AEROSPACE

SAFETY

UNITED STATES AIR FORCE

are you doing your job right?

FEBRUARY 1963

EDITORIAL

from the desk of

Major General Perry B. Griffith, Deputy Inspector General for Safety, USAF

In completing two and a half years as Deputy Inspector General for Safety I have the mixed feelings anyone in the Air Force experiences when preparing for a new assignment. It is always hard to leave a satisfying duty, particularly one in which the results can be charted in terms of lives, equipment and money saved. This is a satisfaction that can be shared with everyone in the Air Force whose dedication to his job has gained for us the lowest accident rates in our history.

I sincerely congratulate all of you for a significant decrease in the number of accidents in almost every area of flight, missile, nuclear and ground operations. These are lowered accident rates of the most gratifying kind. They have brought about a vast improvement in the personal safety of our aircrews, a clear and immediate improvement in our combat effectiveness.

This is a record racked up by the old and young pros who man our aircraft and who work around the clock on our flight lines and missile installations. Many times they must fight weather, isolation and boredom as well as the battle to keep our weapon systems instantly combat ready. This record was achieved by blending experience, ambition and pride of workmanship in every job, large or small. There are no labor unions in our service, no 40-hour weeks, sometimes twice that much, indeed!

But in paying tribute to accomplishments, I must also call attention to weaknesses that have resulted in accidents and near accidents.

We still have pilot factor accidents. We still encounter maintenance errors that result in accidents. Aircrews fail to flight plan properly and end up dead in a pile of wreckage. Dash One procedures are not observed, sometimes with fatal results. Careless maintenance keeps the accident rate above zero, and the hundreds of lives lost in one year in private automobile accidents testifies to a lack of discipline and courtesy on our highways.

Some supervisors still look for their privileges before accepting their responsibilities. We still have the same non-professionals who look at the clock before looking for a tech order.

Professionalism is the answer here: professionalism on the part of the supervisor who gives, and accepts, only the best as his measure of work done; professionalism on the part of every technician who, by the example of those over him, has quickly learned the satisfaction that comes from going all out on everything that he does; professionalism developed and encouraged by the personal interest of the commander.

Our professional attitude is often watered down by a belief that weapon systems and accidents are part of the same package. I hope that, during the period of my safety assignment, some progress has been made in correcting this attitude. Personnel errors, carelessness and inexperience are not components built into our business. Factually and statistically we know that accidents can be prevented.

To all of you I extend my thanks for your past efforts and my best wishes for future contributions to our accident prevention programs. Your professionalism must keep step with our preparedness. We know that one is inseparable from the other. ★ ★

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The Inspector General, USAF

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Director of Missile Safety

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IN THIS ISSUE

FALLOUT

F-84F Engine Reliability

Reference is made to the paragraph "J65 Engine Reliability" on page 21 of the December issue.

The J65-7C Engine modernization program will include 17 major improvements to the engine. Many of these are outlined in TO 2J-J65-563, dated 1 Sep 62. Some changes were instituted prior to the issuance of TO 2J-J65-563. Engines incorporating these changes will be designated as J65-7D engines. The contractor scheduled delivery of the first -7D engines in December 1962 with production to continue until sufficient quantity of engines have been modernized to support USAF F/RF-84F aircraft.

The major periodic inspection cycle of the modernized engine will be increased from 100 hours to 200 hours to coincide with that of the aircraft. Also, it is anticipated the "time between overhaul" will be increased. In addition to the improved maintenance factors, it is anticipated the engine reliability will be greatly improved and the accident rate, due to materiel failure of engine, greatly reduced.

Maj John P. Karr, USAF
DMM, MOAMA, Brookley AFB, Ala.

Lightning Bolt

While reading the article "Look For The Lightning Bolt" (Sept '62), I recalled an experience that might have a moral: A Flight Check C-47 at Tinker was cleared on the active runway to make a check of the ILS equipment. The pilot of the C-47 advised that the check would take about 15 minutes. During this time a flight of transient F-100s arrived and were cleared to enter traffic for the runway on which the Flight Check C-47 was parked (the only runway of sufficient length for F-100s). The jet flight made several low approaches as the tower (and everybody else with a radio) attempted to advise the C-47 to clear the runway. Shortly after the flight leader declared minimum fuel, the C-47 "got the word."

Now the moral: This "flight check" was accomplished during peak traffic hours at one of the busiest air bases in the country. Why not accomplish as many of these checks as possible during periods of low traffic, such as nights, early mornings or weekends?

Capt Charles J. Doherty
Tinker AFB, Okla.

AFCS tells us that whenever possible, Navaid checks are conducted during periods of minimum traffic and are never conducted until coordination with all operating agencies has been accomplished. Flight check units have been apprised of the Tinker incident by the AFCS Stand Board, with proper techniques re-emphasized. As you perhaps know, AFCS is gradually phasing out of the low altitude flight check mission; this responsibility is being assumed by the FAA, using C-47 and C-131 aircraft.

Garbled Language

The article "Read 'Em or Weep" in the May 1962 issue was a masterpiece of explaining what the propulsion system instruments are *trying* to tell us. The only problem is, their language is garbled.

I am referring, of course, to the dial presentations found in the vast majority of jet aircraft. For example, it is utterly ridiculous from a human engineering viewpoint to provide a scale factor on a two inch exhaust gas temperature gage such that a small fraction of an inch represents the difference between normal and dangerous operation. Similarly, on an oil pressure instrument we expect to flag the pilot's attention to a few more minutes of successful engine operation by a 20-30 degree shift of a tiny needle.

To be sure, we're starting to use a few crutches—alias warning lights and engine performance recorders—to help the above described situation, but why not give the pilot a break to begin with so that he may perceive as well as decide and react to what the engine is doing?

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Aerospace Safety seldom publishes an article requiring more than one instalment.
RIDE THE WILD HORSE, by Major Weir, is an exception. When the rather thick manuscript arrived, we started to work with our blue pencil. The pencil is still sharp and the article is just about what it was on receipt. We found it so darned interesting we're running it in three instalments. It's recommended reading for all chopper personnel.

Ride THE WILD HORSE

Part One

THE STORY THAT FOLLOWS was not designed to entertain other helicopter pilots nor to toot my horn in any way, rather it is aimed directly at some of you indifferent type supervisors, the "I've got 'em (helicopter), but I don't want 'em types." The helicopter is a complex machine requiring a pilot with the skill and dexterity of a bird. To see him perform is deceptive. To understand why and how he performs is the problem. I hope to help you on your way to a better understanding of the business of being a chopper pilot.

It was a beautiful, warm late November afternoon at Randolph when the boss called me in. "Chuck, how would you like to take two crews to Alaska and ferry two H-21As back to Olmsted?" Momentary mental flashbacks quickly reviewed the Arctic to me. December temperatures of anywhere from 0 to -60 degrees, limited hours of daylight, rugged terrain, broad valleys, unexpected snowstorms, turbulence and high winds and all the other things in the Arctic which are relative to flight planning; things I had learned and experienced on a previous four-year tour of chopper flying in Alaska. Despite a slight apprehension of unforeseeable dangers which attach themselves to a project such as this, I replied, "Yes sir, when do we leave?"

As our C-118 approached Anchorage, all looked peaceful and serene, a sparkling panorama of snow-covered mountains and valleys flushed with the sparkle of winter, and Cook Inlet reflecting the total beauty of it all. The tranquil effect of this land was shattered by 40 degrees below zero temperatures as we stepped from the aircraft. For the first time, the entire crew was shaken into utter, stark reality of arctic temperature and the numbing effect it has upon you.

After a week of preparation, at last, favorable weather was predicted: clear and sixty all the way to Palmer, our first stopping point. Temperature would hold at -58 to -62. Winds calm at Elmendorf, three to five knots at Sheep Mountain Pass, five to ten knots at Gulkana, and about the same for Northway. Time en route was estimated as 4:40. A full fuel load of 3600 pounds (we carried extra tanks) was taken on. Flight characteristics were considered good at this gross; most of the extra fuel was not needed for this leg but would save us time and effort in refueling by hand pump at 60 below. The interior of each helicopter presented a conglomeration of 263 equipment, fuel cells, B-4 bags, large duffle bags of arctic survival gear, heavy tarp-like covers for blades, windshield, rotor heads, dorsal fin, etc. In fact, there was just enough room left for the crew chief to park himself on the front edge of the troop seat near the forward rescue door.

Maj Charles O. Weir, 3635 Flying Training Group, Stead AFB, Nevada

Due to loose powdery snow on the runways, we made short running takeoffs and were on our way. The time was 1030 hours. Because of our heavy load, full climb power was utilized. The rate of climb was only 150 to 200 rpm but there was no sweat as rough terrain was still 40 miles away. We leveled off at 1000 feet and settled down to the routine business of nursing our wallowing hulk on its way. As we approached Knik River, we encountered slightly gusty conditions, nothing to worry about as it was probably a little turbulence coming down from Knik Glacier about 20 miles to our right.

After crossing the river, we picked up a little headwind and the gusty conditions had all but disappeared. Looking down at the ground, I could see swirls of blowing snow moving across the fields of the Matanuska farms. I figured our headwind as being about 20 knots and knew that blowing snow on the ground was caused by at least 30-knot winds. There was only one place the wind could be coming from: down through Sheep Mountain Pass, the most rugged leg of our route.

Years ago while flying stiff winged aircraft through this pass, I had encountered some mighty blasts and terrorizing turbulence in this area, and had all the respect in the world for avoiding going through Sheep Mountain Pass when she was on the rampage. I was on the edge of decision to turn back knowing that you can give the arctic winds credit for getting worse instead of better when you are trying to get through. Turbulence was picking up a bit, moderate for a helicopter but not to the point of alarm. Airspeed was reduced and rotor RPM was increased.

At 1110, I called Elmendorf Tower and asked for the winds from Sheep Mountain radio and their reply was "four knots." They further stated my route forecast winds would hold. Still not alarmed, I couldn't figure where the chinook winds were coming from. The only station with any winds at 20 knots was Talkeetna, 60 miles northwest of our position. Impossible that we were riding a feather edge of that flow. Forty miles ahead was a glacier field at an elevation of 8000 feet. Could these ice monsters be generating a flow that was shooting down through a cut in the hills? Of course. That had to be where the winds and turbulence were coming from. Cold air spills and tumbles down through the valleys, cuts and gulleys like onrushing tides of water. By climbing, maybe we could escape the high velocity areas of this stream and in a few minutes be in the waning edge of this invisible force. Luckily, at this check point we have a dog leg to the right; if only we can get to the turn, we shall be free from the grip of this ugly, unseeable monster.

Full climb power was applied. At 1500 feet with 2600 rpm and 42 inches, we suddenly nosed up and over to the left. Rate of descent at full climb power was 2000 feet per minute. We were in a dive! Airspeed 110 knots; Controls would not respond! Downwind! Fifteen thousand pounds and a double load of fuel would surely make a big splash! Full back stick, trying to turn, any control response would help — got to hold power; can't slow airspeed or rate of descent. Good Lord, I'm not flying this thing; I'm merely hanging on to it! Is this real? Why doesn't the damn nose come up? The family — what is their day like — the smiling faces of the youngsters. Wonder what the future holds? Still no response! Dive angle is about 60 degrees, still going — nothing helps; sweating through my parka; trees are inevitable. We're going to hit — maybe five seconds left!

A smashing jolt from reverse G forces! We're going up! Up! We are pitching up — rotor speeding up — decrease collective pitch — reduce RPM — can't overspeed — 1500 feet per minute up — a delirious feeling!

Imagine 15,000 pounds autorotating upwards at this speed. Recovery! I'm tired; I'm soaked with sweat. I'm confused as though I've been hit a knockout punch — level, all under control! Think! Think! What can I do? How can I guess? What is the right action to take? Do that famous 180, boy! That's the impulse — the urge — no wait. Don't turn your tail feathers to that blast — you will tumble.

Wham! Here we go again! Winds must be over 80 knots — we are in a swirl! Down — down — we're still flying — I thought the aircraft had broken in half. May be imagination, ripping and tearing of metal. How can the chopper stand the punishment? How can we? Rate of descent on the peg 6000 feet per minute. No, no — it can't be! Surely I'm seeing things — dive angle at least 70 degrees! Surely the wooden blades can't take much more — flapping, stalling, compressibility. How can they stay together? Do we have control failure — controls are useless. Poor copilot, I'm beating his legs black and blue with the cyclic. He's trying to get his legs out of the way but can't. Wonder what he thinks — probably that he

RIDE THE WILD HORSE

should be back in Iowa selling corn to the local granary. Call the other aircraft. See if he has us spotted — will make it easier for the ground party to eventually get to us — only a hundred or so feet above the trees now.

"Dave!" I yelled into the boom mike. My breath was jolted out of me as we again reversed direction and started up — nose high 35- to 45-degree angle — going up like a homesick angel! Control! I've got control! Big open field below. I'll land. No, can't do that — no rotor brake, it will tear the blades off trying to get them stopped. What can we do?

The thought of a 180-turn to Elmendorf was a strong compulsive urge. What could we lose by trying? Negative, we'd tumble like a rolling sagebrush if we tried to run downwind in these conditions — not enough aft cyclic control to keep the tail down. Call the other aircraft. See what his conditions are and what his position is. Good, he's a mile behind and about a mile to our right, in turbulence and wind, but not in any serious trouble.

I'm right! The wind is coming through a slot eight to ten miles ahead of us; to our right, maybe three to five miles, is the waning effect I am searching for. How to get there. Now a crosswind from the right. Full right stick and rudder — she won't come around — here we go again! Nose going down, being blown into a descending left turn. Not severe this time — am controlling rate of descent and partial rate of turn — help the aircraft turn! Let up on right rudder, try neutral cyclic; that's it, it's coming — rate of descent is steady — head for the airstrip — keep control — easy now — we're doing fine. Call Dave and see how close to the strip he is. Good, he's only a mile or so away. Says he'll be right over. "Keep your eye on me, buddy, I'm still not sure we have it made!"

Holy Smokes! A real blizzard brewing on the ground — winds must be 60 to 70 knots, blinding snow blowing and tumbling every which way. Regardless of winds and velocities and snow, we have to get on the ground; better to tear the blades off on the ground than in the air. Shut down procedures would be as though the voice of doom had spoken. Shake, rattle and roll, fight! Got to keep her upright. The strip — we can see it! Easy now, slow the airspeed. At 70 knots we are hovering; ease her up. Over the strip. One hundred feet up — reduce collective. That's it, let her down slow — up we go! Reduce collective! Slam — now down. Up on collective. My God, we're making like a 7-½ ton yo-yo! Quickly now, slam the pitch stick down. Forget about a hard landing — have to get it on and keep it on! Call Dave and have him come in for landing to my right. "Roger, looks mighty bumpy, we'll give her a go!"

What instructions do you give your copilot (he, too, is an I.P.)? The handbook says "Use Caution." No guidance in this case. Do you throttle back to 2000 and let the blades flap? Or, do you hold 2500 rpm and take a chance on a big gust lifting your yo-yo up to a hundred feet again? For some reason or other, I chose the latter and I didn't have to tell Robbie what he could expect. I got out, locked the shoulder harness and seat belt so Robbie wouldn't have any flapping distractions to worry about and waited for Dave to approach and land.

Watching Dave approach the strip was as if I had had my picture taken and was now looking at it. Up — down — surges of power — a real fight! Thrilling, actually, to watch man and machine battle the uncanny treacherous winds that were blowing with blizzard force and velocities. Bang! He's on, or he was. Steady boy, you're up about 50 feet. Try again — easy as you go — that's it, that's it, reduce pitch — wham it on! Hold RPM. Good! You're on!

I climbed aboard and went forward to talk to Dave. "Hi, old buddy — how goes it?" Asinine question but it provoked a grin from Dave. "Now that we are on terra firma — what next? Wanta try for Elmendorf?"

"Not NO, but HELL NO."

"Good, I'm with you, ole friend." During this time the airspeed needle was jolting up and down. As little as 40 knots. Steady around 55 knots and as high as 70 knots! Fortunately the birds were heavy or there would not have been any possible way to keep them from flying when battling such great gusts of wind. Several light aircraft had broken their moorings and lay tottering and flapping in the wind. Nearby was the office of the bush pilot who worked from this strip. Obviously no one around. Better check and see if there is a phone in the shack. It wasn't easy to make my way through deep snowdrifts and the howling winds (particularly at 40° below zero) to the shack. There is a phone! It works! "Operator, emergency government collect call to Base Operations, Elmendorf AFB, please."

"One moment, please, I will try and connect you."

"Base Operations Airdrome Officer speaking. What can I do for you?"

"Buddy Boy, this is the pilot in command of the two H-21s that departed your base an hour and fifteen minutes ago and you can plant a hefty boot to the derriere of your blankety-blank weatherman who goofed on my briefing, that's what you can do for me! We are on the strip at Palmer 35 miles from Elmendorf and we are staying here until these blankety-blank winds die down. Close out our flight plan. If you don't hear from me again tonight, you will know that we shut down safely and don't need any help."

"Yes, sir. Gee, I don't understand t. Pilot reports moderate turbulence around Skwentna and Talkeetna but none from your area."

"Well, old buddy, you're getting a pilot report now. See ya."

Outside both old hens were still squatting there as though the eggs were about to hatch. Robbie was glad to see me. The aircraft had tried to fly a couple of times during my absence. He reported one gust of nearly 80 knots!

"Dave, I'm going to hover over next to that clump of trees and try to shut down — maybe the trees will give us enough windbreak to safely stop the blades."

"Roger, buddy. We will wait here until you have it made."

Trying to hover sideways was as critical as the approach had been; up, down, narrowly avoiding sharp ground contact by full power increases and using full control movement to keep her into the wind took all my effort and attention. Finally, after what seemed an eternity of fighting, we hovered into the windbreak and nudged the forward rotor as closely into the trees as I dared. I called Dave and invited him over to join up on my left side. He experienced the same difficulties that we had. He set his bird down about 50 to 60 feet from us. I told him to throttle down — watch the blade flapping and when RPM was right, to throw the clutch switch into the friction position. This would be the crucial point to the shutdown — as blade RPM would be around a 100 rpm (a very high flap potential) and to prevent extreme damage to the clutch, 30 seconds should be allowed to use the friction position on and off to slow the blades smoothly. Too much friction would create a sudden stop and cracked blades could result.

As we decreased blade RPM, flapping was severe. The tips were bouncing up and down from six to ten feet. I didn't know what the mechanical limitations of tip flap were but could well assume that part of the total flap arc could be attributed to blade flexing. At any moment we fully expected a blade to slap into the fuselage. RPM kept decreasing down, down, friction now! Hit it again! We had done it — blades were stopped and still intact!

I glanced over at Dave's aircraft. The rear set of blades were flapping through a 10 to 15 foot arc! Apparently he was judging the safety of the operation by looking at the forward blades. They were flapping but not to the dangerous degree the rear ones were. My radio had faded out due to the low engine idle speed — the generator cuts out at 1300 rpm. I couldn't call Dave to tell him to add RPM to avoid the rear blades from striking the fuselage.

QUICKLY I UNBUCKLED and clambered through to the rear door and as best I could, was trying to beat my way over to tell Dave of the hairy situation. Leaning full forward into the blizzard, I looked up in time to see the retreating blade on the rear rotor zoom way high. I knew this one was going to come down and tear into the fuselage. I dove forward, face down into the snow to present as small a target as possible for the shrapnel pieces of steel spar and wood that would soon be slinging themselves from the rotor system. I dared look up in time to see it happen. From reading of past H-21 accidents, I knew that some sections of the blade spar could be thrown nearly a quarter of a mile and could cut small timber in half. The blade suddenly hit its peak of upswing and then slashed as suddenly as a cobra into its victim, the fuselage. As the blade sheared and went sailing on its way, the unbalanced rotor system caused the airframe to shudder violently like an elephant doing the rhumba. The next two blades whopped off the two vertical stabilizers. Sections of spar and wood flew in all directions. The rotor system turned only about five times and stopped. Only the howl of the wind was to be heard and it dawned on me that I was still in one piece. Impossible that a man could stand in front of a firing squad and not get hit by one bullet. Those were the odds and I had beat them!

As I climbed forward through Dave's aircraft, I could see that Dave and Harry had their helmets off and were just sitting there, dejected and yet thankful the ordeal was over — one way or the other.

On the bus ride back to Elmendorf I decided I'd better send a wire to Texas, "Mission over, not completed, more to follow."

The shattered H-21A was put on a flat bed and returned to Elmendorf. Four days later, I flew my bird back to Elmendorf. It had seven red diagonals on it for popped rivets and wrinkled skin. The chopper had been gone over by highly qualified people—a structural engineer, a maintenance officer and inspectors — only my crew was afraid to fly it back. We were the ones who had ridden the "Wild Horse." I had a feeling that the fore and aft rotor masts were out of vertical alignment with each other and that the aircraft should not be cleared for even a one time flight to Elmendorf without benefit of a levels and protractor check. My opinion was not honored; the bird was cleared. Needless to say, we flew low and slow *all* the way back. Six months later I learned of the disposition of the two choppers. My bird was found to have a twisted fuselage and it *was* out of alignment. Both H-21As were returned to the Z.I. by C-124 airlift. The old Line Sergeant put it this way, "Both of 'em, Class 26!"

Let's re-hash this story. Surely, we can place the blame for an unsuccessful mission somewhere! Before leaving Texas, I had cautioned the proper authorities of the perils of attempting this assignment. I further recommended that if no urgent need existed to move the aircraft, they should be put in storage and no attempt made to fly them out before late May or early June. If there was an immediate need, why not airfreight them out in C-124s? The decision was not mine to make — all four pilots were highly qualified. All the weather forecaster had on his chart was a big high, no stations reporting abnormal wind conditions, no way of guessing that a phenomenon existed only a short distance away. The clearance officer in base ops had no reason to refuse clearance. The pilot in command? "Me," what about this guy? Is he to blame? Maybe so, maybe no. I personally did not receive any criticisms on any of my actions or decisions. Doubt, yes. My answer to the ones in doubt was, "There were no fatalities, there were no injuries; I am grateful, I think I did right."

We have the requirement, the supervision, the crews, the birds, the people who help you along your way, the weather *and the unexpected.* If you cannot determine who was the cause factor, then determine *what* was the cause factor. Maybe somewhere in the future a requirement will come along that supervision and hard training will be able to accomplish even the most formidable of tasks successfully. ★

(To be continued)

Every winter we have aircraft accidents in which seasonal weather plays an important role. Briefs of several such accidents are presented here as reminders.

THE SEASON'S THE REASON

THE AIRCRAFT touched down opposite the 1000-foot runway marker, slightly to the left of centerline. After rolling approximately 1000 feet it began slowly veering toward the left side of the runway. The pilot attempted to use nose steering, but the steering wheel would not turn. Nr 1 and Nr 2 throttles were advanced in an attempt to turn the aircraft. The left main gear wheels went off the left edge of the runway at a point 2920 feet from the approach end. At the 3140 mark the left main gear wheels reentered the runway and the aircraft veered sharply across the runway. It then went off the right side at the 3660 mark and began a skid to the right. Return to the runway was again made at the 5000-foot mark and the aircraft was stopped at 6500 feet. Approximately 10 cc of water was found in the chamber of the steering control valve that contains the centering spring. The spring and control valve were rusted and corroded, indicating the water had been present for some time. In the —38° inflight temperature this moisture would freeze and prevent the pilot from turning the nosewheel after landing until the ice had thawed. The spring chamber has a drain hole to release any moisture, but the hole on this valve was plugged with dirt.

* * *

PRIOR TO TAKEOFF the pilot was advised by another pilot that the runway was covered by patches of ice. During takeoff, using Runway 04, with an 85-degree, 15 knot crosswind, the aircraft slid to the left of the runway and hit a snowbank. Investigation disclosed that a runway aligned with the wind was available for takeoff but clearance was issued for Runway 04 and the pilot accepted this clearance.

* * *

LETDOWN WAS ATTEMPTED without using all available navaids and the aircraft struck a mountain. One of the survivors suffered frozen feet because of inadequate footwear.

* * *

A HELICOPTER was flying along an icecap with a twin-engine conventional aircraft for cover when white-out conditions were encountered. The escort aircraft crew lost visual contact with the chopper. The helicopter pilot reported that visibility had dropped to one-half mile and that he was navigating by flags along a tractor trail and slowing down. Thirty minutes after visual contact had been lost, radar contact was also lost by the escort crew. The wreckage was found the following morning.

DURING THE LANDING ROLL on a night landing, the aircraft gradually veered off the right side of the runway. The plane then paralleled the runway about 30 feet off the right side, crossed another runway, hitting snowbanks on each side, and stopped. Investigation disclosed that the entire runway surface was covered by compacted snow and ice. In addition, newly fallen snow covered the right one-half of the runway. At the runway centerline the new snow was between one and two inches deep, becoming increasingly deep toward the right edge where it was between 18 and 24 inches deep. The snow condition occurred during a heavy snowfall which began about one and one-half hours before the accident and which was still in process when the accident occurred.

* * *

DURING THE LANDING ROLL on the slush and snow covered runway the jet transport slid off the end of the runway. Cause was attributed to landing under existing runway conditions with a 10 knot tailwind and at excessive speed.

* * *

THE PILOT had initiated a standard jet penetration and ILS approach and noted ice on the wings as he broke out of the overcast. He spotted a strip to the left which he thought was the runway. This proved to be a stock car testing strip. He then looked to the right, spotted the runway and turned sharply to try to line up for landing. His sharp angle of turn forced him to turn back left more than 45 degrees. When over the end of the runway he retarded the throttle to idle. The plane dropped abruptly to the runway. Touchdown was left tiptank first, followed by the left gear, right gear, nose gear and right tip. From skid mark evidence, touchdown must have been in a crab and porpoising. The nose gear sheared and the aircraft skidded right, then left.

* * *

THE ATTITUDE GYRO failed during ascent and climb to on top was completed on partial panel. The decelerons froze in the closed position during the climb. The pilot continued his mission and elected to descend through the overcast on partial panel instruments at a high rate of speed and descent due to the frozen decelerons. At approximately 8000 feet an unnatural oscillation started and the pilot lost control of the aircraft. The needle and ball became unreadable, stick pressures were considered abnormal and available instruments indicated the aircraft was not responding to recovery attempts. The pilot and radar operator ejected.

* * *

ANOTHER CENTURY SERIES fighter pilot, while on a low level radar navigation training mission, flew into a snow shower and struck trees. The aircraft became uncontrollable and the pilot ejected successfully.

THREE ATTEMPTS were made to start each engine on the aircraft batteries. No success. External power was obtained and three more unsuccessful attempts made to start each engine. An engine heater was then used and after approximately 10 minutes heat on the right engine, the heater was moved to the left engine and the right engine was started. The heater was then removed from the left engine and a start obtained. Immediately after starting, both engines were advanced to approximately 1700 rpm and both propellers were exercised several times. Taxi out took place about five minutes after engine start. Takeoff was made 20 minutes after engine start. Nineteen minutes after takeoff the pilot reported no oil pressure and requested a straight-in. He then reported backfiring and two minutes later no oil pressure on both engines and "both engines bad." Tower personnel observed the lights of the aircraft in steep descent followed by a large ground glow. Investigators concluded that as a result of improper warm-up procedures prior to taxi and takeoff, congealed oil in the system restricted the amount of oil available to the engines and both engines subsequently failed internally from inadequate lubrication. ★

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BLACK IS Black

Between January and December 1962, three B-47s were destroyed and all crewmembers killed during low-level night operations. In all cases, qualified crews were aboard and one aircraft was flown by a select standardization crew.

In the first accident, the crash occurred 30 miles off course. There was some weather in the area.

In the second accident, the crew was on track, but for some reason had descended 7000 feet below programmed level-off altitude for that route segment.

In the third instance, this one with the select crew, descent was made prematurely. The crash site was four miles off course centerline, but within the corridor, and 2600 feet below programmed altitude.

Let's consider some similarities in these accidents: All three occurred on black nights; anyone who has had night vision training, such as that presented during physiological indoctrination, knows how very black complete darkness can be. In each case pilots were faced with the difficulty of seeing terrain features on dark, moonless nights, from a lighted aircraft cockpit.

Pilot duties requiring attention included flying the airplane, maintaining attitude and altitude by reference to instruments, reading the bomb run checklist for the navigator and cross-checking his prepared charts for headings and altitudes on each segment of the bomb run.

Some of the major tasks of the investigators were study and evaluation of potential or contributing cause factors. These included flight planning, briefings, clearance, psychological considerations, physiological background, training records, standardization checks, inflight reporting, FAA/RBS/weather station and command post conversations in addition to on-the-scene investigation and analysis.

After this has been done, by the most skilled specialists available from the Air Force and industry, it may still be that "undetermined" will be the finding. But there are "most probables" that represent the consensus of these investigators. And there are suggestions designed to enhance safety without elimination of the training for a wartime mission requirement.

Many would like to see a single altitude used from the entry point to the bomb run climb point for all aircraft without advanced capability radar (ACR). There is no argument that this would be a safer procedure, but so long as operational requirements continue unchanged the present procedure of terrain following on low level bomb runs will be required. With this in mind, the only way to hold peacetime losses to an absolute minimum is to insure comprehensive, accurate, mission planning and preparation of profile, ONC, WAC and other appropriate charts. Then, the ultimate requirement, the mission must be flown *exactly* as programmed.

We have adequate instructions for pilots to execute a missed approach if excessive deviation occurs during a low approach or if not contact at minimum altitude. It appears equally logical that a "missed approach" procedure be initiated anytime there is disorientation during a low level bombing mission. Every member of every crew must have the integrity to call out any deviation and a short climb for reorientation must be executed.

There are no short cuts through the rocks on dark nights. ★

Lt Col David J. Schmidt, Bomber Branch, DFS

With the introduction of many additional stores configurations for the F-105, an old problem brought new considerations to flying the aircraft.

FLUTTER·R·R·R·

Lindell E. Hendrix, Republic Aviation Corp.
Farmingdale, New York

SPEED restrictions are placed on airplanes for a number of reasons. A clean airplane can be restricted because of degradation of control as the limiting speed is approached, or it can be restricted because some adverse characteristic occurs at something above the limiting speed. Modern day airplanes are usually limited in the clean configuration by the power of the engine and the drag of the design. In other words, you can fly the airplane as fast as it will go.

However, when you suspend external stores on even modern day airplanes the picture can change. Some configurations may be limited by power, but more commonly the limits are established by an aerodynamic and structural phenomenon called "flutter."

Practically every pilot flying today has heard the word "flutter" mentioned in some discussion, and many pilots genuinely understand what the word "flutter" means when it is used in an aerodynamic sense. Those of you who do understand flutter have a healthy respect for it and will under no circumstances approach speed conditions with various external store configurations which approach the published handbook limitation.

However, for those of you who are not positive of the meaning of flutter, this discussion is intended; and I'd like to state that this discussion applies to every airplane, not just the '105.

First, and let me stress this, *flutter is not buffet.* This bears repeating; flutter is not buffet. All of you have experienced at one time, buffet of one sort or another. You've had buffet associated with both accelerated and unaccelerated stalls, and in recent years you've encountered the phenomenon known as transonic buffet in some aircraft. You can fly into these buffet regions and fly back out of them without serious consequence. Sometimes, if you persist in probing buffet regions, you might wind up in a spin or a snap roll, but your airplane stays intact.

Flutter, however, is a different matter entirely. Flutter has been defined by the head of our Flutter Analysis Department as "an unstable violent oscillation of one or more of the flying surfaces in which the amplitude builds up rapidly to the point of structural failure of the surface. The rapidity of amplitude build-up generally precludes the possibility of corrective action." The latter statement is quite significant, for it means *no pilot warning occurs.* Once you enter the flutter regions it is too late, since destruction can occur in as little as six or seven seconds.

Again let me quote our Flutter expert: "The flutter phenomenon is due to a complex interaction between the forces generated by the airstream and the mass and stiffness characteristics of the flying surface. On the ground, when a twisting movement is applied to a wing and suddenly released, the wing will oscillate in *torsion* at a characteristic frequency. Similarly, when a load is applied at the elastic center and released, the wing will oscillate at another frequency in *bending.* The amplitude of the oscillations will depend on the applied forces. The oscillation will damp out quickly due to damping forces present in all structures. In the presence of an airstream the oscillations produce oscillatory changes in angle of attack, which in turn produce oscillatory forces and movements. These vibration induced forces alter the vibration characteristics of the wing. Normally they stiffen the wing in bending and weaken it in torsion. In addition, the damping characteristics of the wing are altered. At flutter, the bending and torsion frequencies are usually close together, and the damping goes to zero or is negative. The oscillations do not subside until failure occurs. The flutter point is a function of speed, air density and mach number."

Every aircraft model in the USAF inventory is demonstrated in actual flight in every possible configuration to establish flutter limit speeds. Prior to actual flight demonstration, wind tunnel models which are elastically similar to the aircraft are tested to destruction. Vibration tests are also performed to verify the aircraft modes of oscillation. The data compiled in wind tunnel and vibration tests give the flutter analyst a basic pattern so that he can tell in actual flight aircraft when the damping characteristics are approaching those of flutter.

The actual flight demonstration takes place in highly instrumented aircraft. Telemetering and oscillographs are used to measure damping of the aircraft. In these tests the surface is vibrated or disturbed either by pilot induced control displacements or artificial vibrators at increasingly critical conditions. The time required for the oscillation to subside is noted, thereby obtaining a direct measurement of the damping rate. Speeds are increased in small increments only when the last speed has shown no tendency for a marked loss of damping. When we perform these flights, a flutter analyst is constantly studying the data as it is being flown through the use of telemetered records. When this analyst notes a marked loss in damping, the flutter condition is considered at hand. When these conditions are detected a limit speed is established with appropriate margins for manufacturing tolerances. It should be pointed out that when flying these tests, it is the flutter analyst who first detects the warnings of approach to flutter. *The pilot cannot detect these advance warnings.*

When external stores are installed on an airplane, the vibration characteristics of the wing may change depending on the mass, e.g., length and shape of the store. Hence, different limits will be imposed with different stores and combinations of stores.

Limits on external store configurations can also be imposed because the stores themselves are limiting. An example of this is the temperature limit on the GAM-83.

Usually the jettison limits are established by the characteristics of the stores during jettison to prevent damage to the airplane or collision of stores near the airplane.

So, the published speed limitations in the Flight Handbook must be adhered to. The handbook will list every configuration and show a maximum speed and usually an altitude. I know that with the many possible configurations, it is difficult to remember all the limitations, so pilots must consult the handbook for proper limits on the configuration they are flying. These speed limits are established through actual flight tests; if these limits are adhered to, flutter free flight is guaranteed. So read, heed and live. ★

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HOLDING AT IFR CLEARANCE LIMIT

Whenever an aircraft has been cleared to a point other than the destination airport, it is the responsibility of the ATC controller to furnish the pilot or the air-ground communications facility concerned with an additional clearance prior to the time the flight arrives at the clearance limit. This clearance may authorize flight beyond the clearance limit or contain holding instructions for the flight. Holding instructions will contain information as to the time further clearance will be issued or the time the pilot may expect to receive clearance for an approach.

In the event a flight arrives at a clearance limit without having received either a clearance beyond or holding instructions at such fix, the pilot will be expected to begin holding in a *Standard Holding Pattern* on the course on which he approaches the fix (disregarding any other pattern shown for the fix), maintaining the last assigned altitude flight level and immediately request further clearance through the air ground station. The altitude flight level of the aircraft at this clearance limit will be protected so that separation will exist in the event the aircraft holds, awaiting the clearance.

NOTE: The emergency should not be construed as being related in any way to the procedures which apply when a two-way radio failure occurs.

Flight Information Manual, Vol 13, Dec 59, Consolidated-Amend Nr 7, 30 Mar 62

how do you measure up?

Col Edward D. Leahy
Directorate, Missile Safety

DURING 21 PLUS YEARS of commissioned experience, both infantry and Air Force, it has been my good fortune to work with or for many exceptionally fine commanders. Each of these officers had certain qualities which made him stand out in a group, recognized and respected for his abilities and the positive results he obtained. One cannot be associated with such people for long without consciously or otherwise analyzing the individual in an attempt to discover what makes him great, or that element of character which gives birth to his many successes.

As I think back, each of these gentlemen had a common approach to the business at hand. Whatever the popular parlance of the time, each had a favorite expression, the implications of which he adhered to religiously in getting his job done. These included such mottoes as, "Accept nothing but the best," "Only a well disciplined outfit can succeed," "Learn the ground rules — then hit hard," "Know the rules of the game and any smart guy can run over a listless or complacent opponent." The majority of these statements were coined, borrowed, or preached by people who today are well known and respected general officers. Their successes are a matter of record.

What does all of this add up to? Well, the fortunes of assignment have finally brought me to a position where I sit and watch what is happening to our rapidly expanding inventory of missile weapon systems. Naturally, my job calls for more than just sitting and watching — I've got to act too or I've had it!

Here within the Directorate of Missile Safety we receive and analyze every missile mishap report submitted by USAF organizations. Each mishap is then carefully recorded by type weapon system on the appropriate accident or incident chart for the current calendar year. As we progress further into the year, the numbers of such mishaps become highly disconcerting.

But this is more than just a numbers racket. It's the picture behind many of these numbers which causes even graver concern. I'm talking now about the myriad of incidents which, on the surface, seemingly result in only minor damage to the birds or their operating ground equipment. I say "seemingly" because policy permits reporting such mishaps as one-time damage reports (5-day messages) provided the damaged components can be repaired or replaced within specified direct-man-hour time limits. With regard to incidents of this nature the relative ease of reporting such mishaps can engender complacency at operating unit level. After having reviewed approximately 300 one-time damage reports since my arrival here in September 1961, I fear that this may too frequently have been the case. I am convinced that in many of these mishaps either complacency or poor investigative techniques were present. Before anyone gets up in arms at this remark let me hypothesize a few cases to avoid embarrassment of any particular command or unit since that is neither my intent nor objective.

CASE A: The mishap involved loading of a smaller type missile on an aircraft at a northern base. The operation was being conducted at night. The weather was bad; ice coated the parking ramp. While moving the missile into position for up-loading, a young airman tripped over the missile container. The missile struck the ramp necessitating change of the guidance unit before it could be used. The brief investigation reflected in the one-time damage report found the young airman to be careless. He was briefed to be more careful in the future.

CASE B: A crew of young airmen were uploading a small missile on an aircraft. We know this happened in the daytime and the weather must have been A-Okay. Nobody said otherwise. The checklist called for a check of a particular component of the aircraft launch gear. The crew, however, *assumed* that this component was properly positioned and proceeded with their business. When the bird was nestled into the launch gear, the *assumed* component wasn't in the proper position after all. This resulted in the bird dropping on the ramp, damaging the fins and guidance unit. Both could be replaced in short order so a one-time damage report was acceptable as the reporting medium. The investigator found that the crew had failed to follow the checklist. Obviously! It was reported that all loading crews were briefed to follow checklists in the future.

CASE C: This mishap involved a larger, somewhat more complex airborne missile. A small inspection plate is provided on this particular bird in a rather critical location. An unidentified individual had opened the inspection plate but failed to secure the fasteners after he had completed his inspection. Later, the missile engine was operated and — you guessed it — the inspection plate tore loose, was ingested by the engine and did a remarkable flushing job of critical engine components in the process. The engine could be removed and replaced, however, within the specified direct man hours, so a one-time damage report was submitted. The investigator found that some unknown individual had goofed. Corrective action indicated that all personnel were briefed to assure a positive check of the culprit inspection plate prior to future engine run-up operations.

These particular cases have been intentionally distorted to try and make a point yet avoid outright criticism. They are not isolated for there are dozens of similar mishaps for each case cited. In each of the cases, I have asked myself, "Where was the supervisor, be he loading chief, flight chief, line chief, engineering officer, or what have you? Who let the young inexperienced airman get himself into a position on a blustery winter night where he could clumsily fall over the missile container? Who was the supervisor, or was there even a supervisor present to call off the loading checklist — or assure its use — when the loading crew *assumed* the launch gear component was properly positioned? What type of lax maintenance or ramp security procedures exist when an *unknown* individual can have direct access to a vital missile weapon system of our Air Force inventory?

The gentlemen I described at the beginning of this article would never tolerate such conditions. They well knew that it's these "little" items that can nibble a unit to death. They didn't have to be told that unless positive action was taken on minor mishaps, it would only be a matter of time before they were faced with serious mishaps. They were professionals and would assure that all the facts were reported — and corrected in a positive, disciplined manner.

I urge you to take a long honest look at your own organization. Do your investigations reflect answers to the types of questions I have posed? If not, why not? Don't trap yourself into thinking that these are negligible, inexpensive mishaps and, therefore, an occupational hazard that must be accepted when dealing with complex weapon systems. These *little* mishaps are costing us a lot of bucks. Don't spin your wheels tryings to protect your house against lightning strike or tornados. While you're concentrating on the big things those termites may just about be ready to have the roof fall in on your head. ★

LEARN AND SURVIVE

Survival in the remote, frigid areas over which USAF aircraft operate during the winter is a matter of knowing what to do and how to do it. Subscribing to this idea that *Survival is Knowledge,* Aerospace Safety presents a list and brief description of selected survival films available through base film libraries and the titles of several survival publications. Some of this material was produced several years ago and equipment may have changed in the meantime. During the coming year some new, up-to-date films are scheduled to be produced. Meantime, the fundamentals presented in the films and publications still hold good and might help save Air Force lives.

FILMS

FTA 279d Utilization of Game. 11 min, B&W, 1957, AF. Shows how to use parts of animals.

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FTA 279l Fire-building. 9 Min, B&W, 1957, AF. Information which will help in building survival fires and show different types of equipment.

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FTA 279m Medical Aid. 15½ Min, B&W, 1957, AF. Shows emergency medical measures for treating common types of injuries, wounds and conditions.

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FTA 279w Shelter. 10 Min, B&W, 1958, AF. Shows how to select and erect shelters appropriate to any situation or environment.

•

TF 1-4597 Arctic Tundra. 70 Min, 2 reels, color, 1949, AF. PE, TV. Shows how to survive in the arctic tundra.

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TF 1-5309 Stay Alive In The Winter Arctic. 23 Min, B&W, 1959, RCAF. Shows how an aircrew, forced down in the bleak winter arctic, uses its equipment and survival training to stay alive and promote rescue.

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TF 1-5310 Stay Alive In The Winter Bush. 21 Min, B&W, 1959, RCAF. This film shows how an airman, forced down in a wooded winter wilderness, uses his survival training to stay alive and promote rescue.

PUBLICATIONS

- Aircraft Emergency Procedures Over Water M64-6
- Arctic, Desert, Tropics, Sea, Sea Ice M64-3
- Land, Sea, Sea Ice M64-5
- Parachute Uses M64-15
- USAF Survival Training School R53-28
- AF Manual SURVIVAL Training Edition 64-3.

In addition to this list of publications, there are many supplemental survival materials prepared by the various commands. These deal specifically with the mission and are well worth the research time of all whose operations take them into the areas where survival could become a problem. Also, The Research Studies Institute, AU, issues many publications of interest to persons concerned with combat survival. Requests should be addressed to RSI (ADT), Maxwell AFB, Alabama.

TWENTY-FIVE, TEN OR CUT 'EM

Maj Robert E. Woods, 63 Troop Carrier Wing, Donaldson AFB, South Carolina.

"I'VE GOT 6000 FLYING HOURS — most of it in a C-124 — am an aircraft commander, and have always figured myself to be a real safety-conscious pilot. Now this happens."

These were the first words of the C-124 pilot when he entered the safety office. I asked him to sit down and tell me exactly what happened.

"And it wasn't my fault, either," he continued. "At least not all my fault. This had been a rough trip from the very beginning. We loaded our cargo at Tinker after waiting two hours for a replacement electric winch — ours had become inoperative about halfway through the loading procedure. Weather en route wasn't the best either. We circumnavigated three big thunderstorms and, with the help of radar, found a relatively smooth spot and penetrated the front with only moderate turbulence and light icing. We arrived at our destination about midnight, made a GCA approach and landed without any difficulty — that is, until we turned off the runway. The FOLLOW ME picked us up and we taxied down the taxi strip onto the parking apron. This was my first time into this base, so I carefully followed the yellow line and the jeep. As we approached a parked C-124, I asked the scanner in the top hatch about the clearance. He played the Aldis lamp on the wing tip and replied that there appeared to be about 10 feet between our right wing tip and the radar dome of the parked C-124. We eased past the nose okay and moved forward about 50 feet when I heard a thud and a call on the interphone from the scanner stating that our right wing heater pod had scraped the heater pod on the parked C-124. The C-124 had been parked at an angle which allowed the right wing to protrude farther into the taxi lane than the radar nose dome. I stopped the aircraft and cut the engines.The FOLLOW ME driver came aboard and said that he would locate the safety officer. That's the last I saw of the FOLLOW ME driver. In fact, I didn't even get his name. I knew then that I was stuck with a bent million-dollar airplane."

Looking over the record for the last few months, I found this aircraft commander's story to be typical of just about all the wing tip taxi type accidents that happen in MATS and the USAF.

MATS aircrews are noted for their world travels. Thule, McMurdo Sound, DEW Line, Congo, LaPaz — you name it, they've been there. Most of these air patches come under the heading of "strange fields." Before departure, the aircrews make a careful study of the destination air base to make sure they can get in and out safely. The record shows that their troubles are practically nil while flying at speeds of 175 knots, or even at landing speeds of 120 knots and landing rolls of 40 to 50 knots. Their troubles, like those of many other USAF aircrews, occur when the aircraft is rolling at a speed of 5 to 10 knots. Also, believe it or not, the record shows that most taxi incidents occur at USAF bases — places where ample facilities exist and safety is (or should be) paramount.

Pilots involved in taxi accidents usually state that "It wasn't altogether my fault." However, in most cases, when the truth is known, the real reason for the accident points directly to the pilot. He's the man at the controls. He makes the bird go and stop. Many of the taxi accident investigations also point to the fact that *pilots were trying to accommodate ground personnel by juggling their aircraft through obstacle courses in order to eliminate a towing job.* And, while trying to accommodate these people, the pilot ended up paying a great price for his helpfulness.

It doesn't make sense! Transport aircrews work hard getting their loads on board and tied down. They fly thousands of miles over all kinds of terrain and through all types of weather in order to get their cargo to its destination. Once on the ground, their job, for the most part, is just about completed. From the time the pilot turns the big bird off the runway and until he is parked, the aircraft should be handled safely and efficiently. No short-cuts to safety should be taken by ground personnel. Many pilots who have had taxi accidents have allowed themselves to be mouse-trapped and they feel they will "lose face" if

they cut engines and ask for a tow-bar. Instead, they try to squeeze through with their necks stuck out. They have nothing to win and everything to lose. No one plays a game with odds like these.

A few generations ago there was a saying, "Fifty-four Forty or Fight." Today at Donaldson AFB, we have another slogan — "Twenty-five Ten or Cut 'Em." And we've got AFR 60-11 to back us up. Paragraph 1g reads, "Aircraft being taxied on land within 25 each wing tip. (Commanders may waive this provision for locally based aircraft if established taxi lines are marked and obstructions are either permanent or other aircraft parked on established parking spots or lines.) If an obstruction is present on one side only, a man at that wing tip is required. Aircraft will not be taxied at any time within 10 feet of obstruction."

A close look at the part in parenthesis has been an enlightening bit of news for many aircraft commanders. (It's been there all the time, but has been overlooked.) That's the part about taxi lines. Read it again. The rule here is to follow only the yellow taxi lines AT YOUR HOME BASE. Base commanders are only required to mark taxi lines to give clearance for their LOCALLY based aircraft. If a C-124 driver lands at a T-33 base and tries to casually follow the taxi lines, he's going to find his No. 1 and 4 props doing some fancy trimming on the nose and tail sections of parked T-33s! This was vividly illustrated last year when a transport was following the yellow line at a strange overseas field. Everything came to a sudden stop when his right wing tip took off the top of an old pre-war barn. After the timber and shingles had stopped falling, the aircraft commander noticed that the ramp was loaded with F-100 type aircraft, and that the lines had been marked for a much shorter wing clearance than the wing span of the transport he was driving.

Of course the best rule is never to follow a yellow line, a FOLLOW ME, or a signalman unless you KNOW you have sufficient clearance. On occasion, aircraft commanders have stopped their aircraft and requested signalmen for guidance when they found that clearances were less than 25 feet. Then, as the clearance decreased to less than 10 feet, they have stopped the aircraft and requested a tow. They have also been told at this point, "We don't have a tow-bar for a C-124," and to this the only reply is "That's too bad. AFR 60-11 says I can't taxi any farther. We'll cut 'em and unload right here." You'll be surprised sometimes how quickly a tow-bar can be rounded up when scripture and verse is quoted from an Air Force regulation.

This "get with it" program by Donaldson aircrews has paid off. We're not having any more wing tip accidents. Maybe we're not making as many friends as we used to, but sometimes I wonder about "friends" that lead you into trouble and then drop you like a hot potato. Did you ever try to find the FOLLOW ME driver who was leading you when you damaged a wing tip? Did one ever say "It was my fault?" In fact, did one ever stick around more than five minutes after you "bought the farm?"

Air Force regulations were written for all, not just a few. If Transient Maintenance at some "strange field" doesn't have a tow-bar for your aircraft, that's just too bad. Maybe they will next time. Better still, on your next visit the odds are they will treat you like you're supposed to be treated.

It was a pleasure to hear an aircraft commander, who had just returned from a trip, tell me, "I came out to my aircraft yesterday morning and found that a C-54 had been parked on my right side and a Gooney bird on my left. Old Shakey's wings were overlapping each one about two or three feet. Transient Alert had fireguards all set ready for me to start engines. I told the driver of the crew bus to take me back to Base Ops. There I filed an OHR and requested that my aircraft be towed to a clear area in order that I might make a safe start. The 'you know what' hit the fan, but my simple request was granted in short order. No organization wants a delay charged to them because of something like that."

We have learned the hard way. Sometimes that's the best way. It sticks. ★

Major General Perry B. Griffith, Departing Deputy Inspector General for Safety, USAF

Adieu....

PROGRESS can be made when dedicated people work at safety. Perhaps it is well to pause at times and recognize this fact. At the beginning of 1963, with the reassignment of the Deputy Inspector General for Safety, it appears appropriate that such cognizance be taken.

During the past two and a half years, significant strides were made in the business of preventing accidents.

Consolidation of all safety areas—Flight, Ground, Missile and Nuclear—into one organization was initiated in order to gain a more coordinated and efficient safety effort.

All accident and incident classification and reporting directives were consolidated into one regulation—AFR 127-4.

Continued reduction in aircraft accidents was made, even though such progress becomes increasingly difficult the closer the rate approaches zero. In addition to the savings in lives and defense resources, major aircraft accident reduction accounted for an \$89,000,000 savings from fiscal 1960 to 1962.

The ground accident rate also reached the lowest point in Air Force history. Major nuclear accidents with nuclear yield remained at zero.

The safety survey program was initiated and refined by specialists from DIG/Safety as a means of identification and elimination of potential hazards.

Procedures for Air Force-Industry Accident Investigation Boards were organized so that the best "brains" might be readily available to investigate serious accidents.

AF-Industry Conferences continued at an accelerated pace to probe critical areas of accident potential.

Three annual safety congresses were convened to bring together flight, ground, missile and nuclear safety

Above, General Griffith arrives by T-Bird to host an annual Safety Congress at Sandia Base. Right, General Griffith leads a team of investigators as they spend an Easter Sunday probing for clues at an aircraft crash site.

To find out for sure,
try it yourself.
General Griffith and an instructor
make a free fall parachute jump.

officers and commanders from installations AF-wide for the purpose of resolving present safety problems and working out accident prevention programs for the ensuing year.

These are some of the gains registered in the past two and one half years during which Major General Perry B. Griffith has served as the Deputy Inspector General for Safety. In these, and many others, the measure of success must, in considerable degree, be credited to his intense personal concern and leadership. His actions have well exemplified one of the primary requisites of an effective safety program—dynamic supervisory interest. Frequently he would leave on minutes' notice to visit an accident scene, occasionally arriving before command investigators. Two successive Easter Sundays he spent probing for clues in smoking holes in the ground. Typical of his efforts to explore innovations for improved safety was his interest in modern sky-diving techniques.

General Griffith learned of a parachuting technique that gave promise of reducing injuries and fatalities following ejection. To gain first-hand knowledge, he went through the training course and made several free-fall jumps.

This magazine with regret bids farewell to Major General Perry B. Griffith, the Deputy Inspector General for Safety, head of the USAF safety effort, and wishes him continued success in his new assignment as the Deputy Commander, U.S. Forces in Northeast Atlantic and Middle East. General Griffith departed Norton AFB for England on 8 January. ★

The General
and specialists from industry discuss missile safety
problems during an intermission at an Air Force-Industry Safety Board.
Attendance ranged
from 250 to 400
at these sessions.

THE HUMAN TOUCH

ANOTHER MISSILE ACCIDENT caused by personnel error! The cause factor could be failure to follow checklists, violation of specific technical data, supervisory error, limited experience, a bad decision or just plain carelessness.

Just as malfunction of a critical equipment component can abort a mission or damage equipment, so can a human component of the system. Another way of saying this is that *personnel error can affect system reliability in the same way as the malfunction of a part.*

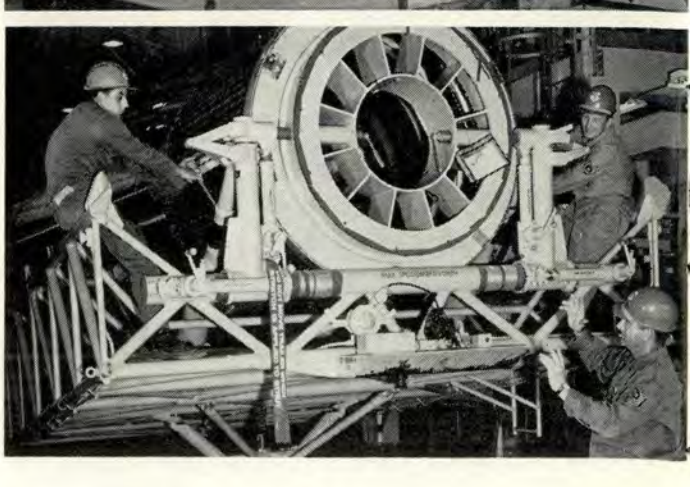
Statistics and Examples. Why make an issue of personnel error? After all, we are human. Admittedly, a 100 per cent human reliability figure is a tough goal to reach. Let's first define Human Reliability then take a look at some statistics to see if there is any room for improvement or if we can afford to be complacent.

Human Reliability (HR) can be defined as the probability that an individual will perform his assigned function without error and within an acceptable period of time. It should be noted that the statistics given below apply primarily to the missile maintenance function; however, they serve to illustrate the degrading effects of human performance on system reliability.

WADD Technical Report 60-39, Feb 1962, entitled "Human Engineering, Testing, and Malfunction Data Collection and Weapon System Test," is a two-year study of 3829 equipment malfunction and 419 unscheduled hold reports from seven missile systems. Thirty-nine per cent of the former and 20 per cent of the latter were classified as human initiated malfunctions. The study concludes that human error might be the largest single identifiable cause of system malfunction (from 20 to 50 per cent of all malfunctions). An article "Rocket Engine Damage, Causes and Cures" in the August 1961 issue of Western Aviation Missile and Space, summarized the analyses of some 600 rocket engine failure and consumption reports. The analyses revealed that 35 per cent of the equipment damage was caused by the human element during maintenance, checkout and transport of the equipment.

Approximately 40 per cent of all missile holds, postponements and failures experienced at Cape Canaveral have resulted from human error.

A 1961 analysis of accident-incident reports on all types of strategic, defensive and tactical missiles has shown that the single highest cause factor (44 per cent) is personnel error. In the same period of time the major aircraft accidents due to personnel error amounted to about 47 per cent.



Complex missile systems require that human factor be designed into the system for man and machine to function effectively.

Some realistic examples may make the above statistics more meaningful: improper adjustment of limit switches, faulty installation of connectors causing bent pins, failure to tighten "B" nuts or over-torqueing them, incorrect wiring, failure to discharge cables after resistance testing, etc.

Sometimes the criticality of the goof might be minor; other times a serious accident is the end result. The closure doors which protect some of our ICBMs are actuated by hydraulic cylinders under 3000 psi. There are check valves in this system to control the direction of the hydraulic fluid flow. During installation and checkout at one missile site, an over-torqued check valve "B" nut connection caused the failure of the connection which whipped out the line and valve, broke the bulb of an adjacent light fixture and sprayed flammable hydraulic fluid on it. The damage caused by the ensuing fire was very costly, not to mention the delay and manhours to refurbish the system.

There are many other examples of carelessness, lack of training or erroneous decisions; components being replaced have been dropped over 100 feet because they were not secured or placed in a secure location; a step in a checklist called for insuring that a pressure closure plate was installed in a missile fuel tank fill line connection before continuing with the automatic system checkout procedure. The technician mistook a dust cap for the required item. This mistake resulted in loss of fuel tank pressure and a bulkhead reversal.

FACTORS UNDERLYING HUMAN MALFUNCTIONS. The above has shown that as high as 50 per cent of system failures can be attributed to human errors. The human errors, however may not be purely the fault of the individual. For example:

a. Equipment may be poorly designed for human use.

b. Technical training may be insufficient or discontinued prematurely.

c. Handbooks, work cards, technical data, instructions may be inaccurate, insufficient in detail for the skill level, etc.

d. Functions assigned may involve task overloading or require too many critical decisions.

e. Distractions, fatigue, etc.

As was emphasized previously, the correct decisions on what man will do in the system is extremely important. Item d, above, would be a factor only if a poor man vs. machine function decision was made in the system design stage and was not corrected during the Personnel Subsystem Test and Evaluation program (PSTE). Likewise, some of the other deficiencies might have been corrected by the PSTE program during the system's development cycle.

THE NEED FOR PSTE. The PSTE program is analogous to the hardware subsystem test programs. Human performance is tested during the development cycle to insure that the demands made on the human by the operational system won't exceed his limitations. This testing is conducted and integrated with the hardware testing program. PSTE is required to discover and correct deficiencies in personnel selection, training, technical publications, equipment design, man-machine capabilities, man's capablity to perform a function assigned to him, etc.

Air Force System Command's System Project Office is responsible for the plans and contracts for the PSTE program. AFSCM 80-3, "Handbook of Instructions for Aerospace Personnel Subsystem Designers," (HIAPSD), Part K, contains detailed information of all facets of the PSTE program.

PREDICTING HUMAN RELIABILITY. The PSTE program validates the design team's choice of the human's function and assures us, for example, that the human can interpret the displays of a complex man-machine system, operate the controls easily, make the required decisions, and withstand the environmental conditions. The designer, however, should also know how often people make mistakes. Unfortunately, there is very little standard data on this subject. If there were some practical way in which to find the personnel error rate for a job, HR would be easily determined. In the first place, there is the problem

Edwin R. Roth, Gen. Engineer, Directorate, Missile Safety.

the HUMAN Touch

of how to categorize the error. Is it failure to perform, performance out of sequence, alternative courses, action outside human capabilities (physical, reaction time, etc.)?

Secondly, there is the problem of effects of the human error. Will it result in a minor delay? Will it abort the mission? Will it result in a catastrophic accident? To the extent that time and other limitations permit, the criticality of the effect of each element on system performance is examined by the personnel subsystem analyst during the PSTE program. Any errors or error tendencies are noted and actions taken to reduce the likelihood of future mistakes. But when you consider the tremendous amount of tasks that would have to be observed before an HR figure for the system could be derived, you begin to appreciate the magnitude of the problem.

It is doubtful that an HR estimate would ever be as accurate as estimates of equipment performance. However, this should not prevent serious attempts to establish human performance criteria. A fruitful future source of data might come from malfunction reports. In the statistical studies referred to above, however, it was clear that the reporting personnel who filled out the original failure data were reluctant or did not consider the classifying of a malfunction as human error. If the reports were taken at face value, hardly any human initiated failures would have been uncovered. Instead of reporting the human error cause factor the effect or failure is reported. Perhaps this is also due to the fact that failure reporting codes give practically no descriptive terms for human errors other than wrong part, improper installation or handling. On the other hand, there are hundreds of codes to describe the failure mode such as shorted, binded, burst, brittle, broken, fails to open, pull position, gouged, grooved, grounded, leaking, cracked, stripped, sheared, contamination, fluctuates, etc.

Accident and incident reports also provide a good source of human error data. The subsequent investigation usually determines what factors contributed to the personnel error failure and corrective action is recommended. Personnel subsystems studies should furnish estimates for certain human operational functions which tend to repeat themselves. At the same time new data will help human engineers design less error-prone sysems and more valid decisions will be made in allocating functions to man and machine.

There is hope, then, that there will be breakthroughs in the future, but what of the present? When a missile weapon system is finally installed in the operational environment it is to a large extent "cast in concrete." Major redesign drives at this stage are a lost cause. For the present we have no quantitative answer to the question of how good is human performance in the system.

There are many unknowns that still plague us about people. For example, performance is affected by such complex factors as motivation, stress, fatigue, selection and training. To improve on the selection of reliable people for the missile business, the Air Force developed a selection program for initial screening and continued evaluation of personnel. The program is described in AFR 35-9, "Human Reliability Program." It considers the stability and dependability of the applicant — his physical and mental (emotional) fitness. A day-to-day evaluation is also required to determine whether personnel on the job are fit to stay on the job. WADC-TN-58-66, "A Survey of Potential Morale, Motivation and Retention Problems at Ballistic Missile Sites" had as its major thesis that "in the area of human relations lies the greatest potential for getting things done effectively through enhancing morale and motivation." Closely related to morale, motivation, and leadership is the training problem. Analysis of accident reports have indicated that this is perhaps the biggest problem area.

WHAT CAN YOU DO? A great many functions must still be performed by the human in today's missile systems. The human factor is absolutely essential which makes it all the more important to control. Although we may not know what HR is quantitatively, there are ways the operational team can improve it:

- Maintenance technicians and combat crew personnel must know what their functions are and have the capability to perform their jobs.
- Missile maintenance and combat crew supervisors must know whether their personnel are proficient and take action to update them if they are not.
- Checklists and procedures must be followed explicitly. If there are any known TO deficiencies they should be immediately reported.
- The operational team should be on the alert for any potential safety hazards and report them to the Missile Safety Officer for corrective action.
- All missile personnel must be on the job mentally. It is surprising how much time each day the human thinks about other things, particularly himself. This attitude is conducive to human errors.
- In reporting component malfunctions, the recognition of a human factor cause, when this is truly the case, will be a significant contribution to the prevention of recurrence. The human is not prone to self criticism. If he is not persecuted, however, and understands the benefits to be derived he will cooperate. The addition of human error type items in the failure reporting system will also help.
- Supervisors must constantly supervise. They must see to it that personnel are adequately trained and have ample opportunity to increase their skills. They must insure that the tools required for all tasks are available, procedures are adequate, the equipment compatible and the proper number of personnel are on hand. Finally, they must lead and motivate if the job is to be done effectively with safety and reliability. ★

1st Lt Harold J Beall | WELL DONE

First Lieutenant Harold J. Beall, 197 Ftr Intcp Sq, Ramstein AB, Germany, was flying a high altitude intercept mission in an F-104 as Nr 2 man in a two-ship formation. After being level at 30,000 feet for approximately 30 minutes, Lt Beall experienced what appeared to be a minor aileron malfunction. The control stick began jerking, similar to stick shaker, and at approximately 10-second intervals. This was remedied by turning off the roll stability control switch. Shortly afterwards, while descending to initial penetration altitude at .95 Mach and passing through 28,000 feet, the pilot joined up in close formation for the instrument approach.

Suddenly the aircraft flipped over to an almost completely inverted position and the stick went to the full forward position, throwing the pilot into his shoulder straps at between zero G and minus one G. Meanwhile the Nr 1 and 2 generators were alternately failing, then coming back on the line. Each time they switched from one generator to the other the "Instrument on Emergency Power" warning light and the "APC Out" warning light would flash on. Power was retarded to idle and an attempt was made to contact the flight leader, but the radio was inoperative. While the aircraft was rolling out, the stick moved forward again and the aircraft started porpoising. The first four or five oscillations were very violent, but as the aircraft slowed, the pilot was able to regain some control. Lt Beall turned off the APC switch, but the aircraft continued to porpoise. He then turned off the other two stability control switches (pitch and yaw), the porpoising still continuing from moderate to severe. The pilot turned off the generators, one at a time, and reset them with no results. He then turned off both generators and the porpoising stopped. Power was advanced and everything appeared normal except that the aircraft was yawing slightly.

Lt Beall then joined on the lead for penetration. When the field was in sight, landing flaps were extended and the generator turned on until porpoising became severe. Turning the generator off got rid of the porpoising. Landing gear was lowered by the manual release and Lt Beall reset Nr 1 generator momentarily to ascertain he had three green lights. Landing was made without further incident and without damage to the aircraft.

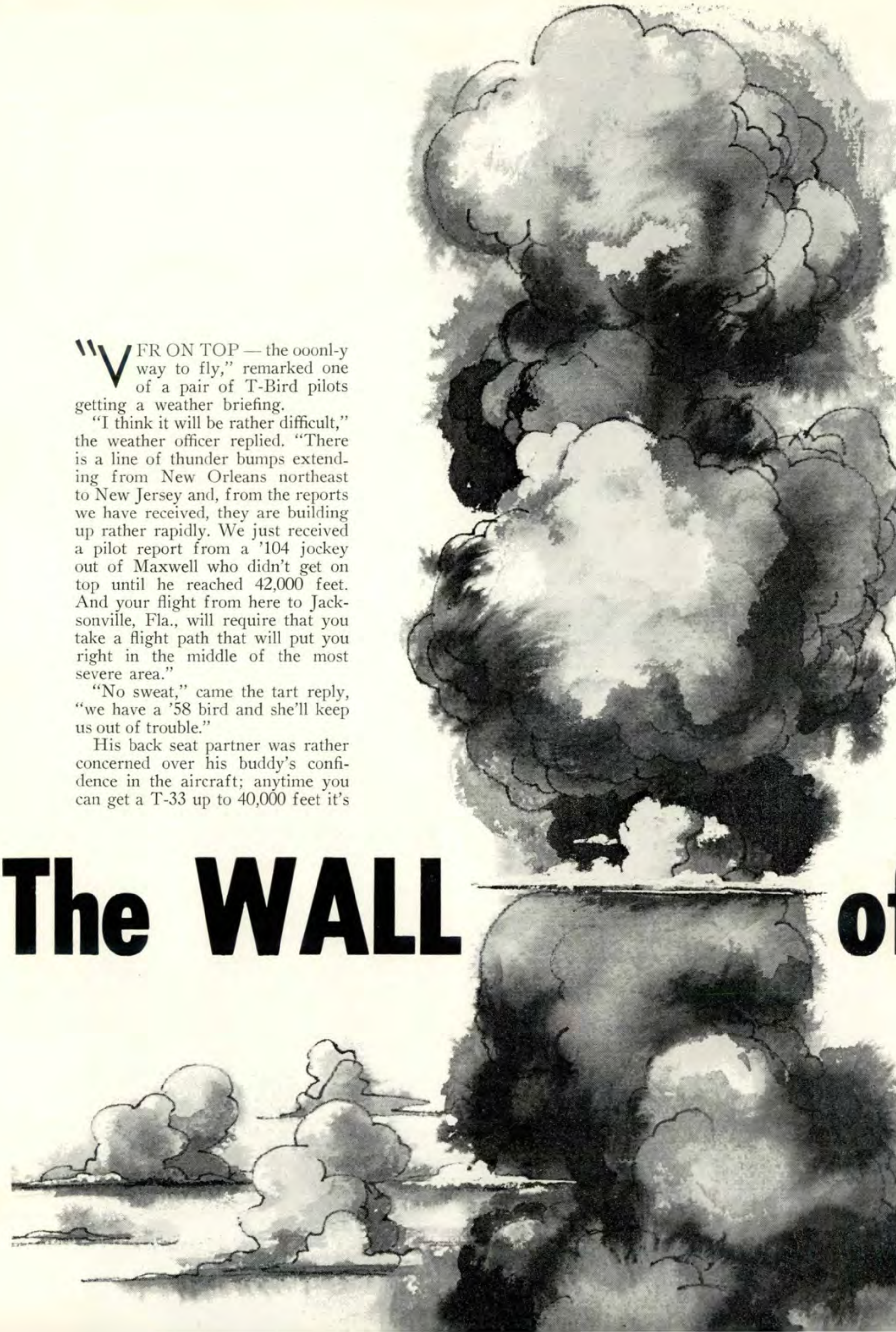
By exhibiting a high degree of professionalism and a thorough knowledge of the aircraft, Lt Beall saved an aircraft and prevented possible injury to himself. Well Done. ★

"VFR ON TOP — the ooonl-y way to fly," remarked one of a pair of T-Bird pilots getting a weather briefing.

"I think it will be rather difficult," the weather officer replied. "There is a line of thunder bumps extending from New Orleans northeast to New Jersey and, from the reports we have received, they are building up rather rapidly. We just received a pilot report from a '104 jockey out of Maxwell who didn't get on top until he reached 42,000 feet. And your flight from here to Jacksonville, Fla., will require that you take a flight path that will put you right in the middle of the most severe area."

"No sweat," came the tart reply, "we have a '58 bird and she'll keep us out of trouble."

His back seat partner was rather concerned over his buddy's confidence in the aircraft; anytime you can get a T-33 up to 40,000 feet it's



The WALL of

Lt Col Anthony S. Cavallo
Editor, Aerospace Accident and Maintenance Review.

CLOUDS

a struggle, let alone getting one up to 42,000 feet and above, especially with a pod. "Look, Jack, why don't we just get a hard altitude and if it gets too rough we can always make a 180 and come back."

"You won't get me in that soup at a hard altitude," replied his partner. "No sir, I've had enough of those bananas. We'll give VFR/OT a try and we can always head east and try to get over. It appears to be a little thinner in that direction. We can then swing south down the coast to Jackson."

His partner reluctantly agreed and they filed their flight plan accordingly. Climb out was VFR and they were able to make the first wall of clouds on top at flight level 390 with about a thousand feet to spare. They were tuned in to Atlanta center on the UHF frequency for that area.

"Looks like we'll be able to make it . . ." Before the confident pilot could complete his remark, an excited transmission from an F-100 pilot was blaring out over the radio on Guard, requesting help from Atlanta Radar. The pilot said he was in the soup at 45,000 feet in severe turbulence and was asking for a steer to a more stable area. Atlanta informed the pilot that the whole southeast was in a severe weather warning category; however, they would give him a steer that *MIGHT* help him out. A minute or so elapsed and the F-100 pilot reported that he had encountered hail the size of golf balls in addition to the turbulence, but was finally on top at 49,000 feet and was proceeding on course. Subsequently Atlanta Radar was jammed with requests from numerous pilots asking for assistance. The radar operator was hard pushed to keep all the jocks happy. However, as is the usual case, he handled all the pilots' requests for help in an exceptional manner. Meanwhile the lads in the T-Bird listened to the chatter over the air. Finally the front seater completed his unfinished earlier remark, this time with a little less confidence in his voice. It even sounded a little shaky. He was determined to make Jacksonville, do-or-. . . . He tried to appear a little cooler when he stated that they may have to climb a little due to a gradual increase in the height of clouds ahead of them. As they approached the wall, it was obvious that they wouldn't be on top before they hit the soup.

"I'll just make a few climbing 360s here, and I believe we'll be OK in another thousand feet or so." The 360s continued for many turns. You know how a jockey will try to look over the clouds as he's climbing, sort of urging the nose up over the mound. Pretty soon he finds himself behind the power curve about to stall out. Our friend made it to 42,000 feet, but it was an up and down proposition. He still had a long way to go to get on top. At this point, with the bird getting a little sloppy, he attempted to continue his climb at around 170-175 knots indicated. T-Birds just won't climb at that altitude at that airspeed. Accordingly this pilot was in a constant mush — getting no higher and losing more space than he could hold.

Much to the chagrin of his rear seat partner the inevitable happened. During one of the dive-and-climb maneuvers, the T-33, (bless her soul, she tried to let them know), went into a spin. Now you readers who have been in a spin in a T-Bird at flight level 420 will appreciate the predicament these jocks were in. It was a real hairy ordeal all the way down to 20,000 feet, when they finally managed to bring her back to straight and level.

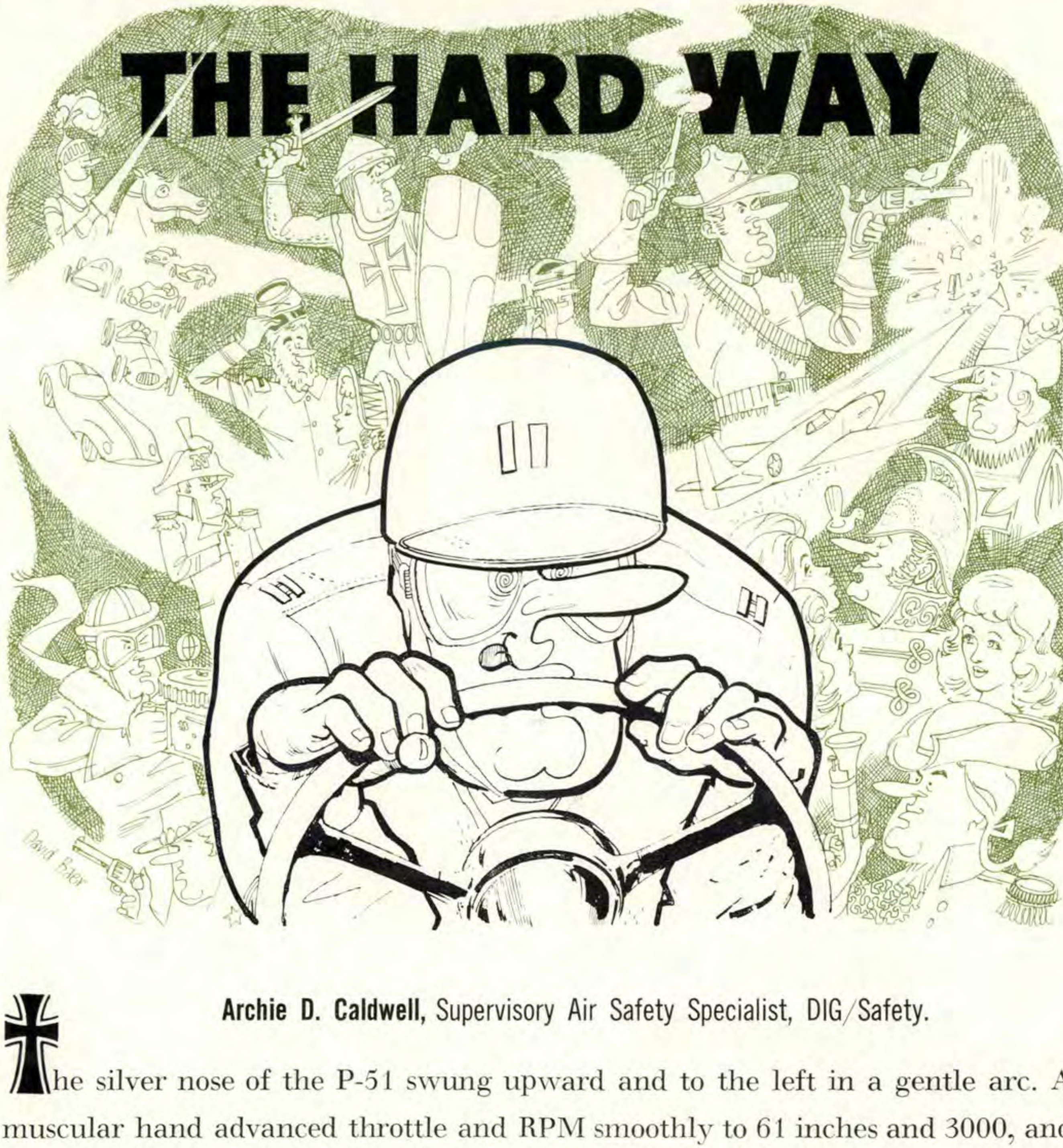
Fortunately this all happened where there were few clouds below them — this story does have a happy ending. After much confusion, mostly in the front cockpit, a few fixes by GCI established their position and they were directed to a VFR installation. There a very nervous and shaky pilot made a very nervous and shaky landing.

After parking, the pilots had a difficult time getting out of the cockpit. It seems that hands and fingers could not hold still long enough to accomplish the simple tasks of doing a little unbuckling.

By the way, they RON'd but, you guessed it: they had lost their pod and with it went their dancing shoes. ★

When it comes to safety on the highway, Captain C. Z. Chumley learns . . .

THE HARD WAY



Archie D. Caldwell, Supervisory Air Safety Specialist, DIG/Safety.

The silver nose of the P-51 swung upward and to the left in a gentle arc. A muscular hand advanced throttle and RPM smoothly to 61 inches and 3000, and the world's greatest pilot, Captain C. Z. Chumley, lined the faltering ME-109 squarely in the pipper of his K-14 sight.

"Five rounds per gun — no more," C. Z. said to himself, and flicked the trigger. The ME disappeared in a cloud of smoke and became victory number 42, or was it 43? C. Z. turned his head to look for other prey.

"LOOK OUT!"

"Where, what?"

"I said look out. You were about to put your coffee cup in your eggs." Mrs. Chumley gave a sigh. "Honestly, you and your daydreaming. What were you doing this time, signing the Potsdam Agreement or charging San Juan Hill with Teddy?"

C. Z., now back to reality, only muttered as his love and best critic continued. "You swore you wouldn't dope off anymore—anytime, that you would. . . . "

"I know, I know. And I haven't. My flying has taken on the safety aspect of a church convention. I know the flight handbook for our birds like Jack knows Bobby and Teddy. I've been a living example of flight planning, judgment and flight safety. I am. . . . "

"You're late for work, that's what you are," Mrs. C. interrupted. "You'd better get off and on and get going."

Chauncey took a final gulp of coffee, smartly deposited the cup in the center of Mrs. C's grits and eggs, gave a resounding kiss that missed by eight inches and shot out the door.

As he and the Jag purred along the freeway, C. Z. reflected on the tremendous improvement he had made in becoming a professional, safe pilot. Why it was only the other week that the Wing Commander himself had come to C. Z. and had given him a "well done" for saving a bird in an emergency. And hadn't he been instrumental (along with the rest of the squadron) for the flight safety nomination. Then there was the . . . "GRRAFRROOM" — a '63 Sting Ray shot past Chaunce and the Jag.

"Johnny come lately — I'll show him!" C. Z. shoved both feet into the carbs and the roadster took off.

The freeway dissolved and became the straightaway at LeMans. "Only one more car to pass and I'll be right on Hill and Brabham." C. Z. mentally pictured himself in a sleek red racing car contending for the world's top racing honors. He hunched down a little more behind the wheel.

The speedometer was approaching 90 before C. Z. realized simultaneously that: (1) He was not at LeMans, (2) he could not catch up with the other driver and (3) the right hand turn onto the road leading to the base was coming up fast. C. Z. downshifted, hit the binders and started into the turn. It would have been neatly executed had not some gravel truck liberally coated that particular piece of roadway with what reacted with the fast moving Jag as marbles on a bowling alley. Chumley remembered two fast 360 degree views of the landscape, then the front end of a blue staff car with a license plate that looked like a star coming up on his left, then little else.

As C. Z's eyes opened and his head cleared, faces in white uniforms became faces in white uniforms. He immediately recognized only the red face of his long suffering commander. Chaunce groaned as the white uniforms eased what appeared to be his left leg encased in concrete into position on the bed. The colonel waited until all but he and the doctor were alone with C. Z. before he spoke. "Well, Chumley, it must have taken some doing but you did it. You became one of the Air Force's 1963 motor vehicle accident statistics. You succeeded in alienating the affections of a general officer who up to this time had thought highly of our organization, and the Doc says you've caused my blood pressure to hit an all time high. You violated every . . .!"

"I think I could have made it," C. Z. broke in weakly, "if there hadn't been that loose gravel; and if the staff car hadn't been right there at that time —."

The doctor cut Chaunce off. "If that staff car had been traveling faster, or had been a truck, you wouldn't be here now. I see other drivers like you first hand, Captain. I try and fan a spark of life into their torn bodies and I'll tell you right now, I get sick when I see the waste of life that's brought about by just such idiotic actions behind the wheel as you pulled."

The long suffering commander picked up the conversation. "Do you realize that in 1961 there were over 2800 auto accidents in the Air Force. Last year's figure will probably top that total. Way over 350 officers and airmen were killed in auto accidents alone last year — people like you, who either forgot the basic principles of safe driving or had their good sense dulled by booze or drowsiness."

"But sir, my flying has become absolutely safe. I've been —."

"You've been half safe, that's what you've been," the Old Man shot back. "The Air Force assumed an obligation when they took you in — to train you, feed, clothe, educate and provide for your welfare. But this isn't where it ends. *You* have an obligation to the Air Force in payment. Part of this obligation includes some overt effort to stay alive, not only to fly safe. Flying is just one aspect of your obligation. If you or any other crewmember gets knocked off in an auto accident, your value as a piece of our combat machinery is just as worthless as if you had never left the used car business."

The Doc took a look at the colonel's flushed face. "Better calm down, Winton, I'll give you a mild sedative and we'll have a cup of coffee." He took the colonel's arm and started for the door.

"Courts Martial's too good for him."

C. Z. flinched a little as the door closed.

* * *

The three weeks which had elapsed since the accident had allowed C. Z. to become ambulatory; blood pressure of the commander returned to normal; he and the doctor had put their heads together to come up with a fitting corrective action for the self-determined "world's foremost aviator."

"Morning, Colonel," Doc said, as the Old Man entered his office.

"Morning, Doc. Well, how did our corrective action work out?"

"Just fine, he's still sick. Your idea of having Captain Chumley and every other member of this outfit who has been apprehended for speeding or involvement in an auto accident spend his weekend nights in the emergency receiving room of the hospital in town, sure makes believers out of them. Captain Chumley has been offering to trade his car for a bicycle."

"Well, some take a long time to learn."

"The only trouble," Doc offered, as he put match to cigarette, "is that some of 'em learn too late and never get a second chance." ★

MISSILANEA

GAR-1D

The missile on Nr. 2 rail slid forward as it was being manually lowered, because it was not locked on the rail. Damage was received by the guidance unit when it struck the forward bulkhead of the missile bay.

Crews were rebriefed on the proper Tech Order rearming procedures and a red line will be painted on all rails in line with the forward launch hook to provide another visual verification that the missile is properly locked on the rail.

GAR-2A

This mishap occurred during uploading of GAR-2As for a mass load exercise. Both members of the teams were current in techniques and had considerable experience ranging from 14 months to almost five years.

The GAR missile was loaded in the left launcher rail of an F-101B and checked for security. It appeared to be positioned properly and could be moved neither forward nor backward. Upon retraction of launcher rails the missile guidance unit struck the rotary armament door; the guidance unit was broken and required replacement.

There have been numerous similar accidents. Proper execution of established Tech Order procedures will preclude such mishaps. In addition easily visible markings on launcher rails, to check proper missile alignment should be expedited. Such markings should provide a secondary check for proper missile position prior to retraction.

WATCH YOUR BUTTONS—

During actuation of the portal doors at a Titan I site, the operator noted that door A was stuck open about 10 inches. Job Control was called but could not furnish immediate support. A conference was held with the crew commander and it was decided that the technicians on site could trouble-shoot the system. A safety briefing followed and the technicians were advised to use extreme caution.

The technicians descended to level two where they opened the portal doors with the emergency system. (The doors are flanged with door B having the flange on the bottom and door A the flange on top. With the doors closed they provide an interlocking face with the door A flange resting on top of the flange of door B.) The doors opened as they should and permission was received to close the doors by the normal system. A recycle using the normal system opened the doors all right, but as they closed, one of the crew thought he observed door B to stop and door A continue to close.

Fearing the doors would close out of sequence or that door B would not close at all, the crewman ran to the door control panel and pushed what he thought was the emergency stop button. However, it appeared that the doors would still interfere with each other and that damage would occur and debris shower down on him, so the crewman released the button and took cover. Door A closed first with door B closing on top of it. Damage, however, was only superficial.

After investigation disclosed that all systems were working properly, a minute analysis was made of the human factor. It was learned that an optical illusion occurs when one watches the doors close from certain positions on the second level. Door B appears to stop and door A to accelerate.

The incident was duplicated when the door B gravity flow button was pushed instead of the emergency stop button. Door B stopped and door A continued to close and overtook door B. Then, if one thinks he has his finger on the emergency stop and releases the gravity flow B button, door B will resume moving toward the closed position. The buttons are only three inches apart on the control panel.

All personnel should be aware of the possible optical illusion and warned to *watch their buttons.*

Lt Col Joseph F. Smejkal, D/MS

SUPERVISION

Despite continued emphasis on proper supervision and use of the checklist, there apparently remains that 10 per cent who haven't got the word. For example, after a GCI mission the pilot wrote up that there was no missile tone on the left hand GAR 8 missile. An airman checked the system and found it to have a broken fuse which he replaced. After the fuse blew again he asked the armament NCOIC what to do and was told to move the missile to the right hand launcher. This he did, removing the umbilical shorting plug for the guidance and control section. He did not replace it after the missile was secured to the right hand launcher. He then checked for missile tone and when he got negative results proceeded to check the missile through the firing circuit. When he noticed smoke coming from the guidance and control section, he immediately turned off all armament switches. Subsequent inspection revealed that the gas grain generator on the guidance and control section had fired, however there was no other damage. All safety pins were installed and the aircraft was properly grounded. It turned out that the airman was not a member of a loading crew; no checklist was used; and the airman had been helping pull checks which required activation of the firing system. Question is: Where was the supervisor? Also, how about A&E dispatch? Who dispatched this unqualified, unsupervised man? ★

X•21

The world's first full size Laminar Flow Control aircraft, the X-21, will soon join the stable of Air Force research vehicles. Pilots with B-66 time will look twice the first time they see the X-21, for these aircraft were once WB-66s. Major modifications include new 60 per cent larger, sweptback laminar flow wings and the pod-mounted engines on the aft fuselage.

The 83,000-pound X-21s are the first full size test beds for LFC (laminar flow control). Benefits expected for large logistic transports (already proven in model tests and in flight tests with an LFC glove on the wing of an F-94 fighter) are friction drag reductions on the order of 80 per cent at cruise. Translated into efficiency and safety this means a reduction of one-fourth in thrust requirement and a range and endurance increase of about 50 per cent.

With friction drag nearly eliminated by LFC, the wing can be made larger, and therefore more efficient. With the additional lift from the larger wing, there are also other safety by-products: Takeoff ground roll is reduced, liftoff speed is less, as is approach speed and landing roll. These advantages in turn lead to others such as less wear on brakes and tires, and the ability to use shorter runways.

• *WHY LFC?*

As air passes over the wing of a conventional aircraft, it must overcome friction. The layer closest to the surface of the wing is more affected. The smooth (laminar) flow of this boundary of air soon becomes disrupted by friction and the air becomes turbulent. Turbulence results in a sharp increase in friction drag. In aerodynamically clean modern jet aircraft, this friction drag from boundary layer turbulence is approximately 50 per cent of the total drag.

The objective of the X-21 LFC program is to remove the turbulent air crossing the airfoil, achieve a laminar air flow, and thereby eliminate most of the friction drag.

• *HOW LFC WORKS*

A wing that inhales air is the secret. Running spanwise of the wing, both top and bottom, are row after row of tiny slots. These slots, cut through the bonded skin, lead to tiny plenum chambers which in turn feed air through drilled holes in the structural cover. The holes lead into small tributary ducts which control the pressure drop and meter the air flow into the large ducts in the wing structure. Turbo pumps, mounted in pods under the wings, suck the boundary layer air through the slots. into the chambers, and through the ducts to the pumps, then exhaust it over-

D. D. Warner, Northrop Norair, Hawthorne, Calif.

board. Thus, a small portion of boundary layer air that becomes turbulent and increases friction on the conventional wing is drawn into the wing and exhausted overboard. Because of this, the air that does flow across the wing remains laminar and friction drag is reduced.

• *FLIGHT CHARACTERISTICS*

How will the airplane handle? Pilots will notice very little difference. Should LFC be lost on one wing, the yaw is expected to be slight — much less than the loss of an engine on a four engine transport. To maintain the same indicated airspeed when the LFC system is turned on, a power reduction on the order of 25 per cent is anticipated. LFC is proposed for cruise only, where maximum benefit is realized. Takeoff, climb, descent and landing will be made with the wing turbulent.

• *PROJECT OBJECTIVES*

Basically, the X-21s are expected to demonstrate full chord, full span, full scale LFC. Various tests have proven that full chord laminar flow can be obtained on wind tunnel models and on sections of aircraft wings, but never before has the system been applied to the entire wing of an airplane. Other objectives include the determination of construction costs, the determination of over-all wing drag reduction, and the evaluation of maintenance procedures and costs.

• *NOISE INFLUENCE*

Incidental to the laminar flow project is a side effect, noise abatement, that adds to the effectiveness of the test program. Research has shown that strong noise fields act much the same as airfoil surface roughness in creating turbulent flow. The X-21 configuration was chosen to eliminate the noise field at the wing. This has been done by mounting the propulsion jet engines in nacelles at the rear of the fuselage. As shown in the photographs, there are retractable cigar-shaped "sonic plugs" which, when moved to forward positions in the inlet, reduce the inlet area to the point that the flow reaches sonic speeds. Then, no sound disturbance can be propagated forward to the wing from the compressors. The plug can, however, be retracted to the aft position to determine if there is an intensity of sound at the wing which will destroy the laminar flow.

Ground tests of the engine installation have demonstrated the effectiveness of the plug in eliminating the noise of the compressor. It remains to be demonstrated in flight whether or not this inlet design will be the answer in the desire to muffle the compressor whine which is so objectionable around today's airports.

Two of the twin-jet aircraft are nearing completion at Northrop's Norair Division at Hawthorne, Calif., and are expected to fly early this year. ★

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AMVER  SYSTEM

THE ENGINE FLAMED OUT, the pilot transmitted a MAYDAY and ejected 158 miles at sea. As the pilot climbed aboard his raft, his wingman faithfully orbited the scene. Home base, a carrier two hours and 45 minutes away, and a command ship, two hours away headed for the scene. The carrier, acting as SAR Mission Coordinator, vectored other aircraft to assist the wingman in maintaining visual contact.

Fortune appeared to smile on all concerned when a tanker, under foreign registry, was seen steaming on a course which would take her to the downed aviator. In order to ensure prompt pickup of the pilot, who at this time was comfortably in his raft practicing seamanship, AD, WF-2 and F4H aircraft made a total of 14 passes over the tanker while another WF-2 fired Very stars over the tanker and over the raft. The downed pilot, not to be outdone, neglected his seamanship while he fired day and night flares. The tanker held course, passed one and one-half miles from the raft, and disappeared over the horizon.

Approximately one hour and 50 minutes later the pilot was rescued by helicopter, still short on time as far as eligibility for the Command At Sea insignia goes.

Ordinarily merchant ships respond eagerly to requests for assistance. The inaction of this tanker is incredible. The crew obviously did not understand the signals, or were terrified by the air raid.

Fortunately, a system exists which should prevent misunderstanding assistance requests off our eastern seaboard. This system is the ATLANTIC MERCHANT VESSEL REPORT SYSTEM (AMVER). The AMVER system plots ship positions from data voluntarily sent by a large number of merchant vessels. The purpose is to provide rapidly, at the present or any future time, the position of vessels located in any given area. In addition, information such as vessel's international call sign, name, nation of registry, radio schedule, frequencies, if doctor aboard, radar, type of rig (tanker, cargo, passenger, etc.), length, weight, position, route and speed will be given. This information, called a "Surface Picture", is important to ships and aircraft which need help, and to those who coordinate search and rescue. The AMVER system tracks about 800 vessels at any given time in the Atlantic Ocean north of the equator, including the Gulf of Mexico and the Caribbean Sea. Merchant vessels of any flag send "position reports" to any of 17 U. S. radio stations which pass them to the AMVER Center, Commander, Eastern Areas, U.S. Coast Guard, New York, for insertion into an IBM computer. (The tanker was in the computer during the above case.)

How does it work? Suppose an AD ditches 100 miles offshore. His wingman, orbiting, sees a tanker disappearing over the horizon but he is afraid to buzz him for fear of losing sight of the raft. The wingman transmits his position, a description of the ship, its course and any other available information to his home base or carrier. The base or carrier in turn will pass the information on to the nearest Rescue Coordination Center (RCC) by land line or any of the international distress frequencies. RCC asks Eastern Area (N. Y.) by hotline telephone, for the present Surface Picture of an area of 30 mile radius centered at such and such latitude and longitude. Eastern Area asks the computer and passes the information back to RCC either by telephone or teletype. RCC, using the Marine Operator, Coast Guard, and/or Navy radios can now contact the specific ship the AD has in sight, using their specific call sign, frequency and language. ★

Courtesy: US Naval Aviation Safety Center, Norfolk, Virginia.

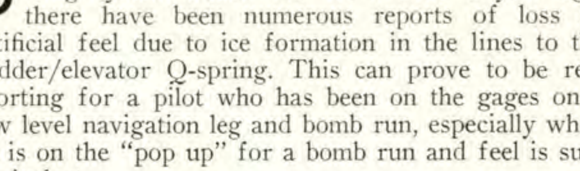
AEROBITS

SINCE DEACTIVATION of the empennage anti-icing system under TO 1B-47-1155 a year ago, there have been numerous reports of loss of artificial feel due to ice formation in the lines to the rudder/elevator Q-spring. This can prove to be real sporting for a pilot who has been on the gages on a low level navigation leg and bomb run, especially when he is on the "pop up" for a bomb run and feel is suddenly lost.

One rather hairy group of maneuvers was recently reported (verbally) by a B-47 pilot who lost his feel on a weather penetration for landing. Another pilot "voiced" his tale of attempting refueling with no feel on reflex deployment. He gave it a "Tiger" try rather than be required to rebut the comment "Ground Checks OK."

We in the safety business recommend a thorough review of emergency procedures on page 3-87 of the Dash One. The latest improvement along this line is the issuance of Interim Urgent Action TO 1B-47-1171 which prescribes the method of cleaning the lines to the Q-spring and increasing the size of the drain hole. The basic caution still stands. Anytime visible moisture is entered, be prepared for the possibility of loss of feel and the means of safely handling it!

Lt Col David J. Schmidt, Bomber Br, DFS



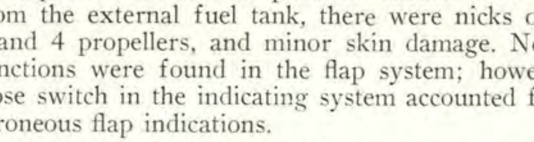
THE KC-97 tanker aircraft was returning to home base. Terminal weather upon arrival was an estimated 6000 feet overcast, visibility 12 miles, light and variable winds, with thunderstorms and very light rain showers. The aircraft was picked up by radar and vectored in on a long final approach. All was normal until flaps were lowered, whereupon the copilot observed that the right flap indicator remained in the full up position. Flaps were immediately retracted and a visual check of flap torque tubes and flap extension was made by the boom operator. Both torque tubes were found to turn normally as 10 per cent flaps were extended; however, the boom operator reported that the right flap did not appear to be extending at the same rate as the left flap. The crew reviewed the no-flap landing procedures and dumped fuel to reduce landing gross weight. The pilot requested that the tower and command post be apprised of his actions.

During the precision radar approach to runway 12, the surface wind changed from calm to an 8 to 10 knot tailwind component so the command post directed a go-around. Radar then directed the aircraft through a box pattern for a surveillance approach to runway 30. On the final approach, moderate to severe turbulence was experienced and the weather rapidly deteriorated. Shortly after reaching the one-mile range, the copilot saw the runway. During the approach the tower officer advised the command post of lowering visibility and a decision was made to send the aircraft around. Approximately 100 feet above the terrain the aircraft began to settle and the right gear hit the ground 1800 feet short of the runway, striking a cyclone fence and the bank of a drainage ditch. One and one-half hours after the go-around, an uneventful no-flap landing was accomplished. A 25-foot piece of barbed wire trailed from the external fuel tank, there were nicks on No. 3 and 4 propellers, and minor skin damage. No malfunctions were found in the flap system; however, a loose switch in the indicating system accounted for the erroneous flap indications.

What were the causes of this near catastrophic accident? The fact that the pilot descended too low on final approach was the direct cause of the damage, but a number of contributing causes set the stage: failure of aircrew to directly communicate with supervisory personnel in the command post; incorrect evaluation of a suspected inflight emergency; rapid reduction in visibility as the aircraft approached surveillance minimums; lack of approach lighting for runway in use; and aircrew inexperience in flying no-flap approaches and landings.

Old tanker says, "Evaluate your inflight emergencies properly; establish direct communications with your command post and discuss the problem; wait out the weather or go to an alternate if conditions permit; take your time, as haste makes waste."

Lt Col Gordon D. McBain, Jr., Transport Br, DFS



REFRACTION FIRES — At 1605 local, fire department personnel discovered smoke coming from the open canopy of an unattended T-Bird. A fire truck was called and the fire extinguished. Damage was limited to the canopy, instrument hood, rear cockpit ejection seat head rest and wire bundles in the immediate vicinity. Investigation revealed that the source of the fire was the rear cockpit instrument hood made of a light weight, olive drab canvas material. No short circuits could be found, no one had been around the aircraft since the early morning preflight and there was no evidence of a covert act.

AEROBITS

With these possible cause factors discounted, the possibility of refracted sun rays through the canopy was considered. This seemed rather unlikely as at 1605 the sun was nearing the horizon and the canopy had been open, allowing good ventilation.

However, in an effort to rule out this possibility, an experiment was conducted. The next afternoon two T-33s with canopies in the full open position were parked in the same area and direction as the aircraft that had been damaged by fire. It was noted that refracted sunlight was focused on the instrument hoods of both aircraft, but the focal point was not sufficiently concentrated to be unbearable to the touch. The focal point at this time was approximately one inch in diameter. Both plain white and gray colored paper with a dull surface were used in the experiment to determine if kindling temperatures would occur. By 1505 hours local the refracted light focal point had decreased to approximately 3/16 of an inch and a high degree of heat was being generated. Within 45 seconds the focal point on the dull gray paper turned brown and began to smolder, leaving a hole similar to a cigarette burn. At the exact same time the white paper in the adjacent aircraft turned light brown under the focal point, but did not burn.

Again at 1555 local, the refracted light focal point was reduced to 1/4 inch and in approximately 30 seconds the gray paper began to brown and smolder.

As a fix, the unit concerned designed and manufactured canopy covers for assigned T-33 aircraft. These are installed during all periods of sunny weather. Discontinued use of olive drab instrument hoods, or any inflammable hood with low reflective qualities, was also recommended. The possibility of refracted light ignited fires occurring in parachute, survival equipment, and navigation publications was also noted. In addition, a UR was submitted and this cause factor raised as a possible explanation of previous unexplained fires, both on the ground and in flight.

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BIRDS AND BIRDS — The degree of damage to an airplane resulting from bird strikes is not measured by the size of the one wearing the feathers. Reports on file tell of airplanes being hit by condors, buzzards, crows, eagles, pheasants and starlings. You may recall seeing the picture spread of all those dead starlings scattered over the runway area at an eastern airport after they knocked a big transport out of business. The starlings weren't all killed that day. Apparently, quite a few are still around. This time they got an F-102 aircraft.

Takeoff was in a light rain. At a point 6500 feet from brake release and at an altitude of between 100 and 150 feet, the aircraft flew into a flock of starlings. The pilot came out of afterburner and retarded throttle to idle. Then he jettisoned his pylon tanks and pushed the throttle forward. He heard a loud bang, and when there was no increase in thrust, he zoomed the '102 and ejected. He made it okay, but his aircraft was destroyed. Too many starlings.

* * *

TANKER EATS CROW — . . . And on another occasion, in this same area, the number one engine of a KC-135 tanker ingested a crow that got in its way during takeoff. The copilot was at the controls when an explosion was heard, causing the aircraft to veer to the left. Takeoff was aborted, maximum braking applied, and the number 2 and number 3 engines were cut off. The aircraft rolled off the runway, after which inspection was made showing the crow had been ingested by the number one engine.

* * *

BUZZARD HITS T-BIRD — The pilot in the front seat caught the impact of this birdstrike. A buzzard struck the aircraft hard enough to shatter the right corner of the right windshield. Pieces of plexiglas, buzzard and instruments flew about the cockpit, injuring the pilot enough that he slumped forward momentarily even though he could still hear the IP's voice. Fortunately, his eyes and face were protected by his helmet visor and oxygen mask. In fact, had it not been for his visor being down, he might have lost an eye.

The IP was all right. The buzzard may have shook him a bit, but he was not injured.

Damage to the instrument panel and interior of the aircraft required 34 manhours to put it back on the flight line.

THE CREW of a C-123 on a functional flight check for a right aileron change could not get the nose gear down for landing. The pilot notified the tower of his difficulty 10 minutes prior to landing and first declared an emergency and minimum fuel five minutes before landing. Twenty fix minutes after takeoff the C-123 touched down and came to rest on the main gear and nose section of the fuselage. Primary cause of the accident was failure of the gear up lock pin to release due to lack of lubrication for an extended period of time. However:

- Sufficient fuel remained in the tanks for the aircraft to have remained airborne for an additional 40 minutes by conforming to manual leaning procedures in T.O. 1C-123B-1 and still have had 50 gallons remaining in each nacelle tank upon landing.

- This flight was the first flight after the aircraft had been washed.

- There was little or no evidence of old grease on the nosewheel zerk lubricating points. The nose gear was then lubricated at all points and the nose gear retracted normally through numerous cycles.

- The landing gear controllable check valve was still wired in the normal position. This indicated that the pilot did not use all published emergency procedures.

The runway was closed for 40 minutes. Six jet fighters were forced to divert to alternate bases. This diversion could have been prevented if the C-123 pilot had used manual leaning procedures.

A C-123 was dispatched on a passenger-cargo mission with several en route stops. At the first stop, some passengers and cargo were off-loaded. There was no loadmaster aboard, so the pilot recomputed his weight and balance with the CG at 23.1 per cent. ETE to the next base was 14 minutes.

After six minutes of flight, an airstrip was sighted. The pilot decided this was his destination and landed. Upon landing, he realized this was the wrong airstrip. Estimating the strip to be 1300-1500 feet long, the pilot made a high speed taxi run to check acceleration. A short field takeoff was attempted; however, the aircraft did not become airborne; it overran the runway, collapsed the nosewheel and came to a stop approximately 750 feet beyond the end of the runway. Investigation revealed that the airstrip at which the pilot landed was only 1100 feet; his destination strip was 3900 feet, and the runway headings of the two differed by 80 degrees. Also, the aircraft CG was at 22 per cent of MAC and the gross weight was 1360 pounds more than the pilot computed.

Lt Col James F. Fowler, Transport Br. DFS

TWO T-33 INCIDENTS that occurred rather recently point up the need for better procedures since both mishaps can definitely be considered as preventable.

In the first one, during simulated flameout procedures the T-Bird got very low before the pilot initiated go-around and raised the flaps too soon. The IP took over and lowered the nose to gain airspeed—but the airplane struck the runway.

In the second mishap, the pilot retracted flaps on an SFO final approach to increase glide distance. The T-33 hit the ground short of the runway.

Apparently, neither IP had time to take corrective action because of the low altitude of the aircraft at the time the pilot took improper action.

A message to all commands expresses D/FS opinion that such mishaps as these can be prevented by establishing minimum altitudes for low-go's of any type, i.e., SFO, ILS, GCA, practice landing patterns. Sufficient altitude would allow time for adequate corrective action by the IP or pilot. Comments, anyone? ★

WHAT'S THE RUSH? Investigation following separation of an NM1A bomb dispenser from an aircraft emphasized that when you are in a hurry, you had better worry. The pilot stated that he had been diverted during his preflight and he had not inspected the type VII pylon to see that it was properly locked and cocked; he was late taxiing and was not sure that the special store unlock light was out but that if it had been on, he thought he would have noticed it. He said he had rotated the special store unlock handle 90 degrees to free his G suit pocket which had become entangled while he was adjusting the rudder pedals. This handle is required to be safetied. The pilot did not believe that the handle was safetied but admitted that he could have broken the safety wire when he rotated the handle. He said he had not pulled the handle out or repositioned it in any way except to free the G suit pocket. Subsequently, in flight with the armament selection switch on special stores and the mode selector switch on manual, when the bomb release button on the control switch was pressed the NM1A separated from the aircraft. Inspection of the aircraft failed to produce any evidence of malfunction. ★

Rex Riley, the Air Force symbol of safety, is interested in YOU! His well-recognized features are portrayed on bulletin boards throughout the Air Force. Recently he has branched out into transient services. He now endorses the transient service certificates that replace the Duncan and Heinz Awards. Of course, he will continue his Cross-Country Notes, Accident Investigations and poster work. His philosophy is quite simple really.

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