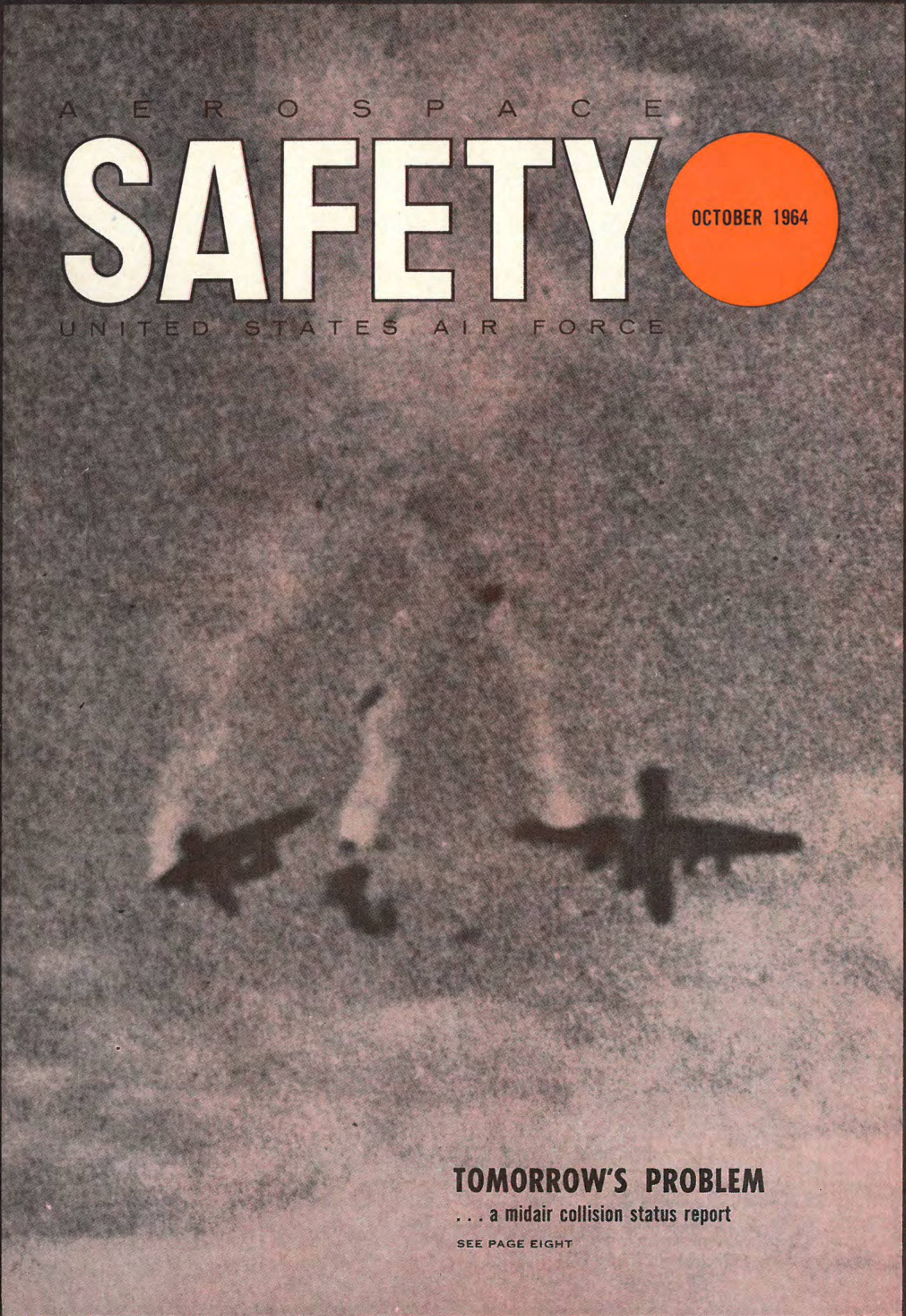
A E R O S P A C E

SAFETY

OCTOBER 1964

UNITED STATES AIR FORCE



TOMORROW'S PROBLEM

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AEROSPACE
SAFETY

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AFRP 62-1 OCTOBER 1964 NUMBER 10

FALLOUT

WELL DONE AWARD

In a recent survey, in answer to the question "What can be done to further reduce the number of accidents?" I recommend that the AEROSPACE SAFETY's "Well Done" and INTERCEPTOR's "We Point With Pride" programs be canceled or drastically revised. I make this recommendation because far too many pilots are publicly praised for saving aircraft when one salient point is overlooked. That is bad judgment. The pilot in one brief referenced in the survey might as well have shot himself in the left temple, *but if he had made it,* he probably would have received a "Well Done!" Bad judgment is bad judgment. If a pilot elects to take a chance in a marginal situation and things are going right for him that day and he "lucks it in," he is to be congratulated on his good fortune, not on his good judgment. Please stop telling him what a skillful fellow he is. Stop telling the entire Air Force what a splendid job it was, when two pages before, Pilot X who tried it and bashed is held as an example of bad judgment.

Let's not make success the tight rope between "Well Done" and "Pilot Error." The adage "You can't argue with success" has no place in accident prevention programs, because Pilot Y, reading about Pilot X and his "cool and accurate evaluation" and "high degree of professional skill" may be encouraged to try a duplication or even to exceed Pilot X and his deed.

Not all awards of course are to lucky pilots who took a chance and made it, but enough do creep in to make another person wonder a bit how he would react if he were involved in a similar situation.

If a pilot saves one through a combination of skill, luck, and questionable judgment he deserves a word of thanks, a congratulation on his fortune and skill, and perhaps a word or two on how close he came to being a bum. But let's have it at the bar with the C.O. and the troops, not splashed in a magazine with "Safety" in its title and accident prevention in its purpose.

Capt. Ronald B. Weinert
Flt Cdr 190 FIS, ANG
Boise, Idaho

The criticism above has been voiced before. "Well Done" nominations (AFR 62-9a) are screened by a Board of Pilots at DTIG and only those whose accomplishments are attributed to good judgment as well as skill are selected for the award. Recognition is considered an important aspect of accident prevention and "Well Done" awards are a part of the USAF recognition program.

Dash Ones and other directives attempt to provide guidance for all anticipated situations and they are to be followed. Such directives, augmented by good pilot judgment, are expected to provide the best assurance of safety in any situation.

SAVINGS WITH SAFETY

We've been hearing a lot for some time now about economizing, cutting costs where possible, looking for new ways to do things better and cheaper. The label for the whole effort is Cost Reduction and a number of projects have been placed into effect, for example, Project Ice.

Efforts to this end have taken many forms. "Why Use Two When One Will Do," over paper towel dispensers; "Turn It Off," referring to electric lights. Some of these efforts are aimed at saving pennies, others are massive campaigns with far reaching effects. The list could get pretty long and there's no use repeating all the slogans that have been coined to publicize this subject.

The point is, the nation and consequently the Air Force, does not have unlimited resources. We're all taxpayers and we feel the bite when Uncle takes his bit to keep this country operating. Therefore it is of interest to us all to keep costs to a minimum, but we can't always be looking at the other guy and worrying what he's doing about it. The place to look is closer to home. What am I doing about it? How can I contribute to the effort which in the final analysis will directly benefit me?

One of the best places to start, in my opinion, is in accident prevention. Obviously if the destruction of an aircraft or a missile can be avoided a tremendous savings will result. How much does a B-58 cost? Or a Titan missile? These are big, extremely expensive pieces of hardware and the savings are big. But what about some not-so-expensive items that when added up run into those big millions of dollars figures?

A rock on the runway causes a tire to blow out on a fighter plane. Another aircraft sucks up a bolt into the engine intake causing an expensive overhaul plus an aircraft out of service. A tug towing a missile backs into the side of an aircraft. A set of chocks not used allows a transport to roll into some parked equipment causing extensive damage. Failure to use a safety cable allows a propeller to fall from an A frame —the prop is damaged, but more serious is the loss of the airman when the prop hit him in the head and killed him.

Pick any kind of mishap you like, from the everyday nickel and dime type up to the more weird ones such as the use of oxygen instead of nitrogen to purge the fuel tanks of a B-52, which caused a fire that destroyed the bomber. It has happened somewhere sometime. Trouble is, we know that any kind of mishap you want to mention CAN happen again. And it can cause the loss of an aircraft, or a missile, or a life.

I started out talking about cost reduction, now I'm on the subject of accident prevention. Well, cost reduction may not save lives or prevent accidents, but it's a safe bet to say unequivocably that accident prevention is cost reduction. So while we're thinking up slogans and issuing certificates for achievement in cutting costs let's remember that we've got a great big area here where we can save the Air Force millions of bucks, a lot of lives and combat capability in the simplest way imaginable—by just doing our jobs correctly.

This has the ring of a sermon about it, but no matter how you look at it you can't get around the fact that resources can be wasted through carelessness, stupidity and ignorance. Carelessness is a personal thing, something each of us can do something about. Stupidity must be eliminated. Ignorance can be overcome by training and good supervision.

How about it, can't we get a real cost reduction program going by doing everything possible to eradicate what we all know are preventable accidents? ☆

Jay T. Robbins

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

The Accident That Didn't Happen

If it had, could the cause have been found?

Maj Frank L. Hettlinger, ANG, Hulman Field, Terre Haute, Ind.

It was a beautiful Sunday morning and the weekend cross-country trip had gone well. The mission for the day was to return to my unit, deployed 1500 miles from home station. For the F-84F, this meant an intermediate stop, but with excellent weather across the entire route, I anticipated a "no sweat" flight.

Immediately after my wingman and I became airborne at 1300 hours, he informed me that his landing gear handle would not go to the up position. After several unsuccessful attempts to retract his gear, we decided to abort the mission.

Back on the ground, I was notified that an ORI Team had arrived at the deployment site, and since I was the operations officer, I was to return ASAP. This bit of, "the last thing I want to hear," type of news was to haunt me all the way back.

We again became airborne around 1530, with my wingman using the override system to retract his gear. An uneventful two hour flight brought us to our intermediate stop where a fast one hour turnaround provided us with food and fuel.

We gained an hour at this point and were going to gain one more before arriving at our destination. We decided not to reset our clocks until we landed. Takeoff then was made at approximately 1900 hours. This time I flew the wing position to spread the workload around a bit. Darkness prevailed the last half of the flight which demanded a higher than normal degree of attention. One hour and forty-five minutes later we taxied into the parking area.

I was greeted by troops in various states of confusion and handed all the TWX's that had been received relative to the ORI. The first task was a head count which revealed only about 60 per cent of the pilots available. The remaining 40 per cent were spread out on rotational and other TDY exercises. A majority of the 40 per cent were the flight commanders and assistant flight leaders, since all requirements for these duties demanded "well qualified" people.

A schedule was made up for the next day's flying. This consisted of 12 sorties of dive bomb, skip bomb, rockets and strafing in the morning, and 8 low level LABS sorties in the afternoon. Another fly in the ointment! No published low level routes for this base. After considerable effort a group of us drew up an acceptable route terminating over the LABS target. By golly, I'm tired. A check of my watch shows 0200! Time to reset to local time, midnight. Now I didn't feel so bad.

All the details taken care of that I could think of, I headed for the shower and hit the pad around 0100 hours local time. But I couldn't sleep. All kinds of ideas, notions, thoughts, etc., ran through my mind. Seemed like I was checking my watch every five minutes too. The night dragged by slowly and finally it was 0430. Time to get with it.

Breakfast tasted good, and I felt pretty good. A mass, painstaking briefing was held at 0600 hours. None of us had ever dropped a bomb or rocket on this range, and very few of us were lucky enough to get some strafing in before the weekend. Nevertheless, we pressed on under the pressure of pencils in the hands of the emotionless inspectors.

The tight schedule required the services of every pilot, including myself and the squadron commander. I was the flight leader on the third flight of four aircraft. We found the targets OK, but it was apparent that there weren't going to be many in the scoring column by the end of the day. I was getting somewhat disgusted with the whole thing by now. Felt a little tired, too.

During the lunch hour, I compared notes and prepared for the afternoon's missions. I found myself scheduled to fly the fifth low level and LABS sortie. Seems like the theory was to get the more experienced lads on this phase to try and salvage a portion of the day's activity.

Walking to the aircraft, I can remember having that feeling of heaviness of limbs and of someone tightening a band around my head. I knew I was dead tired, but I was still thinking straight. A fast walkaround of the bird, then I cranked up and made good my takeoff time to the second. Sure was tired though! Been tired before, but this had a new twist to it. Caught myself narrowing my attention to fewer items than I was used to. Oh, well. So what? The bird's running OK. Only thing I had to do was hit my low level starting point on time and make good that bomb impact time.

Time to hit the deck. Down I went, leveled off a good 500 feet above the ground, set course and airspeed and passed over the shack near the railroad track right on the money.

The first leg went like clockwork. Most of it over flat desert. I was hacking checkpoints within 15 seconds, but I wasn't enjoying this trip at all. The heat in the cockpit wasn't helping matters either. The second leg required climbing over some 5000 feet high mountains and quite a few altitude changes along the route.

Seems to me I'm doing a lot of mechanical flying on this flight. Watch it, boy! The ground got awfully close that time. Running 20 seconds slow on that checkpoint; need a bit of power to catch up. Looks a little high now. What kind of low level run is that? Get it down where it belongs. Thirty seconds fast on the next checkpoint. What gives? Back off with that throttle. Come on, keep it at 500 feet!

On the last leg now and having a fight with myself. Keep thinking to heck with the whole thing, but I had to keep pushing and get this chore over with. Felt tight all over and sweating like blazes. There's that last checkpoint before power pushup. Time looks good. Should be picking up that run-in line about now. Yeah! There it is! Full bore now. Need 504 knots indicated for this run.

I checked in with the range controller who cleared me in. About a minute to go now. Speed almost on. Uncage gyro. The range controller's voice comes through my headset loud and clear. ". . . running in on the wrong run-in line, abort your pass." Abort, hell! I remember briefing about this possibility and know that the correct run-in line was off to my left and parallel to this one. I racked the '84 into a steep bank to the left, picked up the right run-in line and rolled out on course. Geez! Nearly blacked out on that correction. Don't forget the switches! There's the target. Ease in on that 4-G pull, now! Up over the top, roll off and check over the shoulder for the hit. Better turn my switches off. What the . . .? They're all off! Can't be! I swear I turned them on.

The range controller called a hit well outside the ballpark. Sure enough, there's the smoke! So what, who cares anyway? But what about those switches? Right here I have a flash realization that I must be doing things without thinking about them. Seems like the whole flight has been going this way. I better get this "Hog" on the ground, but fast!

I called the tower for landing instructions. Nothing new here. Same old story about a right break; call the initial approach. I screamed down into a descending turn to the initial approach, knowing all about some local procedures describing the correct way for entering traffic. Who needs 'em? I called the initial approach and the tower requested a gear check on base.

I broke hard left. Halfway around the break the tower explodes, "Right break! Right break!" I got the message and mumbled out loud, without pushing the mike button, something about everybody ought to relax. I immediately whipped that '84 into a 90-degree turn so as to roll out on a half-decent down-wind leg. Somehow I managed to put the gear down and landed without further incident.

I don't know what I did the rest of that day, but I do know I couldn't care less about anything. I didn't know how bad a physical and mental shape I was in until the next day after a good night's sleep. The more I thought about the way I conducted that flight and the irrational thinking I had performed throughout that day, the more I shook all over. It was apparent to me then that I had experienced a serious condition associated with fatigue.

All that I have ever read or been told about fatigue since then has made an alarming amount of sense. And I wonder sometimes how many of us have to experience it before we are really made aware of its causes and consequences.

The final question then is, if an accident had occurred, how many investigators would have considered fatigue as the primary cause? ☆

...THE ONE THAT DID

NO ESCAP-ABILITY?

Robert H. Shannon, Staff Safety Officer, Life Sciences Div, DTIG

The lack of a reliable low speed, low altitude escape capability was tragically demonstrated in a recent F-104B accident when two pilots attempted ejection during a landing emergency. Both pilots were killed because of insufficient time for completion of the ejection sequence.

Accident investigators determined the following as the most probable sequence of events:

Approach and touchdown were apparently normal. About 400 feet after touchdown, which was slightly in excess of 1000 feet from the approach end, the aircraft veered right and the right tip tank fins struck the ground. The aft portion of the right tip scraped intermittently on the runway for another 941 feet, at which time the aircraft went off the right side of the runway. It continued through the soft, sandy infield between the runway and an adjacent parallel taxiway, across the taxiway, coming to a stop some 240 feet beyond the taxiway. The underside of the fuselage was damaged extensively and the landing gear system was destroyed; however, the aircraft was essentially intact.

The pilot in the front cockpit ejected midway between the runway and adjacent taxiway. The trajectory height of the seat/man mass was estimated by witnesses to have been slightly over 80 feet. Seat separation occurred at the apex of the trajectory but due to insufficient aerodynamic drag, the parachute did not deploy. Forward speed of the aircraft at time of ejection was just under 100 knots which is less than the minimum speed listed in the Dash One.

Investigation of the pilot's egress system disclosed that the T17E4 Seat Thruster failed to retract and lock, resulting in failure of the primary M-27 initiator to fire. The secondary or backup initiator took over and fired the catapult normally. All other components of the egress system functioned properly.

The rear cockpit occupant ejected two to three seconds after the pilot and in the vicinity of the taxiway. There were no witnesses who observed this ejection. The seat impacted in trees alongside the taxiway while the rocket motor was still burning, consequently it is believed that the ejection trajectory was very flat. The ejection probably occurred when the aircraft was in an excessive left wing low attitude as it skipped across the taxiway at a speed of approximately 50 knots. The man separated from the seat but the shroud lines of the chute were found intact within the quarter bag. Heat damage to the rear canopy disclosed that the canopy adequately protected the occupant from the rocket blast of the front seat.

The reason for the ejection of the crewmembers could not be determined; however, as the aircraft was veering in a right arc, deceleration forces forced the pilots against the left side of the cockpit and probably caused them to believe the aircraft would roll. This is considered to be a deciding factor which influenced the ejection decision. The tragedy of this accident is that in all probability neither pilot would have been seriously injured had they not ejected, since the aircraft remained upright.

It is difficult to assess the pilots' decision to eject in this case; obviously, they made a wrong decision, however, had the aircraft rolled they may have been seriously injured or killed.

This accident again re-emphasizes two very important points:

First, the decision to eject or not to eject under such circumstances must remain with the pilot. Second, there are too many variables, usually peculiar to each individual case, to establish specific guidelines.

Some history of previous ground ejections and emergency landings may help you to formulate a plan of action in the event you are confronted with such a decision. From 1955 through the end of 1963, there

were 34 ground level ejections from USAF aircraft. In the majority of these, the conditions at time of ejection were non-survivable, in that little or no forward speed prevailed. Of the total, 18 (53%) resulted in fatalities; 15 (44%) crewmembers received major injuries and one was uninjured. It must be emphasized at this point that in only one of the successful ground ejections was the system used as designed and under conditions necessary for survival. In this case, at the time of ejection the aircraft had a forward velocity of between 200—220 knots and all components of the escape system functioned perfectly. In other words, this man had everything going for him. In the other 15 cases, survival was attributed to a lot of luck and not the complete operation of the system (seat separation and fully deployed chute).

A study of survival following controlled crashes, by Col Emmert C. Lentz, Chief, Life Sciences Div., Assistant for Medical Services, disclosed that during the 2½-year period, 1 January 1960—30 June 1962, there were 317 such major accidents involving jet fighter/jet trainer aircraft. These accidents involved 427 total personnel with 26 (6%) fatalities and 47 (11%) major injuries. Six of the 26 fatalities resulted from ejection and are included in the above. Thus, only 20 fatalities occurred during controlled crashes. This represents one fatality for every 21 crewmembers exposed as opposed to one fatality in every two ground ejections. Colonel Lentz' study also disclosed that entrapment due to a crash landing is remote. Only three fighter/trainer aircraft ended up inverted. Modern aircraft show a remarkable resistance to flipping onto their backs or to cartwheeling. Entrapment in a fighter/trainer type, due to inability to open the canopy, also is a remote risk.

On the basis of these data it is readily apparent that (once the aircraft is on the ground) the chances of survival in a controlled crash are far greater if you stay with the aircraft. This is particularly true since we DO NOT YET HAVE A TRUE ZERO-ZERO ESCAPE CAPABILITY. In the case of a catastrophic sequence of events that can only terminate in a fatality, such as a high speed collision with a tree, ditch, etc., then perhaps ejection would be the only alternative.

The other point to be emphasized is that a forward speed of 120 knots is a prerequisite to our present zero altitude escape capability. The present rocket assisted seats do not provide sufficient trajectory for completion of chute deployment. The zero altitude capability as outlined in the Dash One was determined through flight and sled tests. Operational experience has repeatedly shown that successful escape under these conditions is contingent upon an IDEAL situation.

Improved low and slow ejection capability is currently being tested for the F-106. Efforts will be made to achieve a zero-zero capability during these tests. This will be accomplished primarily with a high energy rocket catapult, capable of obtaining trajectory heights in excess of 400 feet. A similar catapult is scheduled for installation in the F-105.

This headquarters will continue to lend all possible support to help obtain an optimum escape system for USAF aircraft. Other encouraging component improvements receiving attention at this time include drogue chute stabilized seats and forced parachute deployment.

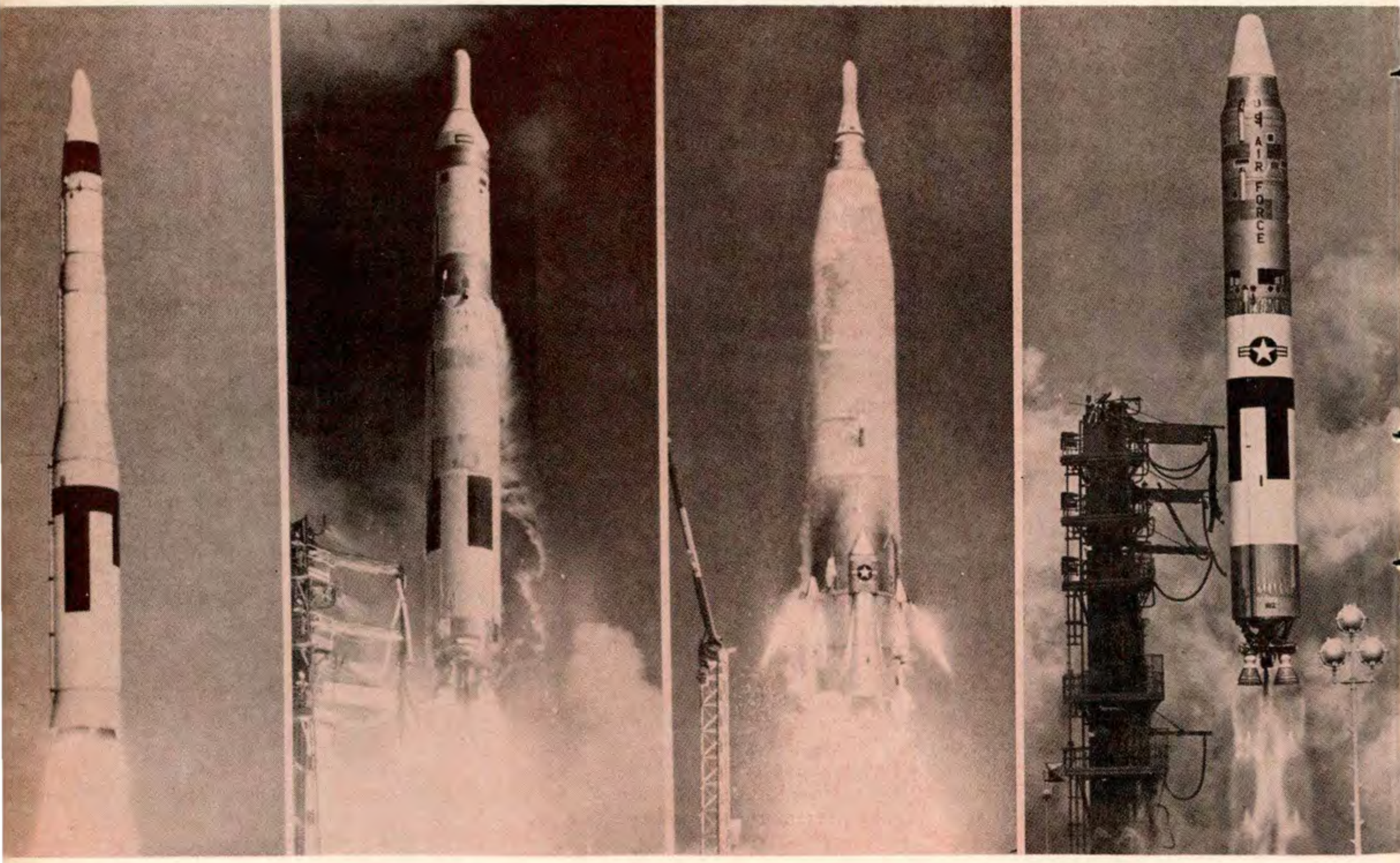
Ed. Note: As the above was being written, a student pilot successfully ejected from a T-38 aircraft, at ground level. The forward velocity of the aircraft was 135 knots and all equipment functioned properly, including complete parachute deployment. ☆

The Missile Decade

In May of this year the Air Force celebrated the tenth anniversary of the missile age. In this brief period of time the Air Force arsenal has been augmented by several hundred combat ready intercontinental ballistic missiles. Never before has there been implementation of a complete new weapon system of such scope and destructive power.

Much of the technological skill of the nation was devoted to this effort. And, to meet the timetable dictated by world events, a new design-development philosophy had to be adopted and practiced—concurrency. (The concept of concurrency is defined as the meeting together at one time of several different scientific, technological, training and other developments so as to reduce the amount of lead time in achieving a given capability.)

Many break-throughs were necessary. Unprecedented weight savings had to be practiced. An aggressive effort to miniaturize components was undertaken. Guidance systems, plumbing, pumps, actuators of all kinds, even the skin of the boosters had to be shaved of unnecessary ounces. Temperature and pressure ranges



never before encountered had to be tolerated. New metal alloys had to be developed to insure integrity under these conditions.

The success of these separate but related efforts is now history. Not only does the Air Force have several hundred operational ICBMs deployed, but also, reliability of such weapon systems was demonstrated most conclusively by the manned orbital flights. Thrust for these flights was supplied by basically the same boosters that stand ready to launch nuclear warheads should retaliation become necessary.

Were it not for continuing demands for technological progress and refinement of present systems, it would be possible to pause and reflect in detail on the accomplishments of this past decade. But just as this decade has proved that unprecedented progress is possible, it also has illustrated the demand that these skills be exercised, not merely reflected upon.

There is another aspect of the missile decade that warrants comment. This aspect is not one to consider with such obvious pride, but it is just as necessary if achievements realized are to be exploited to the maximum. This is the matter of reliability.

It stands to reason that any system as complex as an ICBM, with its attendant servicing problems, its critical tolerances to temperature, pressure and moisture, its computerized components and support equipment, its exotic and potentially hazardous fuels—any such system is bound to create operational and maintenance problems second only to those encountered in its conception and development. In addition, security has dictated another vexing requirement for those charged with the care of these birds—deployment underground in heavily reenforced silos and with a network of tunnels and rooms in the support and control complex. Here, where ventilation and humidity are continual environmental headaches, and where necessary exercise of components and systems holds high disaster potential, the continuing price of the missile age is being exacted. The inspiration that comes with the birth of a new system has passed; now is the mundane chore of meticulously watching over the buried birds to see that they are always ready, and to assure that the greatest technological product of any decade is not wiped out by accident.

Problems, as yet not all known, lurk in these missile silos. Corrosion alone—between metals, between grain boundaries of metals, between metals because of electrolytic or heat treatment action—is a major area that is requiring a field of technological effort all its own. Leaks have been trouble sources in weapon systems since the days of the first airplanes. They still exist. Systems which repeatedly give trouble when subjected to maximum pressures of 3000 psi forewarned that fluids flowing through similar plumbing, with similar seals and fittings, would be prone to leak in missile complexes. Increasing pressures to 6000 psi and more have, as would be natural to assume, only added to this hazard.

And sometime, down in the confines of the missile silo, petroleum products, liquid oxygen, and other fuels are in close proximity. Under the rigidly controlled conditions and in the checklist sequence for which the system has been designed, performance is as advertised. But, as a few spectacular explosions have shown, a small leak, a minor deviation from approved procedures, a component malfunction and a terrific price must be paid for a missile age weapon system accident.

Obviously, the loss from this cause would be much higher were it not for a group of unsung Air Force airmen and officers. They have a devotion to duty and self-discipline that motivates them to meticulously examine each and every component in each and every complex time after time. Their alertness and religious reporting and repair of worn, leaking, corroding equipment is the greatest single factor in prevention of missile accidents. Detection of discoloration, monitoring of gaseous oxygen detectors, noting changes in sound as a bearing wears, cleaning up spills immediately, repacking a leaking pump, verifying free flow through filters—these are the things these launch crewmembers do, over and over again, and with little recognition. These things they must do to preserve the multi-million dollar birds hatched in the missile decade.

As to a forecast for the next decade—it would appear to be as complex, as demanding, if not more so. The more that's known of a technology and the more its ramifications, the greater the potential for technological break-throughs. Miniaturization, expanded use of computers, lasers—these are some of the areas that shout of potentials that must be exploited. New methods of bonding high heat resistant metals must be found. Vibration studies must reveal a means of reducing stress. Component durability must equal that of the system. More efficient, more accurate and more reliable systems can be anticipated. Space age requirements continue and as each new possibility becomes reality complementing technologies must meet the challenge.

And one of the greatest demands in the foreseeable future is that put on people; not just the scientists and engineers who make refined systems possible, but the Air Force blue suiters who now care for systems in being and who will be called upon to care for those to come. Because of the pressures of progress in the missile age there is not always development time to thoroughly evaluate and refine each weapon system and its components before they are put on operational status. Air Force crews who man the sites must not only perform routine maintenance and operational system exercise, but must perform duties as research and development monitors. The feedback of information they can provide as a result of observations learned during their daily rounds and frequent exercises is absolutely essential if the full potential is to be realized and incorporated into subsequent missile systems. The press of expediency, dictated by world events of the post WW II period, forced adoption of the concurrency concept. A large, operational arsenal of ICBMs within the past decade is proof of the fact that such a concept is feasible. It may vary in degree, but the press of modern technology demands that it be continued in some degree.

And so the role of the Air Force airman has taken on a new significance. His contribution, though it lacks the glamor of an astronaut's flight or a moon-probe launch, is essential if progress in the next ten years is to fulfill the potential exposed during the past decade. ☆

Tomorrow's Trouble

. . . A Midair Collision Status Report

The objective is to describe the midair collision hazard, how it has changed, and what the pilot can do to help himself avoid a midair collision tomorrow. Unfortunately, it's the magnitude of the problem, not the clarity of the solution that makes another article on midair collisions appropriate. The following table is an indicator of that problem.

T-33	T-37	F-105	C-54	T-33
F-100	T-37	KC-135	C-97	F-102
T-38	C-119	T-37	F-84	KC-135
T-38	C-119	T-37	F-84	KC-135
F-102	F-100	F-100	T-33	F-102
F-102	F-100	F-100	T-33	Light Plane

The above is a partial listing of midair collisions experienced by the Air Force during the past year.

To see what can be done to prevent tomorrow's midair collision—the one you are really interested in—let's now consider some factors bearing on this problem as they have been identified in the past. Following are conclusions in an article and a study prepared by Anchard F. Zeller, Ph.D., Directorate of Aerospace Safety. Both the article and the study were published more than five years ago, but they are as appropriate today as they were then. Some improvements, primarily that of greater use of radar in air traffic control, tend to be offset by increases in airspeeds, altitudes that must be transited during climb and descent, and numbers of aircraft.

Here are some pertinent aspects of the midair problem, as excerpted from work published five years ago:

Air Force accident experience shows that approximately four out of five midair collisions occur under visual flying rules (VFR) in daylight conditions. Most are within 20 miles of an airfield and occur at relatively low airspeed.

When the assessed causes of the accidents are considered it is apparent that by far the greater number of these are related to either errors of omission or commission on the part of the pilot. In order of frequency these errors relate to failure to see the collision object, a misjudgment of distance, or failure to take corrective action in time to avoid a perceived aircraft. Other errors are committed by such persons as instructors, flight leaders and supervisory and ground support personnel.

HUMAN FACTORS

In any human activity, considered in conjunction with the operation of a piece of equipment, there are three sequential steps that must be followed. This perception-decision-response cycle is always involved. In order of frequency the errors committed in midair collisions fall roughly into the same sequence; that is, the greatest number of errors are related to perception, the second greatest to decision and the third greatest are related to inappropriate decisions and judgment and responses.

The average time taken to read a standard Air Force aircraft altimeter is seven seconds. During this seven seconds a pilot in a standard jet penetration from 20,000 feet at 350 mph, in a rate of descent of 5200 fpm, travels 3600 feet along a flight path and descends 600 feet vertically. Any shift from one instrument to another within the cockpit takes time. The actual lateral movement of the eyes will consume five one-hundredths

The spectacular photos in the panels below were made seconds after two transport aircraft collided in midair over the Atlantic. The camera crew that made these pictures was filming a sequence for a motion picture at the time and was therefore able to document the tragedy. The aircraft involved had been flying formation in support of the project when they ran together.

of a second while traveling through 20 degrees. If a person looks into the cockpit, looks outside, and then re-focuses on the instrument panel, a minimum of two seconds has elapsed.

Other activities are even more time-consuming. When an instrument flight plan must be followed, the time spent monitoring the instruments is much greater, even under VFR conditions. Under emergency or anticipated emergency conditions, even more time is spent looking inside the cockpit.

Even if the pilot is looking outside of the cockpit, there are limiting factors. First, the available space which can be scanned is restricted to the area which can be observed through the windshield or canopy. Even though vision is unobstructed and the object is clearly in focus, an aircraft, particularly a fighter aircraft, on a head-on collision course, presents a very small target, and the distance at which actual visual identification is possible is limited to a few miles at the most.

At high altitudes the eye has a tendency, when looking into space, to automatically focus only a few feet in front of the individual.

Even when straight line courses are involved, the problem of determining whether or not another aircraft is on a collision course is relatively difficult but this difficulty is magnified many times when either or both of the aircraft involved are flying in other than straight line courses. The problem of judging rate and of projecting curvilinear paths by visual reference to open space is almost outside the pilot's capability. High closure rates aggravate this problem.

The decision must be made rapidly and accurately because, in most instances, once the pilot has committed his aircraft to some type of maneuver, insufficient time remains for major correction.

Even after an oncoming aircraft is discerned, and the decision to take evasive action is made, another delay ensues to allow for the modified airflow to produce sufficient deviation of the aircraft from the original flight path for a collision to be avoided.

Under relatively optimal circumstances the minimum perception-decision-response lag, together with the machine lag, has been determined to be about five seconds. Even using the assumed minimum figure, two aircraft on a collision course at a combined rate of closure of 1200 mph will be a mile and a half apart five seconds before collision. Under optimal circumstances a collision could be avoided. At these speeds, if the aircraft were closer together than this before one of the pilots observed the other aircraft on a collision course, a collision would be essentially inevitable.

In his reports Dr. Zeller went on to point out that there are many other limiting factors, all leading to a further degradation of the efficiency with which the perception-decision-response sequence is initiated and hence increasing the probability of midair collisions. Among such additional limiting factors he listed cockpit design, design of the aircraft itself, background, training and experience of the pilot, chronic requirements for additional attention on one or more facets of the operation, boredom and fatigue, oxygen deficiency and poisoning from fumes, the mental state of the pilot at the time, age and physiologic incapacitation regardless of age.

SOLUTIONS

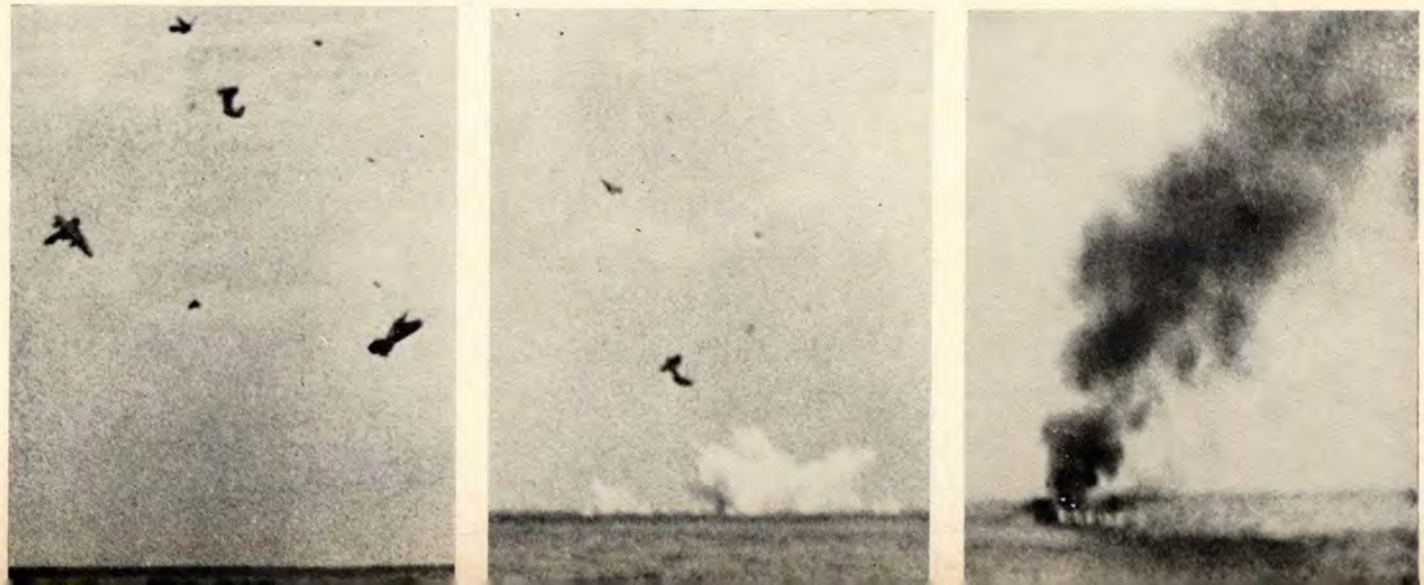
Here are some solutions dusted off from five years ago.

Added emphasis upon training pilots in various procedures and techniques can undoubtedly result in the elimination of many midair collisions, but as was explained above, many midair collisions are the result of the pilot's finding himself in a situation which exceeds the capability of the man and machine.

Additional scanners, when this is possible, will help. Crews of multiplace aircraft find that, when they have all crewmembers scanning, more aircraft will be seen, and seen sooner. Accident histories demonstrate that aircraft with more than one pilot, particularly those with a side by side seat configuration are involved in fewer midair collisions than other types of aircraft. It should be pointed out, however, that human limitations are as applicable to two persons as to one and that additional scanners can be expected to eliminate only a fraction of the midair collision accidents.

Some improvement could be expected with modification of aircraft to increase visibility and improvement of design of the cockpit to reduce the complexity of the pilot's task. This is an aspect most pilots have no control over (unless they habitually place reflective materials on the glare shield).

Any means of increasing conspicuity would be of some help, but probably not to the extent once expected. Studies with conspicuity paints have shown that the eye



Tomorrow's Trouble continued

discerns the object before it discerns the color. Additionally, actual possible space available for the pilot to scan is restricted and aircraft approaching from many angles may not be seen no matter how conspicuously marked. Further, accident histories indicate that most collisions of the non-formation type occurred when one or more of the aircraft were following a curvilinear course immediately prior to the accident, which makes judgment regarding possible collision extremely difficult. Improved lighting should be useful, but over four-fifths of all midair collisions occur during daylight hours in good visibility. Other proposals considered in the conspicuity area have included such things as smoke puffs, vapor trails, coded light signals to indicate direction and optical devices such as binoculars and rear-view periscopes. (Don't count on any of these to help you on your next flight.)

One area in which improvement has been realized is in traffic control. Increased radar coverage and expansion of positive control airspace has contributed materially to reducing the midair collision risk. VFR radar service has helped to reduce the hazard in terminal areas.

ELECTRONIC DEVICES

What about electronic devices? To learn what has been developed in these areas in the past five years that will help the pilot on his next flight, we checked with the Chief of the Research and Engineering Branch of the Directorate of Aerospace Safety. He explained that development and control responsibility of such devices was given to the FAA in 1958. At that time the Air Force closed out their programs and established necessary liaison with the FAA to insure that Air Force requirements were understood. Generally, research in this area tended to show that many techniques that had been advanced were impractical. FAA's main effort was in improved traffic control. The consensus is that improved traffic control has tended to reduce the hazard in control areas, but there are many areas, tactical training routes and areas and training command flying training areas particularly, where no progress has been made. Due to the increase in the number of general aviation aircraft, and their operation in airspace outside of FAA positive control areas, this hazard may be greater than it was five years ago. Recent Air Force midair collision experience leaves no doubt that it still exists.

The Chief of the Research and Engineering Branch is a member of FAA's Collision Prevention Advisory Group (COPAG) an organization made up of members from the FAA, Army, Navy, Air Force, Air Transport Assn, other governmental agencies, industry and various safety organizations concerned with methods of solving the midair collision problem. This group is attempting to set up a meeting with an aircraft manufacturer that, reportedly, has developed and uses a collision warning device in its flight test area.

Airborne devices to minimize midair collisions fall into three general categories:

Collision Avoidance Systems (CAS) that will detect aircraft, evaluate the collision threat and determine the escape maneuver to be executed by the human pilot or the autopilot.

Pilot Warning Indicators (PWI) that will alert the pilot to aircraft in the same area and provide bearing, range or other appropriate information to assist the pilot in locating the other aircraft.

Conspicuity enhancement.

No practical CAS or PWI system has been developed that will help the pilot tomorrow.

Conspicuity enhancement was probably best known for the conspicuity paint on military aircraft in the past few years. However, in the spring of 1963 the Air Force decided to discontinue conspicuity markings except for ATC and tactical aircraft (other than century series fighters) used primarily for pilot training and target aircraft. Reasons given were:

Expense of application and maintenance;

Existence of other programs to reduce near collision potential; and

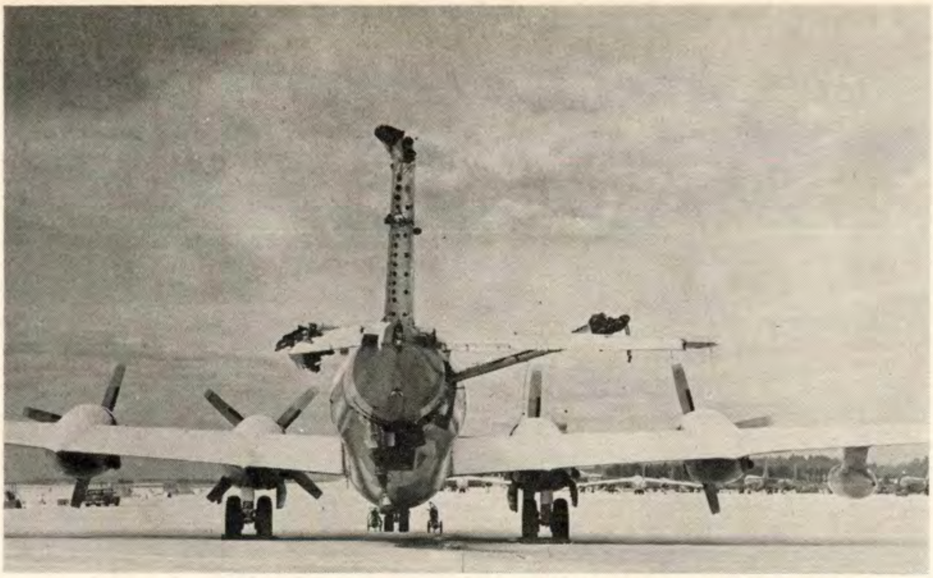
Lack of conclusive findings, either from operational statistics or research studies, as to the safety value of the markings.

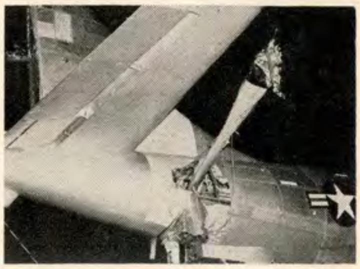
This program was on a one-year trial basis to see if midair collisions increased. The program was monitored by the Directorate of Aerospace Safety. There was no significant increase in midair collisions and the conspicuity paint program for all military aircraft has not been reinstituted. Again, it may be well to point out, research in this area indicates the eye sees the aircraft before it discerns the paint.

EXAMPLES

Information gleaned from near-collision and collision reports emphasizes the fact that factors of several years ago are still pertinent. Over five years ago two multi-engine aircraft collided over a brightly lighted city on a clear night with a loss of 49 lives. The cause: neither aircrew saw the other aircraft in time to avoid a collision. Sobering is the thought that this same type accident could be repeated tonight. Both aircraft types are still flying, with no more effective anti-collision devices than they had then. Minor improvements in traffic control that would tend to prevent a repeat of this accident are probably offset by the fact that, due to population increases, there are more distracting lights from the city now than there were at the time the accident happened.

In another accident, a head-on collision involving a jet fighter and a jet trainer, rate of closure was 1326 feet per second. Recalling Dr. Zeller's perception-decision-response cycle, detection distance would have had to be greater than three miles for a *possibility* of preventing the collision. Considering the head-on profile of a T-Bird, there is some doubt that the pilots could have seen each other, even had they no other task than





The accompanying photographs show damage to the tail section of an Air Force tanker that had been involved in a midair collision with a receiver aircraft during inflight refueling operations.

scanning and had they known where to look. In other words, accidents such as this might well be considered inevitable, and might still be considered so until better avoidance systems are available and in use.

Sometimes even greatly reduced closure rates, do not prevent accidents. Recently, collisions occurred, although pilots of both aircraft knew of the other's existence and approximate direction and were, in fact, positioning for a formation join-up.

Another midair occurred when two large aircraft were on a special mission which required formation flying during part of the mission. The pilot of one aircraft apparently allowed his plane to turn into the other aircraft.

In an accident in which a wingman collided with his leader, the wingman had diverted his attention to observe an airliner.

After rolling out of a turn to place a fighter aircraft on a 90 degree angle to the initial a collision occurred with another aircraft. Pilots of both aircraft involved failed to see the other aircraft at any time. A study made by the command concerned disclosed that possibility of an accident such as this is not so remote when it is noted that:

Ninety per cent of all collision accidents occur in VFR conditions.

Twenty per cent of all collisions occur within five miles of an airfield.

Jets are involved five times more often than non-jets.

Forty per cent of all near misses occur below 5000 feet.

Pilots' visual perception-reaction is inadequate.

Except for the all-jet aspect, the above precepts were applicable in a later accident involving a jet fighter and a light aircraft. A recommendation following this accident was that restricted areas be established in corridors through which jet fighters must regularly fly.

As could be expected, a high percentage of the Air Force collision accidents occur in associated type operations such as refuelings, intercepts and formation flying. In one such case the receiver underran the tanker and both the boom operator and the crew of the receiver lost sight of the other aircraft. As a result of the accident that resulted when the two aircraft subsequently collided, the recommendation was made that a mandatory breakaway maneuver be executed when ever the receiver is within one-half mile of the tanker and the receiver pilot, copilot or tanker boom operator loses visual contact with the other aircraft.

During a night formation flight clouds were entered and the aircraft could no longer safely remain in formation. Number two and the lead aircraft collided when lead made a turn. Following this accident recommendations were:

Flying safety is paramount in formation flying.

Immediate reaction procedures should be devised to provide for emergency actions when unexpected weather conditions are encountered.

Consideration should be given to making night formation weather conditions more stringent than other VFR minimums.

Radio discipline should be redefined to clarify the point that radio discipline does not mean radio silence when communications will enhance the safe completion of a training mission.

Formation leaders must not make excessively fast or steep maneuvers to tax the ability of wingmen and succeeding elements.

Here's an example that points up the fact that at no time can a pilot relax his vigilance. Two T-33s had completed the formation phase of their mission uneventfully. The formation terminated when lead pitched out on initial. The number two man made his pitch too soon, then made his turn too tight and, after about 45 degrees of turn and upon a warning by the rear seat pilot in the Nr 2 aircraft, evasive action was attempted. A tip tank was knocked from each aircraft in this collision, but both aircraft landed without further incident.

Tomorrow's Trouble continued

The above briefs are presented solely to illustrate the variety of midair collision possibilities. In the omni-dimensional environment of airspace there is an infinite number of directions from which two aircraft can approach each other and collide. The triple problem of discerning, evaluating and evading is almost as complex as these potential collision angles in airspace. There are some situations in which, as Dr. Zeller and others have stated, the pilot finds himself in a situation which exceeds the capability of the man and the machine as presently constituted. To make midair collisions potentially preventable requires that better information be supplied to the pilot along with control procedures which positively guarantee aircraft separation.

These aids are not going to be available for tomorrow's flight. But to help the pilot do a better job with what he has (hindsight indicates that many past midair collision accidents would not have happened with better air discipline and common sense) the following suggestions are made:

FORMATION FLYING

Be briefed, know the route, anticipate turns, slow downs and never fly tighter, or looser, than specified in the manuals. Never bank your aircraft to the extent that visual contact is lost with your leader during join-up. Avoid prop or jet wash whenever possible, especially on takeoff and landing. Remember, aileron alone has little effect in prop or jet wash; use rudder and aileron together if ever caught in the wash. When landing adhere to the time interval. Think of the man behind. Take the side of the runway you are supposed to, never the middle. Watch for an abort by the man ahead during takeoff. Know each aircraft's call sign and position. When leading a formation remember these hints: Use minimum amounts of bank. Fly smoothly. Make no abrupt control or power changes. Use proper signals for gear, speed brakes, afterburner, peel off, etc., and give your wingmen and element leaders time to receive and understand all signals. Think ahead of your formation. Never take a formation into areas of poor visibility, low ceilings and turbulence. For large formations, send a weather ship ahead, if weather is forecast to be marginal. Know the limitations of the pilots in your formation. Adhere to altitudes and airspeeds. Fly slightly above or slightly below, not level with your leader.

The single overriding safety requisite of a good formation is a *good formation lead*.

NON-FORMATION

Look around, getting hit by another aircraft can be every bit as deadly as being hit by a bullet in aerial combat.

Use the autopilot during climb and descent to permit more scanning time.

Every ride isn't an instrument check. Airplanes won't stall if flown in a plus or minus 10- to 15-knot-range from best climb or penetration speed. A stall buffet is not as hazardous as a midair collision.

Don't fly exact pattern altitudes at the expense of scanning for other aircraft. Plus or minus 100 feet is not as dangerous as failing to see one of general aviation's bug smashers.

Insist upon scanning by other crewmembers, particularly in highly congested areas.

Listen—a lot can be learned by what others say on the radio—"turning downwind, five out on GCA, initial with four, going around, estimating the omni at four six, one-four thousand, extending downwind, making a three-sixty" . . . each such phrase tells you something about the present and projected location of another aircraft.

Use radar advisory service. Ground controllers won't spot all the aircraft, and they will often spot aircraft well above or below you, but on occasion they spot aircraft headed toward you at your altitude.

Keep cockpit lights low at night for better outside viewing. Be particularly alert when flying over brightly lit cities, on brilliant, clear, star-studded nights. Use night curtains.

Don't use the glare shield as a catch all for maps, flight plans, pipes, flashlights, paper cups, flight lunches, computors, letdown plates, manifests, the Form 781—they block the view, cause reflections and besides, candy bars placed there will melt from the heat.

In bright sunlight use sunglasses or the visor.

If VFR, and visibility is marginal, refile IFR hard altitude—you will still have to look around, but you get better protection from other IFR traffic. In fact, it is safer to always file IFR, safest of all to file IFR and fly in continuous cloud.

Make turns while climbing and descending.

When avoidable, never climb or let down into conflicting traffic, e.g., enter the entry leg from the side and level, not the opposite direction above.

Make instrument approaches, even practice instrument approaches whenever possible — let the GCA eyes help you scan.

Leave altitudes when you report leaving them, not a half-minute or minute later.

Expedite penetrations and let downs, the sooner you get on the ground the sooner you cease to be a collision hazard.

When doing air work select an off-airway area.

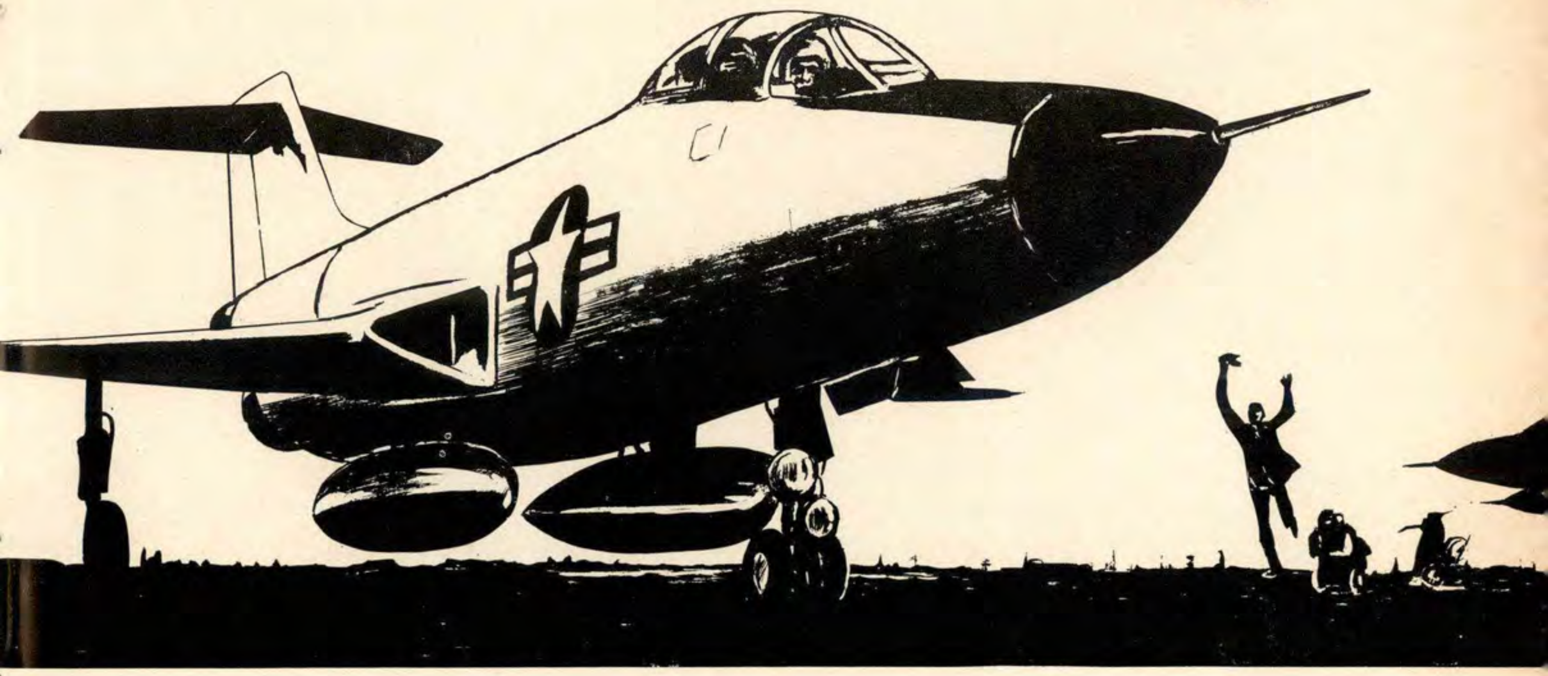
Beware the speck that doesn't move, or stops moving—those are the planes that can hit you.

CONCLUSION

The plain facts are that the man who flys tonight, or tomorrow, faces as great a mid-air collision threat as he did five or more years ago, despite widespread concern over the hazards and the many proposals that have been advanced to decrease such hazards.

To be brutally realistic, the man who flys must accept the fact that collision avoidance is still primarily a problem of see and be seen. His best anti-collision device—though it was surely not initially designed to perceive dangers that approach at bulletlike speeds—is still that pair of eyeballs that are no better, if as good, as the pair his ancestors had when max convergence speed was limited to how fast two Neanderthals could run. ☆

for want of a warning



When the F-101 taxied away a pool of hydraulic fluid marked the spot where it had been parked. That wasn't what caught the crew chief's eye; it was the stream of fluid dripping from the taxiing plane. He tried to catch the attention of the crew. But no yell can carry above the whine of two J-57's. And neither pilot saw his frantic gestures. The mission was a practice scramble from the maintenance area. On a scramble it's a race against time. There are no seconds to waste looking around. All preflight checks had to be made in the three to four thousand feet of taxiway. By the time the runway is reached it's into burner and GO!

The crewchief ran to the nearest communications vehicle and called Maintenance Control. "The One Oh One that just scrambled from the maintenance area—stop him—he's got a hydraulic leak."

Maintenance Control had no direct frequency link with aircraft. But they did have a channel to call tower. They relayed the crew chief's message.

The Mobile Control officer, a pilot himself and trained to watch for any sign of malfunction would surely have caught it, but for one thing: he was located at the opposite end of the runway. Remember, this was a practice scramble. The wind was light enough to permit a takeoff toward mobile. This was the shortest taxi route from the maintenance area—more seconds saved.

By the time the tower controller had the message he no longer had direct radio communication. Scrambles have priority. The 101 had reached the active, been cleared to Departure Control and for immediate takeoff.

The tower controller, trained for quick reaction, still had time. The 101 was just starting his takeoff roll. This was now an emergency and the controller called the aircraft on Guard channel.

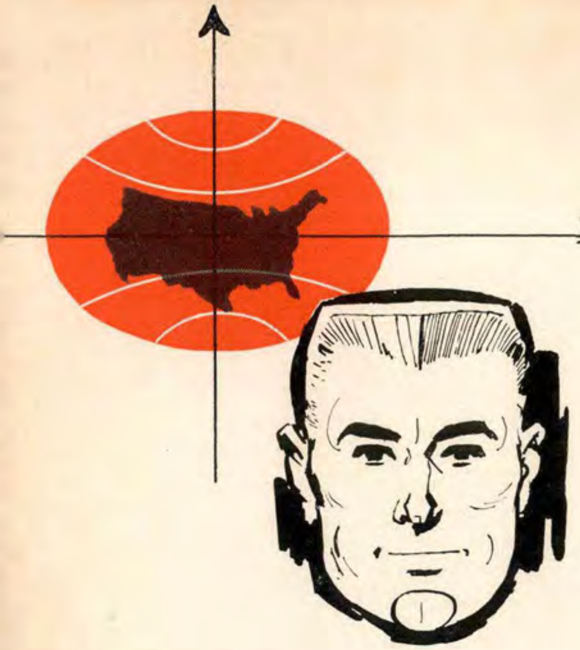
This call, in the nick of time, would have done it, would have except for one thing. The pilots in the 101, even as they heard the near simultaneous sound and felt the jolt as the two A/B's cut in, were cheated of their last warning. The transmission that came through their headsets was garbled. At the same time that the tower controller tried desperately to warn them of the hydraulic leak, Departure Control used Guard channel to transmit to an airborne aircraft.

The tower operator watched as the 101 accelerated rapidly. Why didn't he abort? The nose came up. Quickly the tower operator repeated his message. This time it got through.

For the first time the crew of the 101 learned of their hydraulic leak. Too late, they were airborne now.

As the plane swept up in a climbing turn the hydraulically boosted control system went out. They had no choice. Eject!

Fortunately, the two pilots ejected successfully. But a first line fighter was destroyed. Destroyed because of a hydraulic leak, a blocked Guard transmsision, and a matter of seconds. ☆

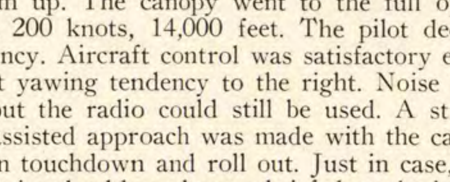


Rex Riley's CROSS COUN

SAME SONG, 'NOTHER CHORUS. Or we might title this one, "the horse THEN the cart." Rex shakes his head, but he vows to keep on reporting these. True, most have been worked into the "minor" or the "incident" category, but they still smack loudly of non-professionalism. In this one the T-Bird jock had applied power to continue his touch-and-go and checked all instruments normal and full power available. The IP followed through on the power application and noted full power available. In the process of checking his instruments the pilot stated that he saw that the airspeed was 125 KIAS, which he knew to be the minimum gear retraction speed. At that point, he automatically retracted the gear although he had not yet applied back pressure on the stick. A fairly predictable sequence of events ensued. The nose gear retracted. This allowed the nose to contact the runway. And then the main gear retracted, first the right, then the left. The throttle was stopcocked, the canopy raised and the crew evacuated without incident or injury. Damage to the aircraft was described as "very light."

CANOPY CAPERS. Prior to taxiing out for a night takeoff, the F-105 pilot closed the canopy, but did not lock it. He missed the canopy closed and locked check during the pre-takeoff check and didn't catch the warning light among the numerous red lights in the cockpit. After takeoff roll was started, and at a point after takeoff was committed, the pilot heard the noise as the canopy began to rise slightly. The canopy stopped after approximately one and one-half inches of travel. The aircraft was now at 270 knots. When airspeed was decreased to 230 knots, the canopy remained approximately one-half inch open, no vibration. The pilot burned fuel down to landing weight and landed uneventfully. A T.O. change is to authorize moving the red canopy warning light from the left console to the caution panel.

TOPPING THIS was the F-102 jock who, during climbout, airspeed 320, noticed an air disturbance around the canopy seal, the canopy creeping open, and a warning light on. He slowed down, but the canopy began to rise. He grabbed the canopy pull down handles but had to let go as the rising canopy began to pull him up. The canopy went to the full open position at 200 knots, 14,000 feet. The pilot declared an emergency. Aircraft control was satisfactory except for a slight yawing tendency to the right. Noise level was high, but the radio could still be used. A straight in, GCA assisted approach was made with the canopy full open on touchdown and roll out. Just in case, pilots of the unit involved have been rebriefed on the importance of insuring the canopy handle is fully engaged and locked prior to takeoff.



FIRE WARNING SYSTEM—One of the things that gets Rex all shook up is a malfunction of a fire warning system. They've been giving trouble for years, but here's a couple of pretty serious cases that deserve note.

A C-130E was on the way from Christchurch, N.Z., to Antarctica when the fire warning for Nr 4 came on. It was caged but the warning persisted, so the crew used the fire extinguishing sytem. They still had a fire indication in the cockpit although a scan of the engine showed no evidence of fire. The aircraft returned to Christchurch after a total flight of nearly eight hours. There, the fire warning was found to be false. Okay, that's what the crew expected. But it was also found that the fire extinguisher failed to discharge even though the activating squib had fired. What if there had been a fire?

Here's another case that cost 60 manhours of labor as well as a bucket of pilot sweat. The pilot of a T-Bird was getting a proficiency check when the little red light came on and stayed on. Power was gradually reduced to idle but the light continued to burn so the crew decided to shut down. They declared an emergency, kept checking for smoke or fumes, detected none, and headed for home. On final they got the engine started and left it in idle. A check of the warning so concerned about these first line troops as he is about the proficiency types who might occasionally need accurate takeoff performance information at a high elevation, hot day field. Accident files disclose that trouble can be encountered even in some of the more ancient birds when takeoff performance information is not accurate.

TRY NOTES

circuit showed that the bulbs were good but that the test circuit did not operate. Again, they shut down and made a landing.

Electricians found a broken wire at the 5 o'clock temperature sensing bulb which they replaced and the bird ground checked okay. On the next takeoff, about 800 feet after brake release, the old red eye again stared at the pilot in an unblinking manner. He aborted and at about 45 knots the light went out. This time two pieces of safety wire and wire clip were found behind the front instrument panel near the test circuit wiring. A metal jacket on the communications cable was touching the wire for the fire warning and overheat circuit. This circuit was rerouted and the engine removed and placed on a test stand. The temperature sensing bulb at the 5 o'clock position as again found loose as was the wiring. Wiring and bulb were replaced.

The last Rex heard on this one was that the aircraft was awaiting test flight. Wonder if anything else was wrong?

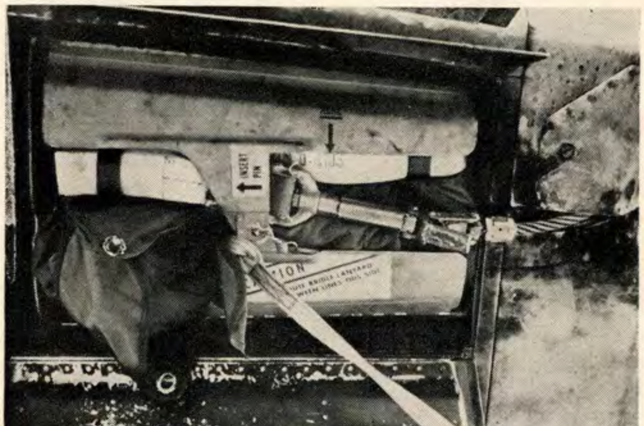
A LESSON IN ADDITION. Plans for the heavyweight takeoff were completed. Rolling takeoff was initiated. Acceleration speed check was above minimum. Acceleration appeared to hang briefly at 160 knots, then increased to rotation speed and lift off speed. Several witnesses estimated lift off came about 700 feet from the end. The main gear appeared to be approximately two feet above the surface of the overrun and skimmed the perimeter road.

Subsequent investigation of this incident accounted for 1150 feet more ground roll than computed. Here's how:

Wind direction indicators were found to be 43 degrees out of phase, thus the aircraft took off with a three knot tail wind factor. This accounted for 650 feet. The point at which the rolling takeoff leadin line intersects the runway took care of another 300 feet. The two-tenths of one per cent runway gradient, not figured in computing takeoff ground roll requirements, added the other 200 feet.

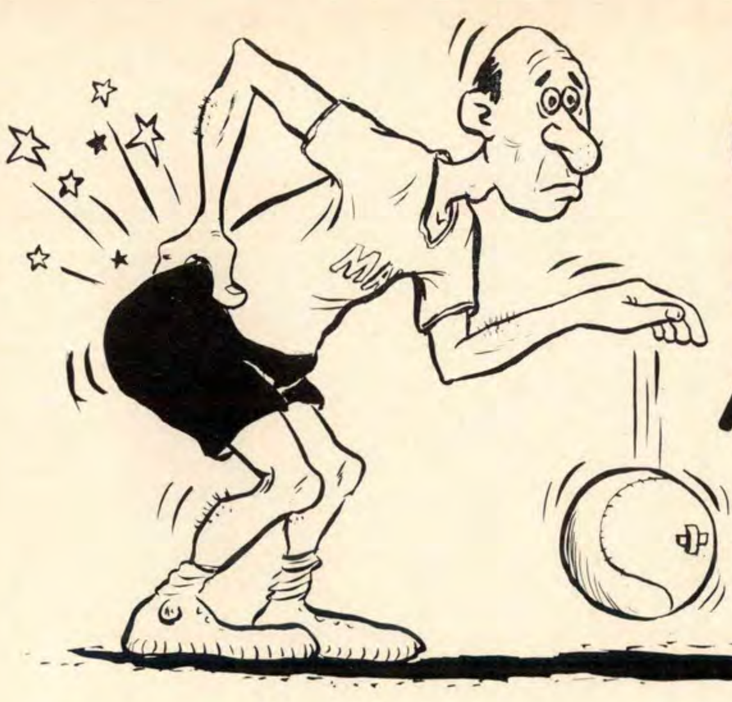
Fortunately, exacting mission requirements such as these are performed by top professionals, who quickly took action required to minimize the hazard. Rex isn't so concerned about these first line troops as he is about the proficiency types who might occasionally need accurate takeoff performance information at a high elevation, hot day field.

OVERBOOSTS AND OVERTEMPS. A few years back, and still today for recip drivers, the hazards of overboosting were frequently a subject at safety meetings. Overboosting was an insidious danger as it didn't necessarily cause immediate engine failure, but was more likely to weaken the engine so that it would fail subsequently, most probably during a time of high power demand. Now, a similar situation exists due to jet engine overtemps. Not long ago an F-100, in full military and passing through 2000 after takeoff, experienced a loss of thrust. The jock eased back to 85 per cent as he noted the EGT going through 700 degrees. He declared an emergency and made a precautionary landing. After landing and during taxi-in no increase in RPM was noted as the throttle was advanced. The aircraft was shut down and towed off the runway. Investigation disclosed all blades of the second and third stage turbine wheels had failed approximately one and one-half inches from the tip due to an apparent overtemperature condition. All blades were twisted or buckled and burned. Rex asks all to remember, the reporting of an overtemp is not nearly as drastic as non-reporting and possibly costing a buddy's life.



How NOT to install a drag chute on the F-100. The misrouting of the pilot chute bridle shown on this "transient F-100" is graphic evidence of improper installation and identical to an error noted on another transient aircraft. This common malpractice has caused so many failures in drag chute deployment, Rex has suggested this photo also be shown to maintenance personnel.

Capt Glen R. Wilson, Flying Safety Div, Kelly AFB, Tex.



OH MY ACHIN'...

Most thinking about an accident is immediately thereafter . . . .

"Bill, Bill, over here!" he yelled, breaking into the open on the base gym basketball court. He cut left, trying to stay in the clear as feet pounded closer behind him. He dodged right, left again, then abruptly stopped. Instantly he felt the excruciating pain when the foot of his pursuer came down on his heel. He hobbled to the side of the court, crumpled on a bleacher and began, gently, to massage his injured ankle. His injury broke up the impromptu game. His friends gathered around, awkward in their helplessness as he grimaced in pain. They helped him to a car and took him to the hospital. There a doctor examined the injury, determined that the Achilles' tendon had been torn and prescribed treatment. For three days the lieutenant came to the hospital for treatment. Later in the month he had to be admitted for corrective surgery. His hospitalization lasted three months.

Unusual? Not really. This sort of thing happens every day in the Air Force. It all comes under the heading of sports and recreation accidents.

What do you care? Not much, really. We don't expect the average reader to be impressed by the fact that such accidents cost the Air Force $8,000 a day, or that they account for 25,000 lost man days a year.

These are rather nebulous things like "millions" and "close supervision" and "reemphasis of inherent hazards" and "reports."

If you had watched your friend's contorted face as he weathered the pain of a torn Achilles' tendon you would have been much more impressed. About the only thing that would make a greater impression would be to have a 200 pound basketball player come down, full force, on your heel.

That would really impress you.

Imagine how this one must have smarted. It was New Year's. An airman, accompanied by two buddies, engaged in a recreational activity known by various terms, including bar-hopping. After several stops, and at about 2230, they decided to stop at a cafe to sober up before returning to the base. One airman decided to go to the rest room. The airman who becomes the central character in this case decided to follow. There was a door. When the first airman went through it and the door swung shut, the second airman doubled his fist and struck the door. Later that same evening the door-striking airman reported to the hospital. His hand was put in a cast and toward the end of the month surgery was performed on his hand.

For anyone inclined to tipple on occasion this one "accident" is more impressive than mere knowledge that a part of the $8,000 per day cost is due to making out of the Form 711's, endorsing same, counseling the suffering, sending copies to Norton where girls tabulate and file and Ground Safety specialists strive to do something effective about this three million-plus-per-year problem.

There are many ways this pain-in-sports business can be treated. How about by selected parts of the anatomy? Easy. The knee. The captain and his friends arrived at the snow lodge, decided to try the toboggan slide. The captain sat in front and a friend behind on the first (his last) run. When the toboggan hit an unusually large bump his left leg flew off the toboggan. His foot caught in the snow but the rest of him tried to continue on. Initially the pain was almost unbearable, or so it seeemed. By the time he reached the hospital he had become more used to it. Among other things, he was given crutches and physical therapy for three days. Satisfactory recovery did not result and ten days later he entered the hospital for knee surgery.

Every once in a while the Records and Statistics types and the Sports and Recreations specialists combine their talents and come up with things like stat run breakdowns, pie charts, and other cataloging techniques. Ultimate disposition of such efforts is made, usually, to interested parties, like commanders and safety officers. A while back they revealed that for 10 months of 1962 and the first 10 months of 1963 a total of 4,737 Air Force personnel experienced such injuries. (Purists might nit-pick this statement, so we admit that the small minority of these might have been reoccurrences during the period of this report. In fact, one airman, a roller skating rink injury repeater, admitted to "one or two falls each two hour skating period.")

Sometimes, even with reasonable precautions, injuries ensue. Here's one. After three hours of classes a lieutenant reported to the athletic field for a game of touch football. (The three hours of classes has no apparent tie in, but it was in the report and we hesitate to take the editorial liberty of omission.) The game was part of a supervised Physical Development and Conditioning Course and was under the supervision of a Military Training Officer. After approximately one hour the lieutenant had to take himself out of the game because of severe pain that had developed in a knee. There had been no horse play, the game had been well supervised and the sufferer could not recall exactly when or what had caused the injury. He was taken to the hospital and admitted with a torn cartilage. Subsequent investigation disclosed that someone had recently planted a tree on the playing field and had dug a hole around the base of this tree. The lieutenant had stepped in this hole, which caused him to fall, and he had twisted his knee as he had fallen.

Another breakout made of the 20 month statistics reported above was contact vs. non-contact sports. It came out this way: non-contact 3045; contact 836. The 856 left over were attributed to recreation. This takes in such things as the airman who tried to ram his fist through the latrine door and people falling down the steps even before they had given themselves a chance to pull back muscles heaving heavy balls down slick bowling alleys. Oh yes, before these figures get stomped on—they are totals; there is more inherent hazard in contact than non-contact, but there is considerably less of the former than the latter.

A cause factor that crops up once in a while is "exceeding individual physical limitations." This is followed by the recommended corrective action, "counseled to not exceed physical limitations." One medical type put the kiss of death on this routine with an additional endorsement to the effect that the normal means of determining physical limitations is by exceeding same.

Some accidents, in retrospect, seem almost as if the individual deserved what he got—just too bad the Air Force has to pay the bill and lose the man days: the major who decided to debark from the motor boat by first standing on a wobbly bench in the boat. He fell. . . . Or the captain who cut the end of his finger off with a power saw.

Once in a while, in leafing through the seemingly endless stacks of Form 711's there comes to light a real gem, or it would have been had not someone suffered pain and loss of productive man days to make it possible. In this category is the case of the alarm clock, the failure of which is listed as a contributing cause. In this case the individual received first degree thermal burns when he fell asleep under a sun lamp. He reported that he had set his alarm clock for thirty minutes, but that the clock had run ten minutes and stopped.

Love, even in its early stages, can be hazardous. An airman taking a moonlight stroll with his girl stepped on a rock, twisted his ankle. The moral, in essence, never become so enamored that you fail to watch your step.

A lot of accidents stand to reason. People are more likely to run into chairs if they come inside from bright sunlight. More are injured on stairs when running or taking steps two at a time than when walking and taking steps one at a time. More falls occur when it is wet than dry; more yet when there is snow and ice. A person is more likely to injure himself if he jumps off a porch than if he walks down the steps.

To wind this up, let's get to the big question—what can be done to reduce the number of sports and recreation injuries?

Here are some suggestions, picked at random, from a few of the many Form 711's the Air Force fills out.

Warm up before participating in sports activities.

There are hazards of exuberance.

Horseplay is dangerous.

Those who don't look where they are going are liable to get hurt.

Don't hurry.

Use proper safety equipment for the sport you engage in.

Momentary lapses in attention lead to accidents.

Playing in unauthorized areas is hazardous.

There are holes along walks, around steps, in driveways.

Use the buddy system.

Most important, all the protective sports equipment made isn't as good as the habit of Common Sense!

Read these again. Think about them this time. They make sense. ☆

Do Unto Others . . .

Previous articles in this series on search and rescue stressed what the individual can do to help ensure his survival and rescue. In this, the last of the series, the other side of the coin is examined: the fundamentals of conducting a search and rescue operation.

John L. Vandegrift, Hq Air Rescue Service, Orlando AFB, Fla

You can hardly beat the Boy Scout slogan, "Be Prepared." It sums up the philosophy behind the first two articles of this series ("Get the Word Out," AEROSPACE SAFETY, July 1964, and "Help Rescue Help You," AEROSPACE SAFETY, August 1964) and it pertains equally to this third and last article of the series only here we'll look at the other side of the coin. The first two articles concerned themselves with helping you cash in on your old age benefits; this one considers the other guy.

You'll never know when you may be called in to assist in a search mission. Therefore, a thorough knowledge of search procedures is important to all Air Force personnel and others who may become involved in such endeavors. After all, the life you save may be your buddy's—and vice versa. Consequently, "Do unto others as you would have them do unto you." For this admirable reason it behooves all who wear the Air Force blue to know at least the rudiments of running a search mission.

First of all, should you be tagged with one of these assignments, familiarization with all aspects of search and rescue is a basic requirement. The area Rescue Coordination Center, or its SAR Mission Coordinator will provide a briefing of all the known facts, and you, as acting SAR Mission Coordinator, will plan a course of action to best achieve the overall objective. No two missions are alike but there are certain ground rules.

Determine whether you can control and direct a search effort from your present location. Are adequate facilities and communications available? It is highly desirable to be as near as possible to the "area of highest probability" so that there will be close contact with the search operation. From this location you will brief and debrief the search crews, pass information on progress and leads to the Rescue Center, consolidate reports, plan future operations, and, in general, remain on top of the mission.

Appoint as many assistant SAR Mission Coordinators as are needed, and designate an on-scene commander to direct operations in the immediate search area. Careful study of the terrain to be searched, size of area involved, leads to be investigated, and distance from base of operations will help you determine what forces are required. Mobile ground interrogation units are of major importance in checking out leads, and CAP units have done highly commendable work in this area. While repetition is to be avoided as time-consuming, when there's any doubt recheck communications reports and airport ramps early in the game. It may eliminate unnecessary searches.

If you have been assigned a search mission late in the day or at night, alert forces immediately; don't wait until morning. Have crews, teams, and aircraft ready to go at first light, or valuable search time will be lost. Speed is essential in recovery of survivors. Establish a mission control facility and provide a room or adjacent rooms large enough to conduct crew briefings, lay out plotting boards and status charts, and set up mobile radio gear and other communications equipment. To consolidate briefing, debriefing, assignment of search areas, plan future operations and maintain overall control it is highly desirable to have all search crews working out of one location.

One of the most important aspects of any SAR mission is the proper use of news media to enhance and intensify search activity. In fact, on a National SAR Plan type mission the proper use of news media personnel can make or break the entire mission effort. Newspaper stories, radio and TV bulletins are an excellent source of leads from persons who may have observed occurrences related to the mission. The importance of the leads thus generated cannot be overemphasized. Wherever possible the services of information officers should be utilized and in any case the guidelines for releasing public information as prescribed in the Air Force AFR 190 series, Appendix B, AFM 64-2, and ARSM 55-1 will pertain. Request that the nearest military base commander provide information personnel to handle this phase of the operation.

Personnel assigned to this phase should stick to the mission coordinator like glue and keep news media representatives as up-to-date as possible on each new aspect of the mission as it develops. The mission coordinator cannot possibly have the time to do the information job properly and at the end of any mission, if the information personnel have been pulling their weight in the boat, they should be just as pooped as the mission coordinator. Handled properly, news media relations can involve the entire community in helping you locate the mission objective. This area, too often neglected, may pay the biggest dividends.

Consolidate, evaluate, and act upon the rumors and leads you will almost certainly receive. Although many will seem unrealistic, you cannot afford not to check them out. Leads will frequently form a pattern in an area; concentrate your efforts here, but don't abandon all search efforts along the route until you're sure. Logic is great but records show that people will occasionally turn up in the craziest places. "Wrong Way" Corrigan did not receive an exclusive patent.

Search crews will frequently arrive with limited, exaggerated or erroneous information concerning the objective. Brief them thoroughly before they start out and periodically thereafter as necessary. Impress on them the importance of their mission; a dedicated and well informed person is twice as effective as one who's just along for the ride. Don't let them think you are becoming discouraged, or that the mission is hopeless—ever. This is a normal reaction after two or three days of intensive, unproductive efforts but too often the troops tend to give up too easily. Stress flying safety and ground safety measures. You have problems enough and don't need another incident on your hands. It is easy for searchers to become injured or lost through carelessness. Personnel must be briefed on all facets of conducting a search including search procedures, scanning procedures, what to look for, what to report, and to whom.

The necessity for accurate reporting must be strongly stressed.

If additional forces are required to carry out the mission adequately, contact the area Rescue Coordination Center (RCC). The men in the Center know where forces are available and will get them for you. The supporting forces will be alerted and turned over to you for operational control.

You will be responsible for compiling a daily progress report based on search area coverage, thoroughness of search, estimate of search effectiveness, leads, sightings, hours and sorties expended, availability of forces for next day's search, and any other pertinent data. A daily telephonic report should be made to the RCC prior to 2200 L with the above information.

Plans for your next day's search should be included in your daily progress report. This is essential so that the SAR Coordinator at the RCC may discuss them with you. He can provide professional assistance, and since he has overall responsibility, he must concur in your actions. Call the RCC whenever there is a major development or a find; the center must remain current to answer inquiries of press, relatives, and higher commands. Here again, the info types can come in handy getting the word out to the ever curious American public.

Maintain an operations log of all pertinent activities during the progress of the mission. This will aid you and the guy who'll relieve you in keeping up-to-date, will assist you in accomplishing your reports, and will be a permanent record for future review of the mission.

In the preliminary search, it is desirable to cover rapidly all the territory in which the aircraft could have crashed. Route search, to include checks of the highest terrain, frozen lakes, stream beds, possible forced landing area, and sightings of smoke or fire, is normally used in this phase. At night, a sweep by any available aircraft—even jet—may reveal fires set by a crash or get a signal on 243.0 mc from a URC-10 or 11 or the new Personnel Locator Beacon (URT-21).

Initial search should cover an area ten miles each side of the center line of the proposed route. If the results of this coverage are negative, expand the search area upon either side of the route, based on past winds, weather and any other pertinent factors.

Failure to achieve positive results with the above procedure should lead to the establishment of designated search areas, based on your judgment as to the area of highest probability. Search patterns to be conducted within these areas fall into five general categories, as determined by conditions existing at the time.

A *parallel track* pattern is generally selected when the search area is large and relatively level. It is especially adaptable to rectangular areas where the object of search is expected to be somewhere between two points and possibly off track due to navigational error or surface drift.

The *creeping line* search is similar to the above, and consists of successive sweeps along a given track, flown at right angles to the course. It is for use when survivors or distressed units are reported between two points along a given tract.

Do Unto Others . . . continued

The *contour* search is used to search mountainous or hilly terrain. Contour search areas should be assigned to conform to either natural or manmade boundaries, such as rivers, roads, railroads, etc. Aerial search of mountains is more hazardous than search of level terrain, and requires skill, judgment and proficiency to be conducted safely.

The *expanding square* pattern is used when the approximate position of the SAR objective is known and the area to be searched is not extensive. It is started at the most probable position of the search objective and expanded outward with a square pattern.

The *sector* search is used also when the position of distress is fairly well established and the area to be searched is not extensive. It consists of a pattern of radii extending from the center point.

All of the above patterns, and variations thereof, are described in detail in SAR manuals. Care should be taken to assign search areas and patterns based upon the experience of the crews, type aircraft, terrain, weather conditions, and radio capability. If you are concentrating aircraft in an area, or if the search areas overlap, assign search altitudes. A 500-foot minimum separation is desirable.

Use ground mobile interrogation teams to the utmost in checking the authenticity of leads. They can save you much time and effort in air search. If possible they should be equipped with radios for expeditious relay of information, and can be used to check out air sightings.

Concentrated search in areas of dense underbrush may be feasible by ground parties on foot or on horseback. You should be lining up such personnel early in the search so they will be available when needed. In nearly all cases some sort of small ground party will be required when the SAR objective is sighted.

Insure that positive identification of wreckage is made. If this is not possible by air surveillance, dispatch a ground party immediately. Coordinate your actions with the nearest sheriff, state police, or military installation for identification of personnel.

Attempt to obtain trained medical personnel before evacuating injured survivors. Don't move the dead unless a military doctor or civilian coroner is present.

Mark the wreckage before abandoning the scene if it's in an inaccessible area where removal appears impractical. Air Force regulations outline the procedures and markings. Include this information in your closing report to the RCC so they can plot and establish it on their wreckage locator board.

In this series of articles we have attempted to familiarize Air Force personnel with the various phases of search and rescue activities, plus making the individual aware of his responsibility in the effort to insure his survival. At the onset, persons involved in an emergency should make every effort to alert Rescue forces as early as possible of any actual or probable situation which might require their assistance. If disaster occurs, they should follow the suggested procedures to the best of their ability to assist in their location and recovery. Finally, they should be aware of the time-tested procedures of the search mission commander or searcher.

Do your homework. In this way, each individual will stand to benefit to the maximum from the professional forces of Air Rescue Service, who seek to insure "That Others May Live." Remember, it can happen to you.

AVIATOR'S BASIC RULES FOR SURVIVAL

1. Prior to departure plan flight meticulously. This should include a thorough preflight check of aircraft.
2. File a flight plan with FAA or a responsible agency or person and follow it to the best of your ability.
3. Insure that there is adequate survival equipment aboard appropriate to the particular flight and that it is in good working order.
4. Wear clothing appropriate to the climate and area over which you intend to fly.
5. Notify the nearest communications facility immediately when an emergency arises or appears imminent. Give pertinent details and maintain contact if possible.
6. In the event of a crash, emergency landing, bailout, etc., regroup and remain in the vicinity of the aircraft wreckage. This increases the probability of detection and enhances your chances of survival.
7. Know your personal and equipment limitations and do not exceed them.
8. Arrange maximum signalling devices from natural resources and equipment and conserve them and your other survival materials.
9. Plan in advance how to effectively utilize your survival gear, natural materials and the aircraft wreckage to provide shelter, heat, sustenance and first aid.
10. Don't panic. Help is on the way. Take stock of your assets and follow a methodical plan of action to stay alive. As soon as conditions warrant, following the emergency, get busy and stay busy. ☆

FILMS:

SFP 1175a & b	The SAR Mission Coordinator (soon to be released).
SFP 1089	That Others May Live
SFP 330	Help Available
TF 1-5333	Helicopter Rescue Operations
SFP 1039	Search Operations
SFP 1085	The Air Rescue Service
TF 1-4968	Know Your ARS
TF 1-5054	Visual Aspects of Search and Signalling
TF 1-5309	Stay Alive in the Winter Arctic
TF 1-5310	Stay Alive in the Winter Bush
14C/3525	Search and Rescue — Search Areas (RCAF)
14C/3526	Search and Rescue — Search Operations (RCAF)

PUBLICATIONS:

National Search and Rescue Manual, AFM 64-2

Inland SAR Plan, ARS OPLAN 506

Survival Training, AFM 64-3

Aircraft Emergency Procedures Over Water, AFM 64-6

Rescue Operations Manual, ARSM 55-1

Taken for Granted

Maj George H. Tully, Hq Air Force Communications Services
Scott Air Force Base, Illinois

How long have you been flying? The answers to that question by you avid readers of flight safety publications will range from one year to perhaps 30 years. The experience you have accumulated during your years of rated service is an item of pride and satisfaction which you keep stashed away in your hip pocket. Let's take a look at a strong contributor to your safe accomplishment of flight experience.

It's 0700 Monday. You've reported to flight planning as scheduled. The routine of preparing for an 0900 wheels up takeoff with your C-118, T-33, U-3, or whatever, is proceeding smoothly. Finally, planning and preflight completed, crew briefed, you fire up and depress your mike button.

"Hopedale ground control 39439 taxi, over."

And Hopedale comes back with, "39439, taxi runway 30, etc. . . ."

Without further ado, with confidence in the instructions you received, you taxi out and follow the appropriate route. After a few more transmissions to and from ground control, your turnover to departure control frequency is accomplished.

You say, "39439 ready for takeoff."

"Roger, 39439, left turn after takeoff. Contact departure control on 394.2. Squawk 3, code 10 normal."

Off you go, confident in your actions and confident in the instructions you received, dedicated to immediate response to the directions these voices give you.

The flight continues, passed from one control agency to another. Voices change but your confidence doesn't. A check with METRO 70 miles from destination throws a slight curve at your well being. Destination is reporting 200 feet, 1½ miles, light rain. It's been a while since your last near minimums approach. Yet, you know you can fly your bird as well as the next guy and you've got confidence in this or any other approach facility.

"Roger, Willow approach, descending to 3000 feet, heading 080."

Enroute descent has commenced. Radar identification has been established and reported to you by the facility. Gets easier all the time, doesn't it? They've identified your aircraft, given the position and provided control. Your confidence peaks again, the handoff from enroute to terminal facility is complete and in you come, chances are without further frequency changes until turned over to Willow ground control after touchdown. A quick stop in Ops, close the flight plan, a few words with Weather, and home to the family.

To a great degree, it's all been taken for granted. After your first depression of the mike button this morning until engine shutdown in the parking place, the handling of your aircraft by the air traffic control facilities has been taken for granted. You expect safe, efficient control and you get it. You converse with two to 20 voices, dependent on your flight plan length,—"voices in the dark"—voices that control your actions and the movements of your bird.

Who are these voices? They're no different from you or me. As a matter of fact the pressure on them is frequently as great or greater than the pressure on you. Yet, they're trained to appreciate your position and your need as you thread your way through the ATC network. You don't need to tell them that you're exposed to hazardous happenings if they make any mistakes. They live with *that* responsibility. Controllers aren't born, they're made. Made by tough and rigid training and supervision. Made by experience and qualification, the same as you, the pilot. Their environment may be different from yours, but their life is much the same — responsibility, pressure, service.

For the most part, air traffic controllers don't hear much from pilots unless the pilots are unhappy and have a verbal or OHR type complaint. You've got the picture in your cockpit but not the big picture. Vice versa, the controller has the big picture (he has to) but not the cockpit picture. Discuss control problems with appropriate facilities when you can (on the ground, that is). You may have an idea or suggestion of interest to a watch supervisor, military or civilian. Don't forget, the confidence that you have in the facilities comes from *your* experience. ☆

FAA ADVISORIES

TWO-LAYER AIRWAY—Effective 0001 EST, September 17, the present three-layer airway route structure was revised to a simplified two-layer system. Also, as of this date, all aircraft operating at and above 18,000 feet msl are required to use the standard altimeter setting of 29.92 hg.

The two-layer route structure provides "Airways" up to 18,000 feet and "Jet Routes" between 18,000 and 45,000 feet. The airspace above 45,000 feet is available for random operations with no established airways or routes. Alaska and Hawaii are not affected by the change.

In the new system, altitudes 18,000 feet and above are referred to as flight levels.

Area Positive Control continues to be those altitudes from FL-240 to FL-600, therefore, pilots may continue to fly IFR, VFR on top to all altitudes to 23,500.

Positive Controlled Airways (17,000 to 22,000 feet) are non-existent.

To avoid conflict between aircraft at high altitudes (17,000 feet), and those at low flight levels (FL-180) when the atmospheric pressure drops below 29.92 hg, assignment of flight levels by air traffic controllers shall be determined from the following table based on current atmospheric pressure:

Pressure in Inches of Mercury	Lowest Usable Flight Levels
29.92 or higher	180
29.91 to 28.92	190
28.91 to 27.92	200

Where the MEA prescribed is at or above 18,000 feet msl and the atmospheric pressure is less than 29.92, the lowest flight level assigned shall be the MEA plus the number of feet specified in the following table:

Altimeter Setting	Adjustment Factor (feet)
29.92 or higher	None
29.91 to 29.42	500
29.41 to 28.92	1000
28.91 to 28.42	1500
28.41 to 27.92	2000

Air Traffic Control personnel shall keep informed of the atmospheric pressure existing to insure that altitude assignments meet the requirements stated in the above charts.

Radar beacon enroute codes are as follows:

Below 18,000 feet—Code 11
FL-180 to FL-230—Code 15
FL-240 and above—Code 21.

WHEW! THAT WAS CLOSE!—You say you've experienced a near midair collision recently? Yes, I realize you've been requested to answer numerous questions from Air Traffic Control. No, these questions were not asked to incriminate you—only to aid in the investigation to learn who was at fault. This could prove to be you or the other fellow, or Air Traffic Control. You see, the only method we have of completing an investigation is to ask questions. These are standard questions, parts of which must be answered by *everyone* who reports a near midair.

For clarification, let's look at the questions, just as they appear in the FAA Facility Operations Manual.

a. DATE AND TIME (GMT) OF INCIDENT.

b. LOCATION OF INCIDENT AND ALTITUDE.

c. IDENTIFICATION AND TYPE OF REPORTING AIRCRAFT, AIRCREW DESTINATION, NAME AND HOME BASE OF PILOT.

d. IDENTIFICATION AND TYPE OF OTHER AIRCRAFT (IF KNOWN), AIRCREW DESTINATION, NAME AND HOME BASE OF PILOT.

e. TYPE OF FLIGHT PLANS, STATION ALTIMETER SETTINGS USED AND WHETHER ALTIMETER CORRECTION APPLIED.

f. DETAILED WEATHER CONDITIONS AT FLIGHT ALTITUDE/LEVEL.

g. APPROXIMATE COURSES OF BOTH AIRCRAFT: INDICATE IF ONE OR BOTH AIRCRAFT WERE CLIMBING/DESCENDING.

h. REPORTED SEPARATION IN DISTANCE AT FIRST SIGHTING: PROXIMITY AT CLOSEST POINT HORIZONTALLY AND VERTICALLY: LENGTH OF TIME IN SIGHT PRIOR TO EVASIVE ACTION.

i. DEGREE OF EVASIVE ACTION TAKEN, IF ANY (FROM BOTH AIRCRAFT, IF POSSIBLE): INJURIES, IF ANY.

j. CLEARANCES ISSUED, IF PERTINENT. (This info normally provided by Air Traffic Control Facilities.)

k. NARRATIVE SUMMARY OF WHAT OCCURRED. (Provided by pilots at destination.)

As you can see, we ask some pretty pointed questions. Not only that, we require the controller to treat the incident with almost as much importance as he would an accident!

First of all, you, as a pilot, must determine if you really had a near midair collision. To determine this, you must ask yourself the following:

- Did I take abrupt evasive action?
- Was there structural damage to the aircraft and/or injuries to personnel? (Serious injury or fatality is also classed as an aircraft accident and must be reported as both an aircraft accident and a near midair collision.)
- As soon as you report the incident to the controller he must ask: "Are you reporting a near midair collision?"
- If your reply is affirmative, the appropriate information must be obtained as described above and a near midair collision report processed.

Bob Terneuzen, FAA Liaison Officer, Directorate of Aerospace Safety

One last point: Remember, if you are in VFR conditions, regardless of your flight plan (IFR or VFR), it is *your* responsibility to *look around*. Don't wait for the other guy to "make a move"; avoid getting into situations that can compromise you.

JET AND CONVENTIONAL CLIMB RESTRICTIONS—The FAA recently amended its controller's operations manual to reflect a change in the initial clearance handling of aircraft. As you may recall, it was sometimes difficult to understand how you could receive a jet clearance at, let's say flight level 310, and then, shortly after takeoff, receive an unplanned for, amended clearance restricting your flight to a low altitude for considerable distance. There were even times when you weren't sure just when you could expect a higher altitude!

Now Paragraph 231.5 of ATP 7110.1A states:

"Initial clearances issued to departing aircraft shall include:

A. Whenever practicable, the destination airport as the clearance limit, even though said airport may be outside of controlled airspace; and

B. Clearance at an altitude or flight level within the highest route structure filed by the pilot, or, if this is not feasible, information as to a specific time or fix at which clearance to such altitude or flight level may be expected.

NOTE: In the event of two-way radio communications failure, prior to receiving a specific altitude/flight level assignment within the highest route structure filed, control will be predicated on the fact that the pilot will begin climb to the expected further clearance altitude at the time or fix specified in the initial clearance."

Without a doubt, this procedure should clarify the bug-a-boo of what happens after takeoff relative to altitude assignment. Now you should have your climb restrictions clearly stated and in mind prior to departure.

The SID problem still remains status quo. Follow the printed climb restrictions of the SID—unless the original cruise altitude as received in your ATC clearance is amended. If this occurs, the controller must then restate *all* climb restrictions of the SID. Failure to do this negates the SID altitude restrictions.

The FAA is constantly striving to improve the Air Traffic Control situation in the ZI. So that you may share in their interest, I am listing a few of the major goals set for completion prior to 1968:

ENROUTE (ARTC)

- Sufficient automation of the control functions to eliminate control errors due to altitude, identification, posting and related duties.
- Positive control of all aircraft operating above 18,000 feet by the end of 1964.
- Stabilize center configuration to create a climate favorable for continuing improvements in the safety, quality and quantity of work accomplished per employee.
- Automation of the communication networks, both teletype and telephone.
- Sufficient reliable air/ground communciations capability to permit continuous operation of the ATC system during a national emergency.
- Develop and implement air traffic control procedures plus criteria to insure safety between aircraft operations and missile/rocket operations.

TERMINAL (TOWERS, RAPCONS)

- Sufficient automation at selected radar terminals to positively control or separate all traffic—VFR as well as IFR.
- Develop and implement a program to provide departing IFR pilots their complete ATC clearance prior to boarding their aircraft.
- Provide positive separation between all aircraft (IFR and VFR) operating in terminal areas.

There is a recognized need to provide pilots with complete weather information on a full-time basis, including thunderstorm activity observed on radar scopes. A method of solving this problem may be forthcoming in the near future.

The Flight Information Division of the FAA plans to publish and maintain the Airman's Information Manual as an improved operational replacement for the Airman's Guide and Flight Information Manual. ☆

63 ARRESTS

Harrie D. Riley, Directorate of Aerospace Safety

This summary documents the 1963 record of aircraft contacts with the USAF Aircraft Arresting Barrier Systems. The barrier installations in operational use during the year consisted of the MA-1A for arresting non-hook equipped aircraft, a modified MA-1A barrier with a supported cable for arresting hook equipped aircraft, and the BAK/6 and BAK/9 cable barriers for arresting hook equipped aircraft.

During the period, 313 arresting barrier contacts occurred of which 276 or 88 per cent were successful. This was an increase of 4 per cent in the success rate of the USAF barrier operations relative to the previous year. The improvement was due to the increase in the number of contacts of hook equipped aircraft and the 98 per cent success rate for these engagements. In contrast the success rate of non-hook arrestment by the MA-1A barrier remained between the previously established 60 to 70 per cent rate.

Of the 37 unsuccessful contacts, 19 were at too slow a speed for engagement. This is a result of the design deficiency of the MA-1A barrier which requires a minimum airspeed for engagement of the main landing gear. Generally, failure to engage the barrier at too slow a speed did not result in any damage to the aircraft or injury to the aircrew and merely indicates the ineffectiveness of the MA-1A barrier for satisfactory arrestment at all airspeeds of non-hook equipped aircraft. There were five hook skips of BAK/6 or BAK/9 cables, three of which were unsuccessful. The MA-1 barrier, acting as a back-up, arrested two aircraft after the hook skips. One hook skip was attributed to a build-up of paint used for marking the runway centerline. Five unsuccessful engagements were the result of the MA-1 barrier being contacted by aircraft which had no compatibility with the barrier.

Materiel failures caused over 80 per cent of the barrier contacts. Drag chute failure was the most frequent offender. Failure of the drag chute to deploy, inadvertent jettisoning of the drag chute due to malfunction, and the failure of the chute to open properly accounted

STATISTICAL SUMMARY

Total Barrier Contacts		313
Successful	276	
Unsuccessful	37	
Causes for Unsuccessful Contacts		
Aircraft Speed Too Slow		19
External Stores or Speed Brakes Deflected Cable		2
Webbing Cut by Pitot Tube		2
Barrier Not Designed for Aircraft		5
Hook Skip (5 occurred; 2 successful by back-up barrier)		3
Other Causes (only 1 occurrence each cause)		6
		37
Per Cent Successful — 1963 66%; 1962 84%; 1963 88%		

BARRIER CONTACTS BY TYPE OF BARRIER

Type Barrier	Suc	Unsuc	Total	Per Cent Suc
MA-1 (Unmodified)	60	31	91	66
MA-1 (Modified, hook used)	27	0	27	100
BAK-6	46	1	47	98
BAK-9	143	5	148	97

BARRIER CONTACTS
CENTURY SERIES FIGHTERS VS OTHER AIRCRAFT

	Suc	Unsuc	Total	Per-Cent Suc
Century Series	220	17	237	93
Other Aircraft	56	20	76	74

for 40 per cent of the barrier contacts. Drag chute failures in conjunction with other conditions caused 32 barrier engagements. It is apparent that more adequate packing procedures and closer inspection of drag chute installations will help to eliminate this as the leading cause of barrier contacts.

Poor pilot technique during landing contributed to a substantial number of contacts. Landing too fast or too far down the runway and errors in operation of the various aircraft systems accounted for 35 of the incidents

There were three pre-planned approach-end engagements by hook equipped aircraft. All were successful cable pick-ups with a maximum runout distance of less than 750 feet. Two resulted in minor damage when the nose gears sheared. These were the result of the nose wheel being off the runway at the time the cable was picked up by the hook; consequently, the nose was rotated forcefully against the runway. Major commands consider approach-end engagement as a valid concept when aircraft control is questionable after landing. The lack of published procedures in the Dash-Ones has limited the number of attempts to date. ASD has initiated a program for determining the best procedures for making approach-end engagements in all century series aircraft. This program will be used as the basis for including approach end engagement procedures in the flight handbooks of hook equipped aircraft and is expected to be completed during 1964.

The experience gained from both inadvertent and pre-planned approach-end engagements dictates that caution must be exercised in determining whether this technique should be used. For example, in one case, when the nose gear of an F-102 aircraft failed to extend in flight, the pilot elected to attempt an engagement on the approach end. The aircraft hook engaged the barrier cable while in a landing attitude. The nose slammed into the runway causing major damage but no injury to the pilot. This particular type and model aircraft has an excellent record of landing with the nose gear retracted with little or no damage. Thus there is some question of the propriety of an approach-end engagement in this instance. This is cited merely to discourage any considerations that may have led to a wholesale acceptance of approach-end engagement as a norm rather than an exception. It is not intended that even in the case cited that it should be prohibited. Commanders, supervisors and pilots must be allowed the prerogative should other considerations warrant such an attempt being made. ☆

CAUSES OF FAILURE TO ARREST BY TYPE OF AIRCRAFT

	T-33	F-84	F-86	F-89	F-100	F-101	F-102	F-104	F-105	F-106	Other	Total
Aircraft Speed Too Slow	7	2	2	0	3	0	2	0	2	0	1	19
Speed Brakes Deflected Cable	1	0	0	0	0	1	0	0	0	0	0	2
Landing Gear Retracted	0	0	0	0	0	1	0	0	0	0	0	1
Hook Skip	0	0	0	0	2	0	1	0	0	0	0	3
Webbing Cut by Pitot Tube	2	0	0	0	0	0	0	0	0	0	0	2
Barrier Not Designed for Aircraft	0	0	0	0	0	0	0	0	0	0	5	5
External Stores	0	0	0	0	0	1	0	0	0	0	0	1
Other	1	0	0	0	2	0	0	0	0	1	0	4
Total	11	2	2	0	7	3	3	0	2	1	6	37

CONDITIONS INDUCING BARRIER CONTACTS

Materiel

Drag Chute System Failures	151*
Brakes and Hydraulic System Malfunction	34
Loss of Engine Power	27
Tire Failures and/or Gear Malfunction	24
Flight Control Failures	6
Other Materiel Failures	9
	251

Air Base

Wet Runways	18
Crosswind	4
Obstruction on Runway	1
	23

Personnel

Pilot — Poor Landing Technique	21
Intentional Engagement	12
Other	2
	35

Other 4

*Includes 32 Combinations of Drag Chute/Brake or Drag Chute/Wet Runway

Aerobits

HOW IS AN AIRPLANE LIKE A HOUSE? Well, if the housekeeping is bad enough it will finally get to the point where you can't live in either one of them. The items about to be related are not fiction, but cold, and pretty sad, fact. They are taken from reports based on inspection of just two aircraft. There are many others, but there aren't enough pages in this magazine to list them all.

Wheel well door switch and wires to switch soaked with oil; corrosion on various cannon plugs and connections including the main fuel shutoff relay; wire in connector broken and gasket torn; various screws loose and oversize clamps; equipment loose in bracket; screws, drill bit, washers, nuts, tape, bugs and dirt; canopy seal torn; loose bolts, loose cannon plugs not safetied; various hoses and wire bundles chaffing; lines and flanges cracked; fuel feed line not properly clamped. (This last item was considered to be potentially very dangerous. In fact, it was felt that in this condition the aircraft would not have flown very many more hours before a serious fuel leak would have occurred.)

As previously stated, this is just a sampling from a much longer list.

Undoubtedly there are many lessons that can be derived from examining the list of discrepancies and pure carelessness associated with these aircraft. We're not going to dwell on this except to say to pilots, how about taking a close look at the aircraft you fly. Would you accept one of the aircraft from which the above list was taken? And to maintenance personnel, are you satisfied with the product you hand to the aircrews to fly?

Some honest answers to these questions would undoubtedly mean fewer aircraft on the junkpile at year's end.

USAF has recently approved a procedure wherein the weather observer will be authorized to listen in as aircraft control is transferred from ARTC Centers to RAPCON. This will permit the weather observer to have advance notice of all inbound IFR traffic. Tests disclosed that the procedure provides the weather observer with tremendous motivation, as a member of the control team, to assure safe landings. Prior knowledge of landing traffic, even in periods of rapidly changing weather, allows time for the observer to check and recheck the meteorological conditions which will have an influence on the landing. This procedure is another step in insuring that the landing pilot has the most current weather information.

Installation of a receive-only drop in the representative weather observation site on the line between ARTC Centers and RAPCON (or comparable facilities overseas) is authorized. Commanders are urged to install this inexpensive facility. Your staff meteorological officer has additional information.

Lt Col Jerry Creedon, AWS Liaison Officer
Directorate of Aerospace Safety

C-NOTE PAYOFF. It is seldom that an author has the satisfaction of knowing that something he published in a safety magazine had a direct bearing on preventing an accident. Therefore it is gratifying to hear about incidents such as the following, which might have become an accident.

After takeoff, while accelerating through 290 knots, the pilot experienced a hard left rudder deflection and a violent yaw. He immediately climbed to 3000 feet and reduced his airspeed below 290 knots. The rudder returned to neutral. Airspeed was held below 290 knots, fuel burned down to landing weight, and the aircraft landed safely. Prior to the flight, the rudder feel system cylinder was removed and reinstalled backward because the T.O. was not correctly followed. The significant point is that the pilot had remembered a similar incident published and took proper corrective action and prevented an accident. This was not the first payoff for getting the word out on this type malfunction.

The incident this pilot remembered was contained in a brief written by Lt Col Jackson Saunders in the October 1960 issue of AEROSPACE SAFETY. A similar incident occurred subsequent to the one reported by Lt Col Saunders.

Since this particular brief (we used to call them C-Notes) probably saved two aircraft and possibly some lives, we are reprinting the original in hopes that if a similar incident should ever occur again another potential accident can be prevented.

"During a recent test flight for rudder actuator and rudder feel-cylinder change, an RF-101A went into a series of uncontrollable yaw oscillations whenever the airspeed went above (approximately) 285 knots. The first indication of trouble occurred on takeoff at about 285 knots, 800 feet over the end of the runway. The aircraft yawed violently to the left, followed by a series of uncontrollable yaws and tendencies to roll and pitch. Ground observers said that it yawed as much as 80 degrees, enough to present a complete side view of the airplane. At this point the pilot retarded the throttles to idle and raised the nose, and as the airspeed dropped below 270 knots, he regained control.

"The pilot initiated a slow climbout away from the base, turned off the yaw damper, and pulled the autopilot circuit breaker. The aircraft was leveled off at 6000 feet and immediately went into another series of uncontrollable yaws, pitches and half rolls. The pilot advised the tower that he was abandoning the aircraft. Due to G forces, however, he was unable to grasp the ejection handles. He then decided that his best chance to eject would be in a deliberate pitch-up so he pulled the nose up sharply, and as the aircraft reached a near vertical position, control was again regained. Once more the aircraft was leveled off and the speed brakes extended. By now the pilot suspected that the airspeed switch had some bearing on the difficulty.

"An airspeed of approximately 250 knots was maintained while the pilot made several turns to see if control could be maintained. No control problems were encountered at this speed and the gear and flaps were lowered for a straight-in approach and landing. An uneventful landing was made with 11,000 pounds of fuel remaining. Here's what the postflight investigation revealed:

"With hydraulic and electrical power on the aircraft and an MB-1 pitot static tester installed, it was noted that any time the airspeed reached 287 knots the rudder would immediately go full left. Bleeding off pitot pressure would return the rudder to neutral at 270 knots.

"Further investigation revealed that the rudder feel cylinder (P/N 20-91390-1) was incorrectly installed—in fact it was upside down. Installed in this position, the cylinder is allowed to extend full travel when the shut-off valve is energized at 290 + 10 knots. Full extension of the feel cylinder in this manner will actuate the rudder servo to the full left position. With the aircraft in an extreme yaw, pitot pressure will bleed off, allowing the airspeed switch to open, deenergize the shut-off valve, return the feel cylinder to the low speed condition and the rudder to neutral. This condition, plus attempted recovery control by the pilot, would account for the rapid yaw oscillation. The rudder feel cylinder was removed and reinstalled correctly. Subsequent ground operation revealed rudder control and feel cylinder to be normal."

A pat on the back for old C-Noter Saunders for sounding his note so true and proving that safety tips do pay off.

Maj James O. Modisette, Jr.
Directorate of Aerospace Safety

MISSILANEA

DON'T DROP THAT GUARD! During an ADM-20C (Quail) propulsion system checkout, with the engine operating at approximately 94 per cent, there was a loud noise similar to an engine compressor stall. The throttle was immediately retarded to the "off" position, emergency shutdown button was depressed, and an immediate engine shutdown resulted.

Investigation revealed that the engine inlet screen strap assembly, which is held in place by tension, had become disconnected, possibly due to vibration caused by the engine operation. This allowed the engine inlet screen at the left side to drop down approximately one-half inch. The metal cable was drawn into the compressor section of the engine and approximately 29 inches of the cable was ingested. All variable inlet guide vanes and all first stage compressor blades within the engine were damaged. An engine change was required.

It has been recommended that the bracket retainer screen, PN MDE 4449003-3 and MDE 4449003-5, on all engine inlet screens be modified to enable a locking pin to be installed. This modification will prevent inadvertent release of the buckle on the strap assembly. In the meantime, let's make sure that all engine inlet screens are properly installed prior to any engine ground operation.

HOUND DOG PROGRAMMER TIMER FAILURE—During an AGM-28B captive flight, the low fuel light came on with normal valve operation (B-52 fuel) and shortly thereafter the missile engine flamed out. The engine was restarted and operated normally except for the low fuel light staying on during the remainder of the mission.

Maintenance investigation revealed a shorted programmer timer and burned wiring internally in the relay distribution box and along the "I" beam. Later, maintenance revealed the armament junction box had an internal failure.

The suspected cause of the inflight malfunction was the shorted programmer timer (PN 7E1083-4). During the past three months there have been five programmer timer incidents that have resulted in electrical fires within the missile. These failures are being investigated by the prime depot. Results of this investigation will determine the correct action required to prevent future failures of programmer timers applicable to AGM-28A/B missiles.

Major E. D. Jenkins
Directorate of Aerospace Safety

RELUCTANT BULLPUP. One more piece of the AGM-12B failure-to-launch puzzle has been fitted into the picture. As a result of detailed investigation of several failures to launch, some obscure factors were brought to light about the Bullpup. The initial investigation by the unit cleared the missile igniters, motors, and missile center sections as suspect components. In fact, all were subsequently launched successfully. The aircraft compoments also received a clean bill of health. This left only the nose section to be investigated. A TDR contract was approved and these TDR's revealed that when the missile had received the launch signal and failed to launch, the thermal battery, airbottle, and gyro in the missile nose section were expended. This constitutes missile damage and is reportable in accordance with paragraph 7f(4), AFR 127-4.

The investigation also revealed that a small degree of turn of the igniter, short of the fully seated position, would break the electrical circuit, causing failure to launch. This could easily result from the press of aircraft launch preparations when the igniter is installed in the aircraft "hot-gun arming" area. The Directortae of Aerospace Safety, MAAMA, OOAMA, and TAC studied a proposal to install the igniter in the storage and buildup area where time and additional care could be taken to insure a fully seated igniter. Studies and electroexplosives tests confirmed the safety and desirability of this procedure. It is anticipated that this action will eliminate failures to launch from improperly seated motor igniters. Checklists outlining this procedure for F-100, F-4C, and F-105 aircraft are being distributed by AFLC and checklists will be out soon on the remaining applicable aircraft.

Three other ways a failure to launch can occur follow:

1. Pilot action. If the pilot releases the missile firing button before the thermal battery has closed the ordnance firing relay in the aircraft, a failure to launch will result. The thermal battery can require up to two and one-half seconds to complete its relay closing function.

2. Ordnance firing relay failure. Failure of the ordnance firing relay in the aircraft will also interrupt the fire signal causing a failure to launch.

3. Gas grain generator failure. Failure of the gas grain generator to rupture both the fuel and oxidizer diaphragms will cause failure to launch.

Therefore, if you have a failure to launch, the aircraft electrical system with its launch control components should be thoroughly investigated. If the aircraft system checks out successfully, report the mishap and request a TDR on the missile. However, if the investigation reveals that the aircraft system malfunctioned and a launch signal was not sent to the missile, the missile can be returned to the inventory and used on subsequent missions.

There we have a quick rundown on why some AGM-12B Bullpups are reluctant to launch. Continued detailed investigation and meticulous analysis and reporting by unit investigators and safety officers are, and will continue to be, important keys to missile mishap prevention. ☆

Major H. M. Butler
Directorate of Aerospace Safety

WELL DONE

CAPT. JOE H. WATSON

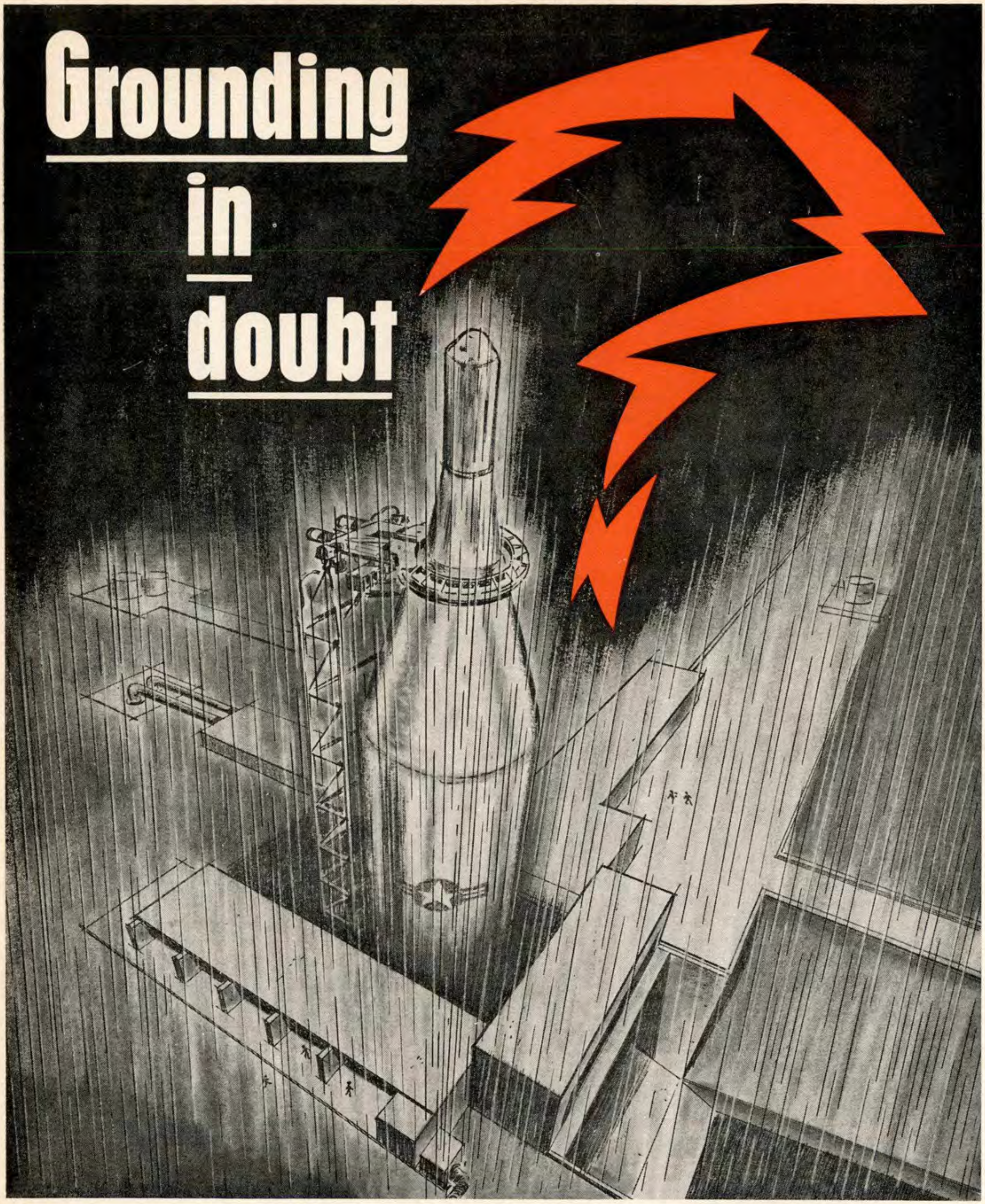
57 AIR RESCUE SQUADRON, APO 406 NEW YORK, N.Y.

Captain Joe Watson and his crew were flying a pararescue training mission in an HH-19B helicopter in an overwater area near Lages Air Base, the Azores. After the last pararescueman departed, Captain Watson began a shallow descent from 3000 feet toward Lages. Immediately after receiving landing instructions, he heard a loud "thump" accompanied by severe fuselage vibration. A feedback in the controls was felt without tendency of the aircraft to pitch in any particular direction. A check of the engine and flight instruments, although blurred from the vibration, indicated that all systems were functioning normally.

Due to the severity of the vibration, Captain Watson decided to land the helicopter in the first available clearing. However, when rudder was applied to compensate for torque, the vibration increased dangerously. The rudders were quickly neutralized and the decision made to land using only forward speed for directional control and without the aid of rudders. Because of the restricted open and sloping terrain, this technique demanded the utmost in pilot skill and precise timing. A successful emergency landing was made in a small grass field enclosed by a four-foot high rock wall, incurring no damage to the aircraft or injury to the crew.

Investigation revealed that the skin had separated from the spar of the tail rotor blade. The slip stream peeled the skin off the blade, leaving the spar and ribs exposed. The unbalanced tail rotor, turning at more than 2400 rpm, caused the severe vibration and control difficulty.

Captain Watson's quick response and skillful handling of his aircraft under adverse conditions averted possible loss of life and equipment. Well Done! ☆



CHECK IT OUT

See

- AFM 32-6
- AFM 88-9 CHAP 3
- AFM 127-201
- TO 31-10-24
- TO 11N-20-2
- TO 31-1-175