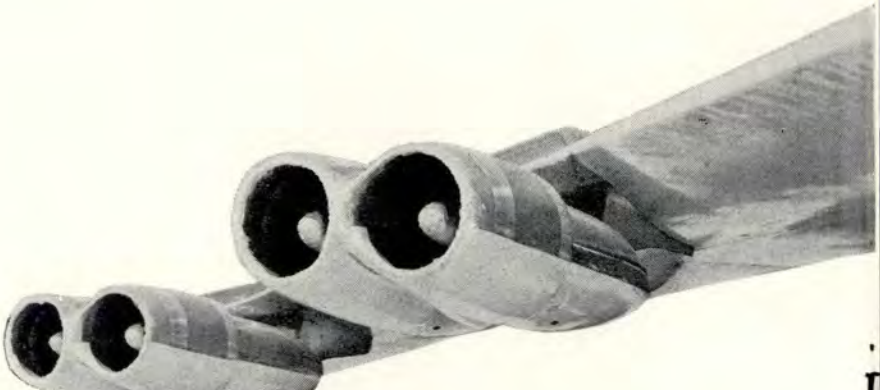
During preflight ice could not be kept off the aircraft due to freezing rain. Takeoff was attempted. A long takeoff roll was experienced. On roll out to level position the pilot lost artificial feel. Airspeed decreased and the aircraft began to buffet. Control could not be regained. The crew ejected.

CONCLUSION

We know what caused trouble last winter: gusty surface winds, restricted visibilities, turbulence, ice, lightning, snow banks and wet runways. Recalling experience from previous winter seasons, we know also that these seasonal weather hazards are not new. We can expect them to give us trouble again this winter. But reviewing what to watch for, and remembering other troublesome cold weather conditions may help all to get around more successfully during the end of 63 and the early months of 64. ☆

WINTER





ICING

General Electric Jet Service News

There is nothing new in this article, but it is being reprinted to remind you that ice and snow are ever-present and dangerous foes during winter operations.

Icing is one of the principal hazards of inflight operations. Ignoring the problems of ice on wings and other aircraft surfaces, ice in a jet engine inlet can play havoc. It restricts the inlet to such an extent that airflow is reduced, exhaust gas temperature increases, stalls may occur, and also chunks of ice breaking loose can cause compressor and inlet guide vane damage.

Inflight icing is not peculiar to winter flying but may be aggravated due to the extensive cloudiness during the winter months.

Clouds are usually the key to icing. They consist of droplets of water, usually supercooled. On impact the supercooled droplets freeze and adhere to aircraft surfaces.

Vertical movement of moist air causes clouds to form. As the air rises, it expands and the temperature drops. When the temperature falls below the dewpoint of water, it condenses and forms clouds.

The supercooling effect, the phenomenon whereby the water remains in a liquid state even though the temperature is below the normal freezing temperature of 0°C, is quite extensive.

The tendency to solidify is dependent upon the size of the water drops and temperatures may be well below 0°C, before freezing occurs.

However, if the supercooled water is disturbed as by an airplane flying through it, spontaneous freezing occurs. Some clouds do have ice crystals present in their makeup but these are of little danger.

There are two general types of clouds which must be considered: cumulo-form and strato-form.

The cumulo-form clouds are the towering, fluffy, thunderhead type. The strato-form clouds consist of layers and there may be several of these separated by clear air.

Cumulo-form clouds generally have a higher liquid water content than the strato-form clouds do. Due to the way they form, the cumulo-forms have an increasing liquid water content up to about 15,000 feet and then it falls off sharply as altitude increases.

The liquid water content of strato-form clouds shows a general downward trend as altitude increases. The higher the altitude at which strato-form clouds originate, the lower the liquid content.

If an airplane flies through these masses of supercooled water, icing may occur. The amount and type of icing depends, however, upon the outside air temperature and droplet size.

At temperatures below —12°C, icing is not a severe problem. Any ice which may form is of the "spear" or "streamline" type. The formation of this type of ice is usually limited. The ice that does form is easily removed with anti-icing systems, and engine damage is unlikely.

Between —12°C and —5°C, ice formation is of the intermediate type. It forms in relatively large pieces, is hard, and is the most difficult type to remove with anti-icing. It may cause severe engine damage.

At temperatures above —5°C, ice formations are of the mushroom type. This type is relatively easy to remove but it forms more rapidly than either of the other types. Sections of engine inlets can be bridged in a matter of seconds with this kind of icing.

Aircraft speed also contributes to the rate of ice formation. The icing rate is relatively constant up to an airspeed of about 250 knots. Above 250 knots the rate of icing increases.

Outside air temperatures above 0°C, do not preclude icing of engines. Inlet duct icing can occur with OAT as high as 5°C, without the formation of ice on the airplane external surfaces. At aircraft speeds below 250 knots, ram effect is low and little heat is generated. Pressure drops occur within the ducts with accompanying temperature drops. Freezing may occur within the ducts because ram effect heat is at a minimum.

Now what can be done to detect and prevent engine icing?

Ice formation on fixed inlet screens and inlet guide vanes of turbojet engines restricts inlet air flow. The compressor slows down, thrust decreases, and the fuel control senses the slow-down. It schedules a higher fuel flow. This causes exhaust gas temperature to climb. Therefore, when flying in icing conditions, suspect inlet ice if EGT begins increasing.

Three major factors, moisture content of clouds, temperature, and airspeed, contribute to icing conditions. Change these and icing can be avoided.

1. Avoid atmospheric icing conditions whenever possible. This means fly over, under, or around the clouds or fly at an altitude where the moisture content of the clouds is at a minimum.
2. If the temperature is in the range of 0°C to 5°C, airspeed should be maintained above 250 knots to minimize inlet duct temperature drop.
3. If icing is apparent on aircraft surfaces (temperature is below 0°C), reduce airspeed if possible to slow down the rate of ice build-up; change altitude or vary the course.
4. Whenever there is any possibility of icing conditions, carefully monitor exhaust gas temperature. If it starts climbing, you probably have an icing problem.
5. Don't forget the engine anti-icing systems. It's much easier to prevent ice formations than it is to remove them after they're there. ☆

Kilo Papas 4 through 8 — Century Series fighters on a training mission.

Point Bravo — GCA handover point.

Point Coca — Approach control recovery point (sometimes called Point Charlie).

Kilo Papa 2 — An inbound Century Series fighter.

Tango — A transport aircraft.

Homeplate Alpha — An Air Force base.

Runway B — Runway with sand and gravel on the approach end.

Snowflake — GCI control.

KILO CONFUSION

The story you are about to read is true. Actual identifications have been changed as true identities would serve no useful purpose. A list of the principal characters is printed initially as the reader may need occasional reference to avoid complete confusion during the course of events.

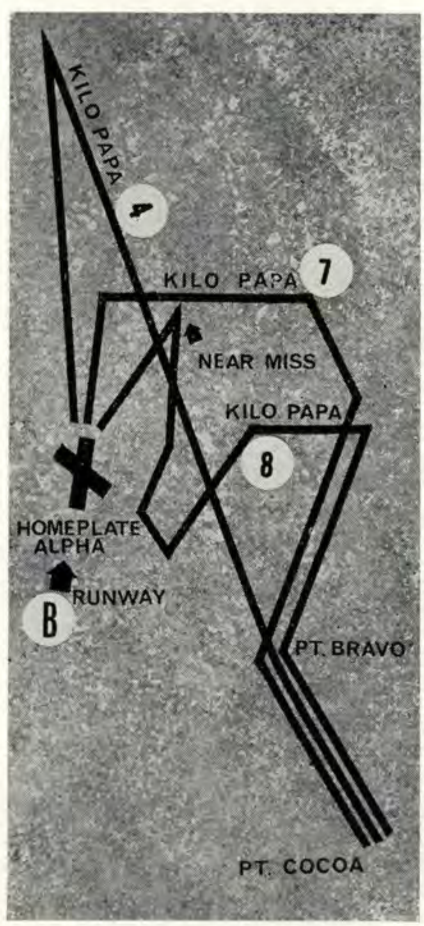
With the help of the above legend, and the partial illustration, it may be possible to accurately visualize the sequence of events. The article is being presented, not as a test of the reader's ability to concentrate, but, as an incentive for those who fly or support flying to be as professional as humanly possible.

Six fighter crews were scheduled and briefed for a radar intercept training mission. Weather forecast was 10,000 overcast, 10 miles, with a possibility of snow showers, but viz not to go below three miles. At 1445Z Kilo Papa 4, 5, 6, 7 and 8 departed Homeplate Alpha. Two hours fuel was aboard each aircraft, with 1:30 time en route. One aircraft aborted on the ground.

During departure the Squadron Ops officer noted that weather seemed to be deteriorating slightly. He advised Snowflake to change the en route time from 1:30 to 0:55.

Thirty minutes after the fighters had taken off the Base Ops Duty Officer advised the tower that Runway B would be closed to remove sand and gravel. At this time the weapons director at Snowflake notified the Intercept Directors controlling the Kilo Papa aircraft to recover the aircraft early; i.e., the aircraft would be over Point Bravo at takeoff plus 55 minutes. This was not passed to the Kilo Papa aircraft, nor was any positive attempt made to make good the early recovery times.

Meanwhile, Kilo Papa 5 reported a bent weapon and returned to the terminal area where he offered to fly target. Snowflake advised no targets needed so he elected to fly practice GCAs. The pilot reported that weather deteriorated on each successive GCA and he pulled up to measure the cloud bases on downwind. He reported to Approach Control that cloud bases were at 2500, intermittent snow. At that time, weather was being reported as 10,000 overcast, seven miles.



Before Kilo Papa 5 made his termination landing, the Mobile Control Duty Officer noticed that the wind had shifted to the southwest, 12 knots, and he requested that the active be changed to Runway B. The tower requested this change from Base Ops. The duty officer denied the request due to the sand and gravel. The Mobile Control duty officer then called the Base Ops duty officer for confirmation. Base Ops promised to coordinate with Squadron Ops and advise. Base Ops called the Squadron duty officer in the tower and asked which he preferred, landing the aircraft on the stones or with the tailwind. The duty officer in the tower said he couldn't make that decision, so Squadron Ops was queried. The decision was made to use Runway B. This decision was relayed to the tower at 1628. GCA began turnaround procedures and the fire department changed the jet barriers.

Kilo Papa 5 had made his termination landing at 1622Z and his PIREP of visibility one mile at 1500 feet in snow showers was entered in the base weather log at 1627.

At 1616Z Kilo Papa 2 took off, destination Homeplate Alpha.

At 1624 Tango departed Homeplate Alpha on a transport mission.

At the time the decision was made to change the runway, assistance was required to turn the GCA unit due to the wheels being frozen to the track. Approach Control advised Snowflake to expect a 10 to 15 minute recovery delay due to changing runways. Snowflake advised the aircraft and, since the base was reporting VFR, the pilots elected to hold at Point Coca at high altitude. These pilots were not aware of the fact that weather was deteriorating.

During climbout, Kilo Papa 2 experienced smoke and fumes in the cockpit, declared an emergency and was descended direct to the Homeplate Alpha area by Snowflake, since Homeplate Alpha weather was reported as VFR. Kilo Papa 2 broke out in the clear at 7000 feet, 22 miles southeast of Homeplate Alpha and was requested to make an airborne radar recovery since GCA was changing runways. Kilo Papa 2 had no airborne radar available, rechecked the weather as 7000 overcast, five miles and canceled IFR. Inbound, he found he was unable to maintain VFR at 1500 feet, informed Approach Control and turned to a heading of 135 degrees. He was instructed to contact GCA on channel 2. After several calls GCA answered and identified him on radar. Kilo Papa 2 was set up on search radar for vectors to Runway B as final approach scopes were not yet aligned.

At this same approximate time GCA advised Snowflake to begin feeding the four fighters in from Point Coca. Approach had been advised that the order of feed-off would be Kilo Papa 6, 7, 4 and 8.

At 1740Z Tango reported he was returning with an overheat light in his wing de-ice pneumatic manifold. He said he would have to descend to cool his wings before dumping fuel and that he would have to dump before landing. Approach advised Tango to contact GCA. GCA established radio and radar contact 21 miles east. Tango was cleared to descend to 2500 feet and at 11 miles was turned on a 170 degree heading. In the meantime Kilo Papa 6 contacted GCA at Point Coca and again at Point Bravo inbound at which time Kilo Papa 6 advised that he would be minimum fuel on final approach. GCA acknowledged. During the next few moments Tango interrupted the transmissions of other aircraft on four occasions while transmitting to GCA and, although the pilot did not declare an emergency, his transmissions during the emergency of Kilo Papa 2 and minimum fuel declaration of Kilo Papa 6 compounded the confusion that was beginning to develop. Also, Tango was icing up at 3000 and had to have a lower altitude.

Then, to add to the confusion, Kilo Papa 7, the second fighter scheduled inbound from Point Coca, called "Kilo Papa 8, Charlie." He was advised by GCA to report Bravo and squawk 3, dial 00. He rogered. Meanwhile, Kilo Papa 2, the one with smoke and fumes in the cockpit, was vectored to final approach. The tower, expecting Kilo Papa 7 to follow Kilo Papa 6, asked if 6 and 7 were flying formation, since 7 had inadvertently called himself 8. GCA didn't answer this question.

Shortly Kilo Papa 4, the third fighter scheduled inbound, checked in with GCA at Point Coca and was given an IFF mode to squawk. He requested the latest weather and GCA reported 7000 and five miles. Kilo Papa 6 heard this transmission and advised that he was at 2000 and still IFR. Soon after, Kilo Papa 7, using his proper call sign, checked in at Point Bravo. This is believed to have been confusing to GCA since Kilo Papa 8 was expected. A pause occurred, then GCA gave a pattern steer for Kilo Papa 6.

Now the tempo picks up! The tower informs GCA that Kilo Papa 8 will report Point Charlie in two minutes; Tango is now at 1500 feet and requesting permission to dump fuel. GCA gives Tango a steer and approves dumping. Tango questions the position of another aircraft at his altitude. Kilo Papa 4 calls two miles past Bravo. Kilo Papa 7 is turned to 010 degrees. Tango again questions GCA about the other aircraft at 1500 feet. Kilo Papa 4 calls Bravo. The tower clears Kilo Papa 2 to land. Kilo Papa 6 requests a radio check. Kilo Papa 8 reports Charlie. Kilo Papa 4 calls past Bravo and is steered to 340 degrees at 1500 feet. Kilo Papa 8 calls Point Bravo.

Saturation plus now, compounded by confusion stemming from the use of improper call signs, unnecessary radio transmissions and made serious by extreme weather conditions and unreliable GCA radar. GCA is using IFF returns to aid in the tracking of all the aircraft as radar skin paints are fading in and out due to the heavy snow showers.

Kilo Papa 2 lands on Runway B at 1649. The pilot reports to the tower that the weather is now 800 feet in snow with one mile viz.

The situation: Tango proceeding south, dumping fuel; four Kilo Papa aircraft under GCA control, minimum fuel, with landing weather near or below minimums.

At Point Bravo, Kilo Papa 6 is instructed to steer 360 degrees and descend to and maintain 2500 feet. He is subsequently cleared to steer 340 degrees and descend to and maintain 1500 feet and then to 280 degrees at 1500 feet for base leg. He is turned over to the final controller and declares emergency fuel on final approach. Kilo Papa 6 lands at 1753 hours with 1000 pounds fuel remaining. Meanwhile, Kilo Papa 7, the second aircraft, has been turned to 010 degrees at 1500 feet at Point Bravo with a subsequent pattern correction to 330 degrees. Kilo Papa 4, following Kilo Papa 7 from Point Bravo, has

KILO CONFUSION

CONTINUED

been cleared to descend to 1500 feet and steer 340 degrees. This places Kilo Papa 4 inside of Kilo Papa 7. Kilo Papa 7 meanwhile steers to 280 degrees base leg. Kilo Papa 7 maintains this heading at 1500 feet while Kilo Papa 4 is maintaining 340 degrees, also at 1500 feet, with Kilo Papa 4 being on the left of Kilo Papa 7. The pilot of Kilo Papa 7 momentarily glances up from his instrument panel and observes Kilo Papa 4 on a collision course in the 10 o'clock position, at approximately 100 yards. The pilot of Kilo Papa 7 pushes full forward on his stick and passes less than 100 feet below Kilo Papa 4.

To simplify ensuing activities for the reader, events concerning each aircraft will now be briefed, one at a time.

Kilo Papa 4, thinking GCA does not have him on radar, advises GCA of his position, heading and that he cannot make Homeplate Alpha on this heading. GCA advised Kilo Papa 4 to go to Approach Control. Eventually Kilo Papa 4 is again picked up by GCA at five miles on final. Landing is accomplished at 1700 hours with weather 500 obscured and one-eighth mile.

Kilo Papa 8 is turned over to final controller on dog leg to final. Contact is lost and the pilot takes up a heading to home the TVOR. GCA then asks Kilo Papa 8 to squawk flash, identifies him, and initiates a short pattern as the pilot reports he is below emergency fuel. Two and three-quarters miles from the end of the runway radar contact is lost, but the turn to final heading is given and the aircraft descends to 700 feet. Kilo Papa 8 passes over the end of the runway at 700 feet, makes a 360 degree left, descending turn, rolls out and touches down at 1702 hours with 600 pounds of fuel remaining. Weather is 500 obscured and one-eighth mile.

Kilo 7, turning for final approach, is given a 360 degree turn for traffic separation while Kilo Papa 6 lands. During the turn radar contact is lost, and the pilot attempts a circling approach, using the TVOR as a guide. The aircraft breaks out too high and a go-around has to be made. Radar contact is made. Again however, while in the pattern, a 360 degree traffic separation turn has to be made as Kilo Papa 8 makes his circling approach. After this turn, below emergency fuel, it is determined that if another go-around is necessary a pull up and ejection will be made. Landing is accomplished at 1705 with 400 pounds of fuel. Again, weather is 500 obscured and one-eighth mile.

That's the bucketful. All this transpired in the time span related. But it took investigators several days to unravel the sequence. The GCA controller was supersaturated. He had four aircraft without enough fuel to proceed to an alternate. Three of these became emergencies. All told, he had five emergencies, never less than two at a time. Kilo Papa 7 reported over Point Coca as Kilo Papa 8 at the time the controller expected Kilo Papa 7 to report. He thought that 7 and 8 were at Coca without separation as he was painting only one aircraft. Kilo Papa 4 reported Point Coca at this time and, after him, the "real" Kilo Papa 8 reported over Point Coca. Trying to unscramble this the controller either had two aircraft using the call sign Kilo Papa 8, or else Kilo Papa 8 had circled and reported twice over Point Coca. Remember too, that Kilo Papa 7 had showed up at Point Bravo without having reported at Point Coca.

Among the cause factors proposed by investigators are:

GCA did not have positive control with Kilo Papa 4.

Weather Service deficiency in that at no time were the involved aircrews, Snowflake, Base Operations and the fighter squadron given any indication that the weather at Homeplate Alpha was deteriorating.

Supervisory error in that Snowflake failed to recover the Kilo Papa aircraft in sufficient time to meet the approach time the fighter squadron ops officer had required.

Inadequate recovery capability for a high density traffic situation.

Aircrew error in Kilo Papa 7's use of the wrong call sign over recovery point. Aircrew error in that Kilo Papa pilots held over the GCI-GCA recovery point until fuel remaining dictated recovery at Homeplate Alpha, regardless of conditions.

Aircrew error in that pilots of the Tango and Kilo Papa aircraft used poor radio discipline.

The decision to change the active runway after Kilo Papa 4 had been airborne 1:43 and the other three fighters approximately 1:25.

It should be noted that all participants, and their parent organizations, do not agree with all findings enumerated above. The purpose of relating them here is only to enlighten the reader, not in any way to pinpoint responsibility. The real purpose of publicizing any situation such as this in which there may be less than desirable performance is to illustrate the seriousness of situations that can occur, and to remind readers that flying and supporting flying operations is an extremely challenging occupation with little margin for error. ☆

DON'T TAKE ME WITH YOU

This is an appeal. Studying the Air Force private motor vehicle fatality list on the day after Labor Day prompts it. Of one thing I am sure; the Air Force, like all society, includes some who are destined to achieve death by driving. This is fact; repeated on the average of more than once every day by my fellow airmen. I don't like it, or understand it, but I have to accept it. Because of this, my only defense is the plea, DON'T TAKE ME WITH YOU.

Airman driver of POV traveling east on State Road 24. Car left road and crashed into a utility pole. Death occurred 2 Sep 63.

Friday evening, when I left the base, there was a horribly mangled car, decorated with red smeared dummies, by the main gate. The car, I knew, was one in which three airmen had been killed. It was not pleasant to see, or think about. Some, I knew, would forget it once outside the gate. To them I voice my plea, DON'T TAKE ME WITH YOU.

Airman was a passenger in POV. Driver of vehicle lost control, crossed U.S. Highway 99, and hit a bridge abutment. Airman was thrown from vehicle.

Seat belts alone won't make you a safe driver. It takes more than a buckle and two pieces of webbing. Seat belts will give you a better chance if you won't drive safely, or if another unsafe driver hits your car. I want more than a belt. To those who use belts in lieu of care, I ask, DON'T TAKE ME WITH YOU.

Airman involved in auto accident. No details given. Date of death 1 Sep 63.

"I'm a good driver; it won't happen to me." Sure, I know many sincerely believe that. Nothing is as impressive as your own skill and confidence. Even though it's just for a brief moment, should your skill desert you, to you I say, DON'T TAKE ME WITH YOU.

Airman was passenger in POV driven by father. Driver apparently misjudged distance when passing a semi-trailer truck, and struck the rear of the truck.

Posters, safety articles, billboards, commander's calls, radio announcements, statistics . . . like water off a duck's back to some. To those of you who refuse to be impressed, again I say, DON'T TAKE ME WITH YOU.

Airman driving POV north on Highway 66 when he apparently went off the right side of northbound road and in driving back lost control, crossed center median, turned over, and was struck by southbound vehicle.

Your mother would understand my plea, and your father, and they would endorse it completely. In fact, until after the accidents, and confronted with the evidence, they would never believe their sons to be so irresponsible. I'm sure it is with their endorsement that I ask, DON'T TAKE ME WITH YOU.

Narrative portion of message garbled. Vehicle turned over on sergeant.

I'm certain that there is room for considerable improvement. I am also convinced — accident investigation reports have done this—that most of these accidents are preventable. Because they can be prevented, and because some of you won't try to prevent them, all I can do is plead, DON'T TAKE ME WITH YOU.

Airman driver of POV which swerved to left to miss a semi-truck while proceeding west on U.S. Highway 10. Car struck center divider and rolled over three times. Date of death 30 Aug 63.

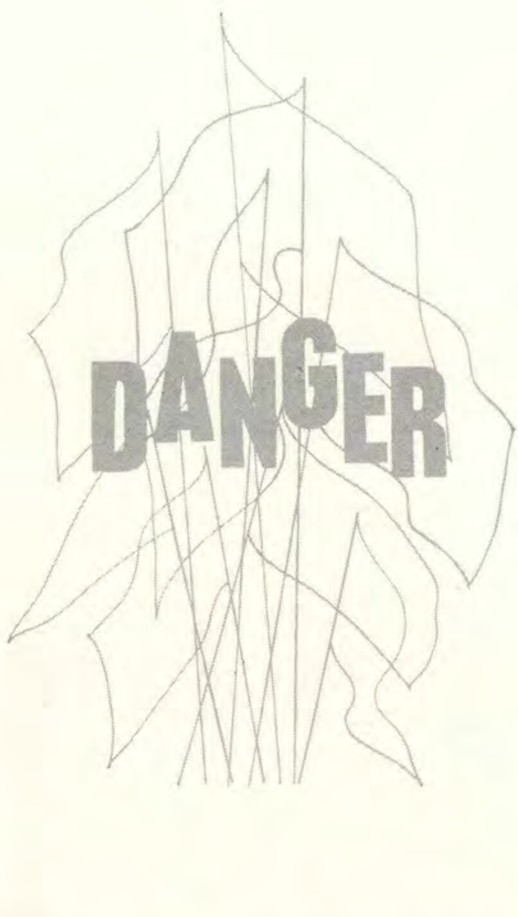
Sometimes, I realize, there are others who share the blame. But it doesn't matter, really, when you're dead. The loss, to your families and friends, is just as great, no matter who may share the blame. It's because I don't want to share this experience, regardless of who is at fault, I say, DON'T TAKE ME WITH YOU.

Airman riding motorcycle attempted to pass a vehicle and met an oncoming vehicle. When he swerved to miss the oncoming vehicle, motorcycle hit gravel on pavement causing him to lose control. Motorcycle rammed into rock wall throwing airman from cycle.

You see, it's because of the accident reports reported verbatim above — they're the ones for the Labor Day weekend — that I make this plea. I suspect that, eventually, it will be worse. Probably all of the injured haven't died yet. From this evidence, of a typical "holiday" weekend I can only conclude that little or no progress is being made in death by driving. If *your* life isn't an incentive, then there is little left but my plea, DON'T TAKE ME WITH YOU. ★

How many accidents could be prevented simply by heeding

WARNING FLAGS



Here, gleaned from an accident and an "almost" accident, are warning flags; warning flags that, *ignored,* led to hair raising experiences.

Come along as we join the flight deck crews, vicariously, and observe their reactions to the warning flags that were waved at them on landing approaches. They aren't the little warning flags that we expect to see when flight instruments fail — they are the big red flags that are expected to wave in the mind's eye of the professional pilot to signal a potential emergency.

In one case the first flag came long before the approach. It came when, en route, the flight engineer told the pilot that the Nr 1 oil temperature was higher than normal due to an inoperative oil cooler door. He advised that only limited power would be available from that engine in event a go-around became necessary. No problem; fit this bit of information into your approach planning in such a way that high power will not be needed from that engine. On the plus side is the fact that weather is 1400 scattered, 2000 broken, 6000 overcast with three miles viz and wind of seven knots, gusts to 16.

The second flag came on final. The copilot first sighted the field at two miles. The aircraft was at approximately 900 feet, on a surveillance approach, and one-fourth mile right of centerline. The pilot corrected to the left to line up visually. He lowered wing flaps to 30 degrees, permitted airspeed to taper from 135 knots to 125 knots, then lowered flaps to the full down position — he missed the warning flag that suggests not establishing a high drag configuration until the field is made, especially when he had been warned to not expect full power from all his engines.

The third warning flag was missed when, over one mile out, he reduced speed to charted 1.3 of 117 knots. This is minimum at start of flare — not necessary over a mile out.

The fourth warning flag was missed when, one mile out, he reduced speed to 110 knots. As most pilots know, this is going into the back side of the power curve which, particularly on final, spells nothing but trouble.

The fifth warning flag identified itself as a sinking feeling. Now, some reaction, but not enough. First, 40 inches, then 45 inches, then maximum power on Nr 2, 3 and 4 engines. Finally, the copilot, seeing they were headed for trees, slammed Nr 1 engine up to full power. An old rule of thumb, still a good one, is put your margin on the high side — the safe side — then back off what you find you don't need.

Now let's look at the other case, a similar situation of warning flags not heeded, but in a more condensed time span.

On final, with ceiling reported at minimums and visibility near minimums, airspeed was above computed speed for aircraft weight and the GCA controller reported the aircraft as high on the glide slope; as much as 200 feet at times, but 25 feet above glide path at middle marker. Both pilots reported seeing the runway at the middle marker at 300 feet (minimums).

Now for the flags:

• Neither pilot saw the approach end of the runway.

• Neither pilot saw the strobe lights.

• Neither pilot saw the threshold lights.

• Neither pilot saw the runway lights.

• Neither pilot saw the crossing runway.

• Neither pilot saw the intersection taxiways.

• Neither pilot saw painted markings on the runway.

• Neither pilot saw identifiable landmarks or objects nearby.

• Neither pilot saw the far end of the runway.

Eyewitnesses reported seeing the aircraft emerge from the overcast at altitudes varying from 20 to 300 feet. Two pilots, standing at the approach end, estimated cloud break at 150 feet. The tower local controller first observed the aircraft at 50 feet. A fellow pilot, riding as passenger, said the aircraft broke out at 300 feet, but he didn't see any of the lights that were on.

In all cases eyewitnesses on the ground reported that the aircraft flared, floated, and, still airborne, disappeared in a patch of fog.

Another warning flag was missed on this one. While the aircraft was making its final approach, runway visual range fluctuated rapidly. Investigators concluded this deterioration of RVR should have been called to the attention of the pilot.

Now for what happened. Let's go back with the low, slow, backside-of-the-power-curve types. Their aircraft leveled off, momentarily, as it crossed the first line of trees, then settled slightly permitting the nose gear, left main gear, Nr 1 and 2 props and left main wing flap to strike the tops of 55 foot trees 1750 feet from the end of the runway. The aircraft veered slightly left and the pilot initiated go-around procedures. During the go-around Nr 1 engine oil temperature rose rapidly to 160 degrees, with oil pressure still 65 psi. As the aircraft climbed out on crosswind Nr 1 began to backfire. Power was reduced, but backfiring continued and the engine was shut down and the prop feathered. Level off was at 800 feet, still under GCA control. A close-in pattern was flown. On downwind the flight engineer advised Nr 2 was losing power. Torque was 142 with oil temperature rising to 150 degrees and oil pressure at 60 psi. Approach was continued with turn to final approximately two miles out. About one mile out the gear was extended. An unsafe gear condition was indicated on the left main gear. The gear handle was placed in the emergency down position but the warning horn, warning light and gear indicator continued to show an unsafe condition.

Time did not permit determination of the cause of the difficulty and the pilot made another go-around. Max power was used on the three operating engines, flaps were raised to 20 degrees and the gear was retracted. A slow climb was made, still under GCA control.

As the aircraft turned toward downwind, Nr 2 engine began to backfire, with a loss of oil. Nr 2 was shut down and the prop feathered. Another close-in pattern was flown and a successful two engine landing made.

Inspection of the aircraft disclosed damage to the leading edge of the nose gear doors, the taxi light bracket and dents in the nose steering cover. Both ADF sense antennas and mounting masts were damaged. The left main gear down lock safety switch and the outboard main gear door were damaged. The left wing flap was bent and wrinkled at the inboard corner and in the area between Nr 1 and 2 engines. A ragged hole was torn in the flap. Nr 1 and 2 prop deicer boots were damaged and a large amount of leaves, twigs and branches was found in the Nr 1 and 2 oil coolers and engine cowlings.

Now for the other case. The aircraft initially touched down 3165 feet beyond the PAR touchdown point. After rolling a distance of 124 feet the aircraft again became almost airborne for an additional 614 feet, leaving just a trace of the left main gear tire mark on the runway. (Checking of performance data disclosed that approximately 1200 feet would be covered in dissipating each 10 knots of excess airspeed.)

At point of touchdown 3438 feet of runway remained. Runout terminated 420 feet beyond the end of the runway in 16 feet of water. Damage included loss of the two engines from the left wing and major damage to the fuselage at and below floor level.

It probably should be mentioned that one of these mishaps occurred in 1961, the other only three months ago. Fortunately for the people riding with these pilots, there were no injuries. ☆

Aerobits

RETURN WHAT YOU BORROW—It's a fine trait to have, for when the need arises and you have to borrow something, chances are you'll get it.

But, don't go to the extreme of being so eager to return something as one helicopter crewmember was, who borrowed a headset that belonged in a C-118. He saw the aircraft parked on the ramp and decided to return the set as the chopper taxied by on its way to pick up passengers. As the chopper rolled up even with the transport, the pilot heard a loud noise and looked out the window to see what was happening. He saw pieces of headset falling to the ramp and immediately shut the copter down so an inspection could be made of the forward rotor head for possible damage. There was a hole in the blade.

The crewmember who wanted to return the borrowed headset had motioned to a crewman of the C-118 to come over as he held up the headset to let him know he intended to toss it. The transport crewmember came closer, stopped outside the rotating blades area, and motioned for him to "throw it." He did. The headset went into the rotor path and was chopped to bits. Result: One less headset, and one blade damaged enough to require a change, plus a delay in takeoff for more than one hour.

SEE WHERE IT HITS—Following air to ground gunnery, an F-84 pilot brought his aircraft back to the ramp for postflight. It was discovered that damage had been done to the nose portion of the right pylon tank. Inspectors suspected "ricochet," especially since the brown smears on the tank matched the brown colored ammo. This was news to the pilot; he was unaware of any ricochet damage during this flight, and he was sure he'd made satisfactory pullouts and that no fouls were called. All this was corroborated by the range officer—there were no improper firing passes. He did state, however, that he believed ricochets that occurred recently were a combined result of the lower minimum dive angle (5 degrees) and lazy pullouts. The lower dive angle sets up a temptation for the pilot to take a "looksee." And as he watches his hit, without realizing it he makes a shallow pullout over the bullet impact/ricochet area.

It is recommended that range officers observe more closely all strafing passes for minimum dive angles, fouls and lazy pullouts. Might be a good idea to rebrief all pilots on this and other ricochet incidents. Fly the aircraft now, get the score later.

RIGHT SWITCH, WRONG POSITION—This F-86 pilot already had two conventional gunnery missions to his credit while assigned to another wing. Now—assigned to a different outfit—he was briefed to accomplish his third rocket, skip bomb and strafe mission. Yep, it happened. On his first dive bombing pass, he inadvertently placed the armament master selector switch in the wrong position and lost his tanks. Fortunately, there was no damage to the aircraft; the base, however, has taken action to prevent recurrence of such incidents.

- Pilots have been briefed to check and double-check the *positioning* of any switch. This must be checked *visually*. Counting the clicks is not acceptable.
- It has been emphasized that the first pass in each event will be dry. This will give all pilots extra time to recheck their switches.
- A project is under way to relocate armament switches in locations where it will be easier for the pilot to see them. Apparently the present location creates a definite safety hazard when they must be set and checked for position at high speed and low altitude in the gunnery pattern.
- A white line will be painted on the master armament selector switch at each selection to indicate proper alignment of the switch.

IMPROPER HANDLING OF BAGGAGE—A C-135 pilot sent in an OHR about the dangerous manner in which baggage was offloaded and onloaded. Apparently there were no supervisory personnel around to see how those big cartons, boxes and large footlockers were lifted by tiedown straps and lowered from the cargo door.

The pilot suggested using the loading ramp, but said that his suggestion was ignored. If a handle or strap were to break, the boxes and footlockers are heavy enough to injure personnel and cause damage to the aircraft. It is recommended that the passenger ramp (if cleared, of course), or a conevyor belt be used to facilitate the on and offloading of baggage.

T-BIRD—WILL IT OR WON'T IT? The September issue of Aerospace Safety had an article about an abandoned F-104 running errant; then over, about and into a T-Bird. The pilots in the T-Bird saw this deluge of F-104 scrap hurtling toward them so they tried a hasty withdrawal.

They got the canopy raised slightly before the 4's engine disconnected the T-Bird's batteries along with its nose section. The front seat pilot was in a hurry and by "Herculean" force shattered the forward section of the canopy with his back. The rear seat pilot was fastidious and carved a hole with one blow of his escape knife. They got out OK, but it could have been done more easily.

The canopy jettison system will fire with the canopy partly open, but the canopy will *not* eject from the aircraft. It will lift, breaking the raising chains, but will not leave the aircraft. Instead it will reach a maximum height then fall to a nearly closed position. The hinge pins will not shear, however the front seat pilot will be able to push the canopy up to enable exit.

The T-Bird Dash-One writer snafued when he wrote the Part III section, but responsible people are aware of this and changes are forthcoming. Jocks, circumstances will dictate action so be aware: The canopy will eject from the full closed position; the jettison system will operate in any intermediate position but will not eject the canopy from the aircraft. It can easily be lifted, however, to allow escape because invariably the lifting mechanism will break.

CHOPPER EMERGENCY—About once a year a USAF helicopter sheds a wheel or gear on touchdown and is lucky enough to get airborne again. When this happens, the pilot has his troubles, but very shortly he is going to prove how easy he can set the old crippled bird down if he can get someone to hep 'im. While the maintenance types are scurrying around looking for something to substitute for that missing leg, the spectators and experts begin to gather. Strange as it may seem, the helicopters are usually landed without further damage. Just about everything has been used at one time or another: barrels with board attached, old mattress placed on a bomb cart, jacks, sand bags, old tires, wooden cradles and hastily-constructed braces and slings.

A little preplanning and indoctrination for such an occurrence can save a lot of last minute sweating. A few suggestions are:

- Have readily available materials for use as pads on which to land the aircraft. Prefabricated padded cradles are recommended.
- Have a long extension cord with head set and mike that can be plugged into the helicopter intercom system. Be sure the cord is heavily weighted every few feet to prevent its being blown into the rotors. This

will aid in talking the pilot into proper position on the landing pad.

- Designate an area for the attempted landing of the helicopter. This area should be away from personnel, buildings and parked aircraft to prevent unnecessary damage or injuries from flying debris in the event the helicopter rolls over.
- Be prepared to refuel the helicopter in a hover if necessary. In one instance, this was successfully done from 55-gallon drums using a hand-operated pump. *This is a last resort emergency measure and extreme caution should be exercised.*
- When attempting to land the helicopter, clear everyone from the area (including fire trucks) except the person directing the helicopter onto the pad. On one occasion lead weights, thrown from a helicopter blade which struck the ramp, penetrated steel hangar doors over one quarter mile away.

Lt Col James F. Fowler,
Directorate of Aerospace Safety

Aerobits

B-47 "Q" SPRING ICING—For nearly two years the B-47 has been without an anti-icing capability for the rudder-elevator "Q" spring. This problem is programmed to be cured in the near future; however, some B-47 pilots stand a good chance of experiencing "Q" spring icing before the fix can be put into the entire fleet.

All B-47 pilots who have experienced loss of artificial feel will immediately recognize the "sloppiness" in the elevator axis of the control wheel, but those who haven't are in for a few real thrill-filled, sporting moments—especially if on a low-level sortie during IFR conditions at night.

Some time ago an experienced aircraft commander lost artificial feel due to "Q" spring icing and gyrated through over 10,000 feet of airspace on a "pop up" with several roller coaster-like climbs and dives before finally regaining control of the aircraft at 14,000 feet. At one time during these didos, the airplane was

less than 1,000 feet from the ground and could easily have wound up an "undetermined" statistic.

One not-so-fortunate pilot took off from a diversion base under known icing conditions after some discussion with his home base. After takeoff and landing gear retraction, the gear indicators showed an intermediate indication. While trying to solve the landing gear retraction problem, loss of artificial feel was experienced and control of the aircraft was lost. Shortly thereafter the crew abandoned the aircraft before it crashed, but the pilot suffered fatal injuries.

The purpose of this article is to forewarn all B-47 pilots, and particularly newly upgraded aircraft commanders, of the hazards associated with "Q" spring icing which results in loss of artificial feel.

Play it safe and become intimately familiar with the proper emergency procedures.

Lt Col David J. Schmidt,
Directorate of Aerospace Safety

FLIGHT PLAN DEVIATION—A pilot sat at his desk working on his AF Form 21A. His flight was to be a round-robin with two passenger stops. His first point of intended landing was about a one-and-a-half-hour flight. He could go two ways: He could go SID to Haven LF and then direct via V-32 to his first planned stop; or he could go to Haven LF then via V-32, V-32N, V-8, and then finally V-32 to his first intended landing.

The pilot elected the latter and entered this routing on his Form 21A. After all this nice planning, however, he didn't follow through. He went to Base Operations, filled out his DD Form 175, listing an IFR SID departure to Haven, then direct V-32 to his first landing. This was his first consideration in his preflight planning, but not what he charted on his Form 21A. The request for IFR clearance as proposed on the '175 was approved by FAA and the flight departed.

En route, the pilot reported to the ARTCC that he was over Milton intersection. This was the intersection of V-32N and V-8, according to the '21A, but not where he should have been, according to his approved clearance. This was, of course, disconcerting to the air traffic people. They made a note of the incident and charged the pilot with an alleged violation of Civil Air Regulations. Since this was quite a deviation from his approved flight plan, the Air Force investigation substantiated the FAA report and the pilot received appropriate disciplinary action.

Although the flight was conducted in VFR conditions and proper vigilance could be maintained, serious consequences could have developed from failure to adhere to approved flight plans. The only excuse for a deviation is an emergency where safety of flight is paramount.

Harrie D. Riley,
Directorate of Aerospace Safety

LAST MINUTE CHANGE—Recently a B-52 aircraft commander was giving his copilot a landing during gusty crosswind conditions with the wind shifting rapidly. The AC took over *just prior to touchdown* and called for the drag chute as the aircraft touched down. Almost immediately, the aircraft became airborne to approximately 20 feet and then dropped off the right wing, damaging the tiptank and causing a bad fuel leak. The AC forgot to extend the air brakes on initial touchdown. This would probably have prevented the ballooning action which was caused by a strong gust. Gusty wind with rapidly shifting wind direction does not appear to be a good time to be giving your copilot a landing. Safe landings under marginal weather conditions are accomplished through good crew coordination and following checklist procedures. In this case, the change of control at the last minute disrupted the normal checklist procedures and resulted in the omission of a critical item. ☆

Lt Col Robert P. Rothrock,
Directorate of Aerospace Safety

CORRECTION

October Aerospace Safety, page 24, the article, "Make the Sharks Work For It," contains a typographical error in the Technical Order number. The number should read TO 14S3-2-1, par 5-4(c)., section V.

WELL DONE

CAPTAINS

Robert K. Simm • Harry F. Zahn

Captain Robert K. Simm, ATC Pilot Training Standardization/Evaluation Board, Randolph AFB, and Captain Harry F. Zahn, III, 3560 Pilot Training Wing, Webb AFB, were flying a check ride for Spin Instructor Certification in a T-37. After recovery from five spins, with normal responses to control pressures, the aircraft was placed in a spin for an attempted recovery by holding full pro-spin rudder while moving the stick forward. During recovery, Captain Zahn commented that the recovery rudder (left) seemed mushy; however, a normal recovery was made. Shortly before returning to level flight, a loud noise was heard and the aircraft immediately pitched down to a near vertical attitude. The rudder had fallen to the left, 90 degrees, and was lying on the left elevator. This forced the aircraft into a vertical dive. The 4½ negative G maneuver was so violent, Captain Simm's helmet was shattered on impact with the canopy. The aircraft could not be returned to level flight because of a restriction in aft stick travel. It took the efforts of both pilots to forcibly pull the stick back to raise the elevator enough to break off the damaged rudder. As soon as this was done, the aircraft came back to level flight.

The crew was advised by another pilot that the top section of the rudder was missing and the portion remaining was cocked 45 degrees to the left. Rather than destroy a valuable training aircraft, they elected to simulate a landing approach at altitude to see if a landing could be made. This indicated that positive control was available down to 110 KIAS. However, because of a strong crosswind at Webb they were advised to eject; instead, they diverted to a nearby municipal airport and made an uneventful landing.

A missing nut caused this incident—the nut that holds the rudder in the brackets. Further investigation revealed that the bulkhead assembly was improperly installed, which—with the missing nut—permitted the rudder to be raised high enough by the air loads to clear the top and center pins, causing the rudder to tear away from the elevator cut-out. The decision of Captains Simm and Zahn to remain with their aircraft permitted determination of the exact cause of the incident. Result: All T-37s at the base were inspected, thus preventing a recurrence of this near-accident. The knowledge of the aircraft and the superb airmanship demonstrated by these pilots under adverse conditions are worthy of commendation. To Captains Simm and Zahn for an outstanding performance, WELL DONE! ☆

Rog Tower, I saw the runway at 300 and one half.

Bad! Man, I caught a greenish glow, figured I was over the approach lights, held my heading and spiked her on.

TWO POINTS OF VIEW

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