AEROSPACE
SAFETY
UNITED STATES AIR FORCE

MAY 1965

T-TAILS

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AEROSPACE SAFETY

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AFRP 62-1 MAY 1965 VOLUME 21 NUMBER 5

FALLOUT

APPROACH END ENGAGEMENTS

Your article in the March issue on approach end engagements is excellent. The tests conducted by Wright-Patterson and Edwards AF Bases resulted partly from a request originating from the 5th Air Force in 1963 when the flight safety shop became aware of the possibilities of the approach end engagement to lessen the severity of a potential aircraft accident.

The conclusion that the touchdown point should be 450 feet in front of the barrier corresponds practically to ours at Fifth Air Force. We recommended 600 feet. As a pilot I would have to ask myself if I could gauge 450 feet from the barrier, particularly when under stress.

I recommend that bases with BAK-6 or BAK-9 barriers be instructed to paint a distinctive mark on the runway which a pilot contemplating an approach end engagement could use as a guide. This instruction should be incorporated in AFR 91-17, National Standard for the Marking of Serviceable Runways and Taxiways.

Maj Bradford L. Benson
Chief of Safety
Bangor Air Defense Section, USAF
Topsham, Maine

This sounds like a good idea. Your suggestion has been forwarded to AFOCE for their consideration.

WHAT HAPPENED?

SEE PAGE 22

THE IPIS APPROACH

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

Q. In discussing unusual attitude recovery procedures, AFM 51-37 states on page 9-3: "If you are climbing, add full power and roll, or continue your roll, to bring the bank index pointer toward the nearest 90-degree bank index mark." Does this mean that you must roll to 90 degrees of bank? Does this require some degree of roll for all aircraft?

A. The answer to both of the questions is no. The use of bank will aid pitch control, however, the amount of bank used should not exceed aircraft limitations. When recovering from a steep climb, some aircraft may have to sacrifice the aerodynamic assist of bank due to aircraft limitations.

Q. Reference: "Point to Ponder" in the January issue. Under circumstances where radio failure occurs prior to receiving a clearance into the high altitude route structure and the pilot climbs to maintain the lowest cardinal attitude in the highest structure filed, or MEA, what consideration is given to the lowest *usable* flight level? (Example: Departure altimeter setting is 28.38 - lowest usable flight level is FL 200.)

Captain John L. Bristow
Chief, Flight Test Section, AFLC Liaison Office, Greenville, Texas.

A. The problem does not affect the pilot because he should follow normal procedure. This procedure is to climb to Flight Level 180 as stated in FLIP and maintain this altitude to destination. Air Traffic Control will take into consideration the low altimeter setting and will provide the necessary separation from other aircraft under their control. You can avoid this situation altogether if you will not accept the clearance until Air Traffic Control specifies a flight level plan that satisfies your flight plan requirements.

Q. We would like to know whether the altitudes depicted on the FLIP terminal charts are mandatory altitudes or whether they only serve as a guide as long as the minimum safe altitude is not violated. *Major Ralph J. Maglione, Hq USAFE.*

A. Unless otherwise noted on the FLIP terminal charts, the altitudes depicted are minimum altitudes to comply with obstruction clearance criteria stated in JAFM 55-9 or to separate approach traffic from underlying air routes.

POINT TO PONDER

Recently a situation was brought to our attention that we feel deserves mention. A pilot was flying a precision radar approach; weather was 200 feet and one-half mile. His lost communications instructions were to proceed to the VOR and execute the published approach. The conflict is pretty obvious, isn't it? Since the weather was 200 and one-half, the pilot could not attempt a non-precision approach of any kind.

It isn't too difficult to see in print that a problem would exist in such a situation. The problem lies in the fact that a pilot on instruments in weather may become so preoccupied with the job at hand that he will accept such instructions without hesitation.

There are two factors to consider when lost communications instructions are received: First, do you completely understand the instructions, and second, are the instructions such that they can be safely complied with?

Another tip on planning. Ever gone into a strange field in bad weather expecting to fly a precision radar approach only to be told "Radar temporarily out of service"? Usually a frantic scramble for the terminal charts is begun and a silent prayer (or curse) is muttered in the hope that the depicted approach can be figured out in the few minutes left before station passage occurs.

If you have sufficient fuel remaining, one solution might be to request holding until you feel ready to begin the approach. Unfortunately, this may not be possible.

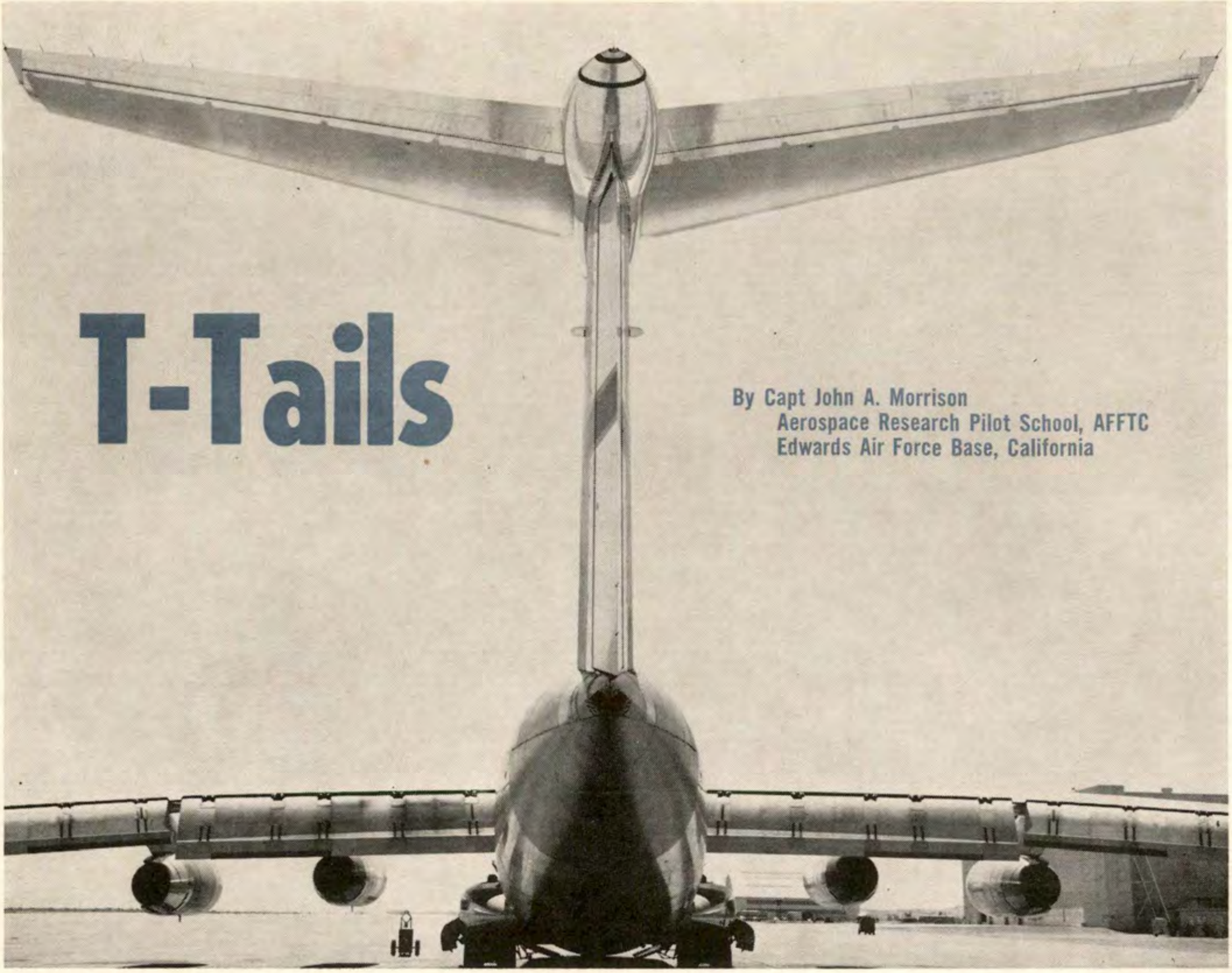
Obviously the best way to prevent this kind of confusion is to be familiar with the various approaches to the airport well in advance. This is one part of preflight planning that is often sadly neglected and which adds to the confusion of the pilot, the irritation of approach control, and frustration of other traffic in the vicinity. An extra few minutes spent in Base Ops studying the charts can pay off real dividends.

SERVICE TO YOU

One of the missions of the USAF Instrument Pilot Instructor School is to standardize and promote techniques of instrument flying in the Air Force. To assist in this effort AEROSPACE SAFETY magazine features this page developed by the IPIS in order to aid the flow of information.

IPIS wants your questions and comments on all aspects of instruments, navigational aids, weather, flight planning, regulations and publications, procedures, techniques or any other area.

The value of this page is up to you, the reader. Send your questions to either of the following: ***Air Training Command, Attn. IPIS, Randolph AFB, Texas, or Editor, AEROSPACE SAFETY Magazine, Deputy The Inspector General, Norton AFB, California.*** ☆



T-Tails

By Capt John A. Morrison
Aerospace Research Pilot School, AFFTC
Edwards Air Force Base, California

The MIG-15 was one of the first jet aircraft designed with the high-tail, swept-wing configuration to meet performance requirements. Its control characteristics often shook-up its pilots.

The MIG-15's entry into the Korean War opened a new era in the age of aviation. The great advance in performance over WW-II aircraft introduced new problems for the pilots involved in jet versus jet aerial combat. The MIG also brought with it some stability and control characteristics that gave its pilots a bad time. On several occasions the MIG was seen to "dig in" or "pitch up" during a high G turn. At least two confirmed victories over the MIG were attributed to the airplane entering an uncontrolled maneuver from a hard turn.

Ten years later "pitch-up" is still a fearsome characteristic. There are a lot of aircraft flying today with pitch-up possibility. Pilots of these airplanes use caution and avoid the area of pitch-up because of the resulting uncontrolled maneuver.

Why is the MIG configuration popular today?

The high-tail swept-wing configuration was dictated by performance requirements. An aircraft so designed will cruise efficiently in the high subsonic Mach range (0.85 to 0.95). Wind tunnel tests of the XF-104A showed the high tailed configuration to have lower overall drag than any other configuration.

A sweep angle of 30 to 35 degrees will increase the speed at which the drag-divergence occurs due to Mach number (Fig. 1).

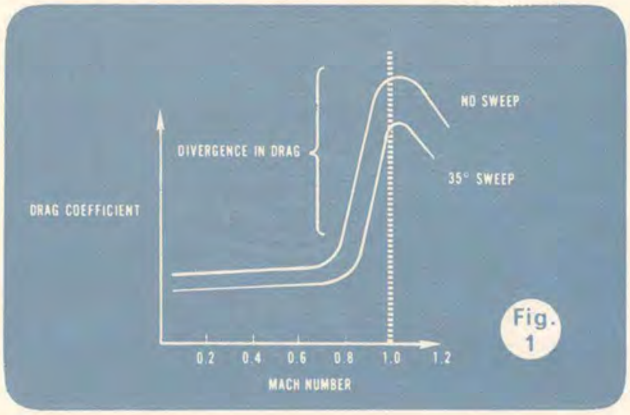


Fig. 1

The delay in drag-divergence becomes the most important design criteria for flight at high subsonic speeds. If the tail is up high out of any airflow interference, it will be more effective. The higher degree of effectiveness will allow it to be physically smaller with a smaller thickness to chord ratio. Thus the parasite drag and the induced drag of the tail will be less. The airplane will cruise at a higher Mach number using less power and its overall range, endurance and rate of climb will be better. Thus, economics play a deciding role in the basic aircraft design.

The increase in performance doesn't occur without penalty; the high-tail aircraft configuration has a pitch-up possibility. Both the swept-wing and the high-tail contribute to the aircraft instability, the wing because of its airflow patterns. The pressure gradient along the wing surface causes span-wise slipping of the

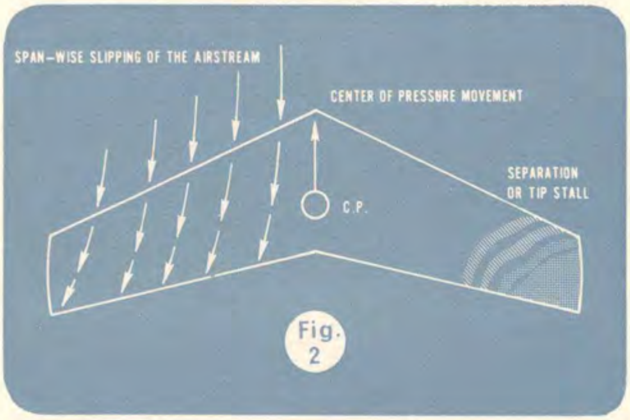


Fig. 2

airstream (Fig. 2). This produces a thicker boundary layer of air near the tip. Air flow separation will occur first at the tip and thus the stall occurs first at the tip.

The wing tip stall causes the center of pressure to move forward. As the center of pressure moves forward the moment created is a nose up moment.

Airfoil and control surfaces at the rear of the airplane are used to stabilize and control the moments on the airplane. The horizontal stabilizer gets its name because of the function it performs. By virtue of its position behind the wing, it operates in airflow from the wing. Airflow over the wing is deflected up by the

Fig. 3

shape of the wing. This air must come back down and this change in airflow pattern is known as downwash (Fig. 3).

An airplane moves through the air fast enough so that the deflected air is still on its way down when it arrives at the tail. As a result, downwash reduces the angle of attack at the tail. Also, the amount of downwash at the tail will increase as the wing angle of attack increases, and an increase in downwash has a destabilizing effect.

When the airplane wingtips stall, the wing vortex

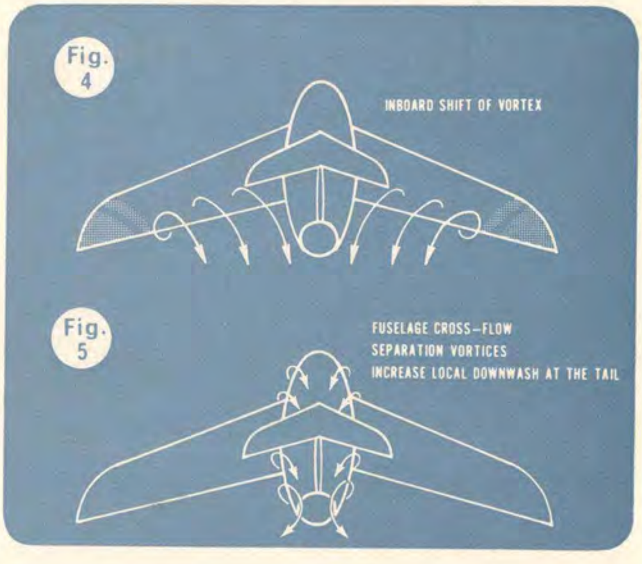


Fig. 4

Fig. 5

shifts inboard increasing the local downwash at the tail (Fig. 4). At high attack angles (approaching stall) the airflow across the fuselage separates and the resulting vortices also increase local downwash at the tail (Fig. 5). Thus the tail suffers a decrease in effectiveness and stabilizing ability as the airplane angle of attack increases.

By placing the tail high enough it can be kept out of this region of downwash and it will not show a decrease in effectiveness with angle of attack. But if it moves from an area of no interference to an area of

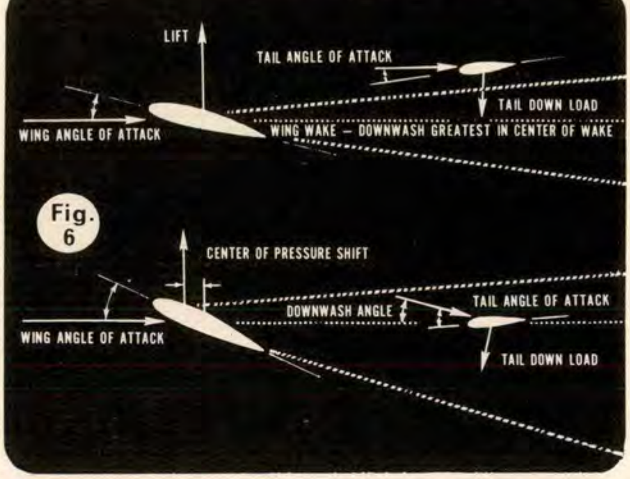


Fig. 6

strong downwash (Fig. 6), then a sudden and significant loss in stability can occur. The angle of attack at which the tail enters the downwash area is determined by the height of the horizontal stabilizer. However, since the vertical distance is limited by the structure of the vertical stabilizer it is practically impossible to get the tail high enough to avoid the pitch-up region completely.

The pilot can fly the airplane into this region in several ways: (1) slowing down while holding altitude, or (2) holding a high pitch attitude as the rate of climb decreases, or (3) as is most common, tightening a turn as the airspeed bleeds off. The latter is what happened to the MIG-15 pilots. Those fellows usually had their attention to flying distracted by a Sabrejet behind them. The MIG's immediate survival depended upon its ability to turn. So the pilot kept pulling it in and suddenly without much warning, "pitch-up!"

The unstable flight regime that exists in this aircraft configuration establishes a control limit for the airplane. Trying to fly the airplane in this region is just as foolish as trying to fly a low tail airplane past its stall limit.

If we examine a plot of pitching moment versus lift of the high-tail, sweep-wing airplane we can see why it is that the aircraft can suddenly pitch nose up. Technically we apply the term "pitch-up" to a longitudinal static instability that can occur with this aircraft configuration at high angle of attack. The plot of pitching

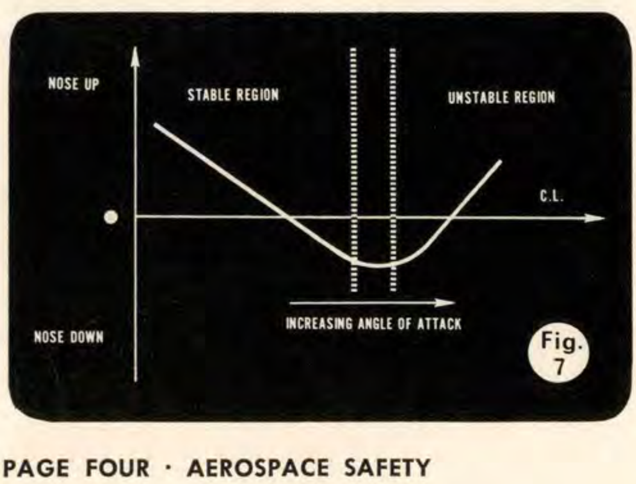


Fig. 7

moment coefficient versus lift coefficient shows a stable region for low values of C_L and a transition to an unstable region at high C_L's. The unstable region is caused by the horizontal stabilizer being moved into an area of strong downwash (Fig. 7).

The slope of the C_m versus C_L curve indicates the longitudinal static stability level of the airplane. If the airplane is flying in equilibrium in the stable region and experiences a nose up disturbance the resulting increase in C_L indicates a nose down moment is created. Thus there is a tendency to return the airplane to its undisturbed position. Conversely, if the disturbance occurs with the airplane in the unstable region, the moment created tends to reinforce the nose-up disturbance, hence the instability.

The static stability of the airplane is obvious to the pilot during normal flying. If the airplane is trimmed for cruising flight and the control column is bumped or the airplane flies through some air disturbances, the static stability is indicated by the tendency of the airplane to return to its undisturbed position. If the airplane did not come back toward the original position, but rather continued to pull up similar to a loop, then the airplane would be statically unstable.

The plot shows the high-tail, swept-wing airplane to have an angle of attack area where the airplane becomes unstable. The suddenness and severity of the instability depends upon the design of each particular airplane. If the longitudinal control were adequate and entry into the unstable area slow enough, a good pilot could fly the airplane out of this region once he noticed the nose starting up.

The MIG-15 entered the unstable region without warning. The pilot soon discovered the maneuver was violent and beyond his control. Operational use of this aircraft was a dilemma. The MIG pilot had two choices. Stay out of the high C_L region and get shot down or use the region and if pitch-up occurred, use the published recovery technique. His published recovery technique leaves a little to be desired by our standards. He had a white line painted vertically on the center of the instrument panel. In the event an uncontrolled maneuver was entered, he was to hold the stick on the line. If the airplane did not recover, he would bail out. The pitch-up characteristic was the price the MIG-15 paid for its performance.

There are many aircraft today with a similar configuration; among them the USAF F-101 Voodoo, F-104 Starfighter, C-141 Starlifter, BAC 111, Boeing 727 and the Douglas DC-9. The airplanes are fitted with warning devices to tell the pilot when he is approaching the unstable region. Horns and stick shakers are such devices. In addition, the control systems incorporate devices to automatically push the stick forward in order to prevent inadvertent entry into the pitch-up. The pilots are provided sufficient control authority so they can "fly out" of an approach to the instability.

These modern airplanes are fool-poof; but they're not damn-fool proof and it still requires the pilot to have knowledge of the stability and control characteristics of his equipment. He must know his operational limitations and keep his attention on the business of flying. ☆

HOW ABOUT YOU?

This article was written within a short time of the event related, while the experience was fresh in the pilot's mind. If you've never been hypoxic outside an altitude chamber, read on. These words might be your life-saver.

By Capt William J. Starr, Hq 9th Air Force, Shaw AFB, S. C.

Once every three years I, like all other pilots, go to an altitude chamber and carefully learn what my symptoms are at the onset of hypoxia. Mine are quite definite, always the same, and leave little doubt in my mind that I am hypoxic — when I'm in the chamber, that is.

Today, however, in a trusty old T-Bird, I got my symptoms again. As we leveled off at FL 240 (16,000 feet cabin pressure) I felt sick. My pulse was very rapid. I was breathing fast and there should have been no question in my mind that I was hypoxic. I automatically went to 100 per cent oxygen, but that didn't help. In fact, I seemed to feel worse. Do you know what my next thought was? I thought we had contaminated oxygen.

I pulled my mask off my chin and tried breathing cabin air. No change. Then I made another brilliant deduction. I must be hyperventilating since I was breathing so fast. So I held my breath. The only trouble was, I couldn't seem to hold it for more than a few seconds. I thought that was very strange since I knew that when you are hyperventilating it should be easy to hold your breath for a considerable time.

While all this was going on, I had been responding to radio calls from the ATC center. I had made a frequency change involving setting up a manual frequency. I had even received and acknowledged a route change and repeated it to the pilot in the back seat, who had missed it.

Finally I decided that I definitely had some contaminated oxygen. I went back to normal oxygen and pulled the mask off my chin again, wondering if the transient crew had put nitrogen in our oxygen system. I wondered what other contaminant could have found its way into the oxygen which would be odorless, as I smelled nothing unusual. I debated calling our departure base to warn them of this potential killer they were passing out. But I never said a word to the jock in the back seat about my difficulty or about my conclusions. It never occurred to me that he was breathing the same oxygen as I.

Well, for some reason I started feeling better after a few minutes. I was very relieved and not just a little proud of the way I had solved the mystery. I was holding my mask off my face except when I had to talk on the radio. The back seat pilot was flying the bird all this time and I started checking radio frequencies.

A few minutes later, I very suddenly felt bad again. All the symptoms returned. I felt close to passing out, and loosening my mask didn't help a bit. At that point, finally, I thought of hypoxia. I checked my blinker—nothing. I took a deep breath—still nothing. 100 per cent—still nothing. Finally, when I realized what was wrong, I reacted. I told the other pilot I was in trouble. I told him I was definitely hypoxic. (I guess I wanted to make sure he didn't get off on my tangent about contaminated oxygen.) I said something about descending and started pulling my bailout bottle handle.

I started feeling better quite fast, although I think my vision was considerably reduced for a few seconds. We leveled off below 10,000 feet and I soon found the source of my trouble. The aircraft oxygen hose had pulled off a fitting down by the left side of my seat. I had checked my oxygen system prior to starting so I know the hose was connected then. I suspect the hose had pulled loose during a subsequent seat adjustment. Route changes, NAVAID troubles, clearance changes, etc., prevented me from noticing the malfunction during the 5000 foot and 20,000 foot checks.

So what is the point of this little tale? I have learned that I can experience all the symptoms of hypoxia, the same ones I have so carefully learned in the chamber, and never realize that I am hypoxic. I have learned that my judgment can be so severely impaired that I will remove my mask to avoid breathing *contaminated* oxygen but never mention it to another pilot using the same oxygen supply. I have learned that I can *recover* from hypoxia only to suffer a relapse far more rapid and acute than the original attack. Most important, I have learned that thorough and frequent oxygen checks may save my life.

How about you? Will you take my word for it or will you wait until you learn the hard way? ☆

Dangerous Cargo

Suppose you've just turned in your 175 and filled out an RON message and are waiting for the crew truck driver to return from chow so you can go to the VOQ. A sergeant comes up to you and asks if you'll have room for about 300 pounds of cargo in the morning. It is destined for your base and it will sure help if you can take it.

Sure you have. Just see that it is aboard and secured by 0730. You always feel better when space isn't being wasted.

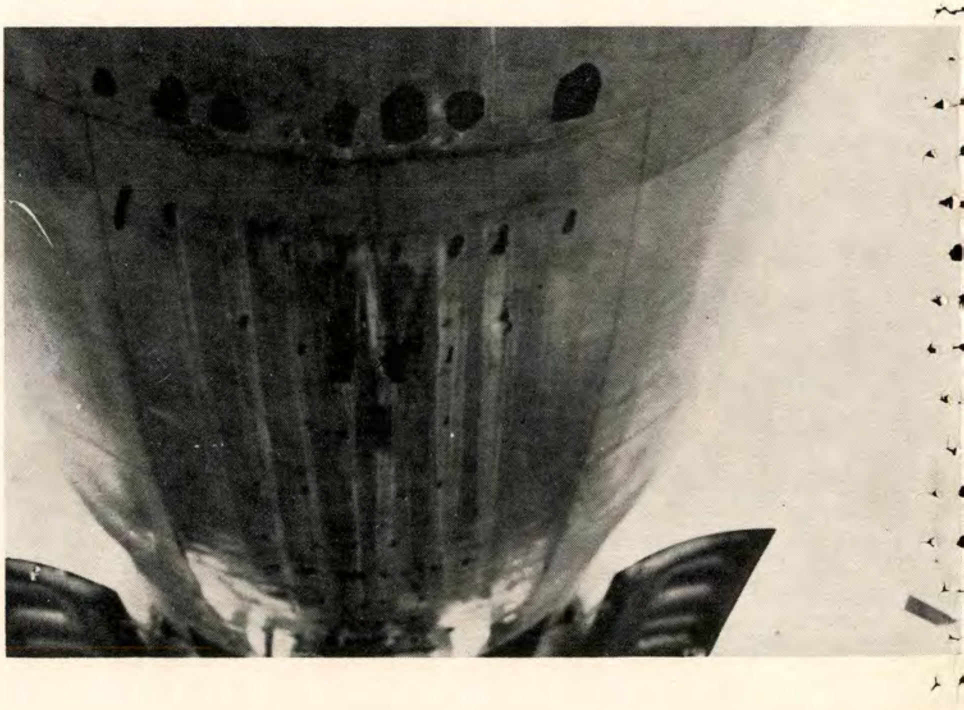
Comes the dawn, and with it the pounding on the door in response to your note left on the wake-up sheet. At Base Ops you file and are told. "Some sergeant put about 400 pounds of cargo on your bird. Said he'd checked with you."

"Right. He cleared it with me last night."

No problem. Thirty minutes later you're winging your way toward home and a hitchhiking passenger comes forward, coughing slightly, and tells you the back end of your Goon "don't smell so good."

He's right. When you go back to inspect you find strange odors emanating from the cargo. There are fumes, too, quite irritating to your eyes, nose and throat. You go forward, close the door, invite the young army troop to stay forward and act like he's a crewmember and buckle in. "Joe," you say to your copilot, "get us — cough — a clearance — cough — back. There's — cough — something leaking — from that cargo."

So you go back and land, your Good Samaritan attitude dented somewhat. And in Base Ops, discussing your problem with the flying safety officer, you learn there are regs and manuals that cover this sort of thing. Further, the ser-



Graphic evidence of what dangerous cargo can do.

geant who put the stuff on board and some vague "someone" doesn't get all the blame. You, mister pilot, have a responsibility, too. The FSO invites you upstairs and his ground safety sidekick pulls out AFM 71-4, which defines dangerous material: **any material which by virtue of its properties is flammable, corrosive, combustible, an oxidizing agent, explosive, toxic, radioactive or unduly magnetic.**

Because of the incident and possible culpable liability on your part you read on. Here's an out for you: A pilot assigned to the operation of an aircraft on which dangerous materials are scheduled for shipment will be notified during or before loading and he will initial entries made of such dangerous materials on the manifest. He will also be briefed by the local transportation, medical, ordnance or safety personnel as appropriate, regarding the properties of each dangerous material, its proper handling, first aid, and measures to be taken in the event of an inflight emergency. It will be the responsibility of the transportation officer to arrange for qualified personnel from his or other departments to acquaint the pilot with the dangerous materials to be loaded on his aircraft. Aha! That let's you out. But when the safety guy points out that freedom from fault is little consolation when you're dead you lose some of your enthusiasm.

You read on: All dangerous materials will be stowed in such a manner that they will be easily accessible in flight without moving other cargo. Farther down you note: When materials, whose vapors are toxic, irritating or corrosive are a part of the cargo, all personnel will have in their possession personal protective equipment of a type approved by the Medical Facility and Ground Safety.

You read on, and learn more: When any item of cargo has properties presenting a fire or explosive hazard, smoking and ignition of matches or lighters in the cargo compartment is prohibited. Further, it is the responsibility of the aircraft commander to see that this requirement is met.

There's lots of good stuff in chapter one. On with the manualese.

Certain materials as indicated by their freezing points must be protected against freezing.

All packages of dangerous materials will show on the container the proper item name.

A separate shipping document will be furnished for explosives and other dangerous materials when other general cargo is transported on the same aircraft.

Metal containers of liquids or gases showing any signs of corrosion or any dents at a seam, soldered or welded area will not be accepted for air shipment.

Under some conditions major air commanders can authorize deviations, provided each aircraft commander is thoroughly briefed as to identification, dangerous properties, and location of dangerous materials.

Dangerous materials will not be offered or accepted for transportation by air unless the shipper or his authorized agent has certified on the shipping document that the shipment complies with the requirements of this manual.

The phone rings; the FSO answers and turns to you and says, "Your bird is all set to go again. No cargo this time."

You close the cover of the manual, checking again to be sure you know the identification—AFM 71-4.

"Here," the ground safety technician suggests, "I'll jot the reference material down for you. Paragraphs 1-2 through 1-6 of 71-4 are especially important." He writes down some more numbers. "You might want to check AFM 71-6 and MATS Manual 55-1 also has information of value."

"Thanks." You pocket the memo. "I'll check these when I get back."

On the way down the stairs the FSO has a final suggestion. "Why don't you report your experience to your safety office. This would be a good matter to bring up at your next safety meeting. It can be anonymous—just so the word gets around. You might save one of your buddies."

"Yeah, I'll do that." ☆

The accompanying picture shows the belly of a C-124 after an attack by dangerous cargo. Here's what happened. The aircraft departed an east coast base early on a May afternoon in 1960 on a routine cargo run. On board were more than 32,000 pounds of miscellaneous cargo, including 860 pounds classified as dangerous. Approximately one hour after takeoff, at 7000 feet, fumes were detected in the rear of the aircraft just aft of the elevator well where the dangerous cargo was stored. It was found that the wooden box containing the hydrochloric acid was leaking badly. An emergency was declared and the pilot landed at the nearest Air Force base. Time from discovery of the fumes and landing was approximately 20 minutes. Immediately after landing the crew deplaned and observed that holes were appearing in the skin at the bottom of the fuselage aft of the elevator well and, in addition, stringers and formers were showing. A laboratory was contacted for information necessary to neutralize the corrosive acid. The aircraft was then washed down with water to dilute the acid and dry soda was spread over all accessible contaminated areas to neutralize the acid. Later, after the aircraft had been flown to its home station by the chief of maintenance, it was discovered that the acid had not been entirely neutralized and a vinegar and water solution was sprayed over the contaminated areas in an effort to further reduce the corrosion. The aircraft was then flown to a contract repair facility.

A glass carboy had broken, allowing the acid to leak into the airplane. Inspection of the broken glass carboy disclosed flaws in the glass. ☆

AN ENERGY APPROACH TO LANDING

By Don Stuck, Experimental Test Pilot,
McDonnell Aircraft Corp
(Reprinted from "Tiger Talk")

In looking at landing accidents of all aircraft on which we could dig up information, there appear to be a couple of trends that I feel are significant.

First — the accident rate seems to be tied pretty directly to the energy level of the aircraft at touchdown.

Second — the ratio of preventable to non-preventable landing accidents increases as a function of energy level also.

What this means to me is that the aircraft with the combination of higher weight and higher final approach speeds has the best chance of having an accident. I can't believe that people who fly slow, light aircraft are as a group better pilots than those who fly heavy, fast ones. So my assumption is that for a given number of "boo boos" in the landing phase, the heavy-fast pilot gets caught easier and more often than his light-slow brother pilot.

You might say that today's fighter pilots are not only sitting on a bigger "hand grenade" than the gooney-pickle pilot, but it's got a shorter fuse to boot.

There's nothing the pilot can do about the design weight and touchdown speed of the aircraft he's flying, but is there anything he can do about reducing the accident rate in the landing phase? You bet there is! It all centers around techniques which hold energy levels to be a practical minimum at touchdown and dissipate this energy during the landing roll in the most efficient manner.

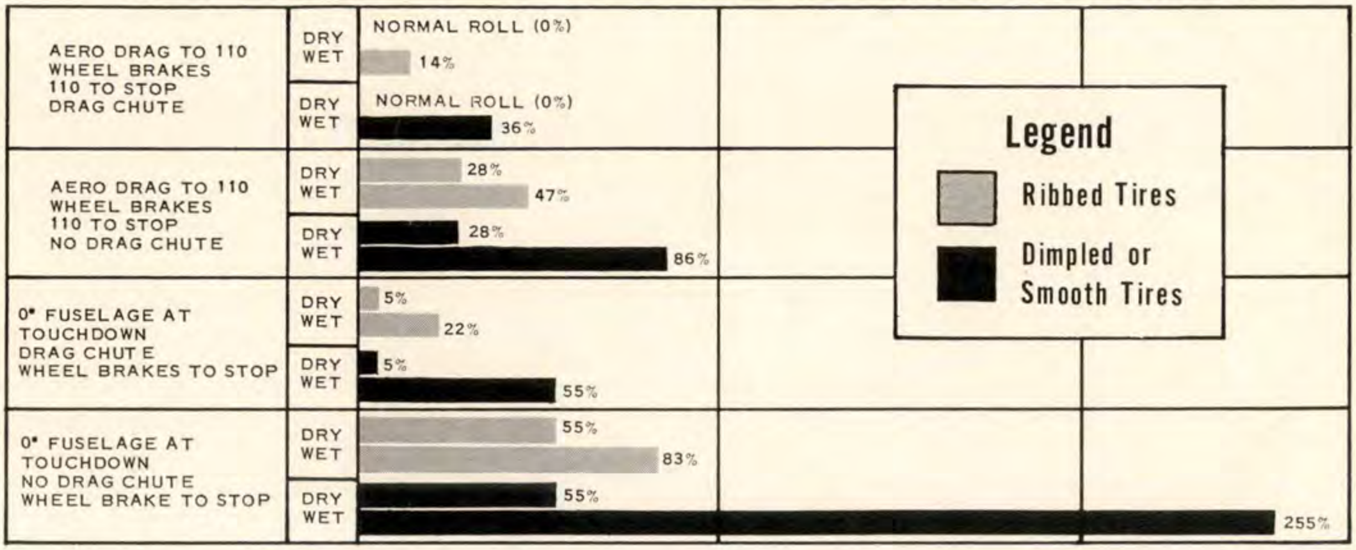
Energy is a function of weight and speed. I'm not going to try to impress you by writing a bunch of formulas because it isn't necessary to know them and I'm liable to get them wrong anyway. It is important that you understand the parameters that affect energy, however, so know them well—WEIGHT and SPEED.

Weight affects energy directly—twice the weight, twice the energy—half the weight, half the energy. Speed, however, has a more decided influence on energy. Energy changes as a function of the *square* of the speed—this means twice the speed, four times the energy and half the speed, 1/4 the energy. It becomes readily apparent that it is more important to control speed than weight. This is fortunate since once we commit ourselves to a landing, there's nothing we can do about the weight of the aircraft, but we do have direct control of that other all-important parameter—SPEED.

Although the information in this article applies generally to any aircraft, I will use the Voodoo as an example. Let me throw a couple of fast numbers at you which come close to describing the F-101B aircraft. If you add 15 knots to the final approach speed, you have increased the energy level of the aircraft over eight million foot lbs. This increase might have little meaning to you so allow me to use a couple of everyday examples. That extra 15 knots is equivalent to the energy required to lift a five-ton elephant to a height of 800 feet (for those of you interested in raising animals).

Converting this excess energy to heat—which you

Increased Stopping Distances (F-101B - 35,000 Lbs. - TD Speed 165 Kts.)



do if you make the brakes take care of it—means 10,000 BTU. Once again, here is a number that means nothing to me unless I equate it to something else. This amount of heat will melt 37 pounds of steel which now means hot and a lot of it.

The landing phase is pretty hard to pin down because of the many variables, and the inter-action of these variables. Speed, weight, runway surface, aero drag, wet, dry, tire design, drag chute, etc., all affect the landing roll, but even more important, they affect each other.

There is only one right way to land and stop any aircraft: proper final approach and touchdown, followed by the most effective utilization of decelerating forces available. Techniques vary slightly from aircraft to aircraft and for different landing configurations, but it's all pointed at the same end result: maximum decelerating force working on the lowest possible level.

Let's run through some various landing techniques and conditions to see how they affect energy levels.

The handbook shows a 34,000 pound gross weight F-101B aircraft touching down at 165 knots. This means that the handbook final approach puts you on the ground with about 42,500,000 foot pounds of energy. (That's enough to kick that five-ton-elephant over 4000 feet straight up.)

From this point there is one way, and one way only, to begin the landing roll in the F-101—nose high, aero drag. There is no aircraft configuration, runway condition, tire design, weather condition or pilot frame of mind which does not call for nose high, aero drag during the first portion of the landing roll if you're interested in getting stopped in the shortest distance, in the most efficient and safe manner possible, with the least wear and tear on the machinery.

Since 110 knots is the point where the handbook calls for discontinuance of nose high, aero braking, let's analyse the touchdown to 110 knot portion of the landing roll first.

If handbook recommended aero drag is used, the distance required to get the aircraft slowed to 110 knots will be about 1800 feet with drag chute and 2500 feet without. At the 110 knot point our energy level is down to 18,900,000 foot pounds. We have "lost" 23,-600,000 foot pounds of energy, enough heat potential to melt 115 pounds of steel, and we've done it without putting one bit of heat into the wheel brakes. Although using wheel brakes instead of aero braking to this point is not the recommended technique, let's do it on paper to see why the decision was made in favor of aero rather than wheel braking.

Above is a chart to show as many variables as I can think of and their effect on the landing roll expressed as a per cent increase over normal dry runway conditions. The numerical values of this chart are realistic everyday numbers but do not fully agree with the handbook for the following reasons:

- The handbook computations use moderate wheel braking whereas my computation uses moderate to heavy braking which is considered realistic with anti-skid protection.
- The handbook incorporates a marked degree of conservatism to take into consideration those pilots who will not utilize the proper landing techniques.

Under favorable conditions it only extends the total landing roll five per cent to use max wheel brakes from touchdown instead of aero braking to the 110 knot point. However, the energy input to the brakes is increased over 200 per cent, which is a lot of unnecessary punishment to the brakes, possibly causing fade, to say nothing of the heat effect on the tires. And all for the dubious pleasure of *extending* the landing roll more than necessary?

Things start getting a little more critical as far as proper landing techniques go when conditions start

getting "tighter." Let's take a drag chute loss for example. With proper technique on a dry runway the loss increases the roll about 28 per cent and increases the energy into the brake about 10 per cent. However, if we don't use aero braking but try to use wheel brakes from touchdown, we increase the roll 55 per cent and the energy into the wheel brakes by 300 per cent.

In the event you're still not convinced, let's go further and lose a drag chute on a wet runway with bald tires. The handbook landing technique will demonstrate an increase of 86 per cent in roll, whereas the "nose down, right on the binders technique" will increase roll by 255 per cent.

From all this I hope it becomes apparent that there are certain adverse factors with which you are likely to be faced on a landing. Within reason there is nothing you can do about the fact that these conditions might be prevalent; however, minimizing their effect on your landing roll is completely up to you. Increase of landing roll due to adverse or semi-emergency conditions is directly affected by landing technique. The worse the basic conditions, the more important it is for you to use the right technique.

Unneccessarily increasing final approach speed follows pretty much along the same line—the worse the conditions, the more that excess speed hurts you. The landing roll is set by the amount of energy you land with and how you "get rid of it." The energy you land with is a function of weight, over which you have no control once you have decided to land, and the *square* of the speed. That extra speed does horrible things to the energy level at touchdown. Keep it where it belongs.

Once you hit the ground the landing roll resulting from your energy level is affected by technique and conditions. Once again you can't do anything about the tire type or runway conditions once you've committed yourself to landing, but you can keep the adverse effect of any condition to a minimum by using the proper landing technique. It's the same, day and night, wet or dry, hot or cold, flaps up or down, chute on or off—it just doesn't change—use it on every landing; it's always the best, safest way to get stopped with the least wear and tear on the equipment.

A research of the F-101 landing accidents shows some beautiful examples of how landing technique alone can be the difference between "no sweat" and "oops!"

If you are interested in a minimum run landing with a properly operating aircraft, good conditions and proper final approach speed as a base point, you can stop in 3600 feet of roll every time. Now let's install bald tires, remove the drag chute and soak down the runway.

These adverse effects will increase your minimum run landing roll 3100 feet if you land "by the book"—nose high, aero drag to 110 knots, then nose down and max wheel braking available to stop.

By the simple (and too often used) change of dropping the nose immediately on touchdown and using max wheel brakes all the way (there's almost none available above 100 KIAS), you can increase the roll 5600 feet. Now add 15 knots to final approach and you can stretch it out another 2000 feet. In the event you haven't added as we went along, we have just taken an aircraft which can stop in a roll distance of 6700 feet every day of the week under the adverse conditions outlined, and by the simple expedient of adding a few knots to final and trying to use wheel brakes from touchdown instead of the handbook technique, with the same aircraft we have gobbled up over 11,000 feet of concrete after it touches down. Smarts a little if you've only got a 10,000-foot runway.

Since I have mentioned the use of maximum braking and anti-skid protection, I'd like to very briefly cover the anti-skid system as installed in the F-101. The system is passive in nature—it contributes nothing nor does it have any effect on braking up to the point that for one reason or another a wheel tries to lock up and skid. The intelligence system of the anti-skid is continually monitoring wheel RPM. When the wheel RPM changes (slows) at such a rate as to indicate an oncoming skid, the system comes into play and dumps brake pressure, even though you have the pedals depressed, and then allows it to be reapplied again according to the amount of pedal you have commanded. It will continue to recycle in an ON-OFF action until the wheel stops showing skid tendencies or you back off on the pedals (commanded brake pressure). The cyclic rate of the system is as required but can be fast enough to prevent detection by the pilot. To prevent any directional problems the anti-skid works on both wheels simultaneously even though only one wheel may be showing skid tendencies.

The anti-skid switch should be left on at all times unless there is a malfunction. It should be considered part of the brake system of the aircraft, which it is. It is interesting to note that no F-101 has been involved in a landing accident caused by anti-skid brake failure. However, I'd have to take my shoes off to have enough digits to count the number of aircraft "crunched" when

You might say that today's fighter pilots are not only sitting on a bigger "hand grenade" than the gooney-pickle pilot, but it's got a shorter fuse to boot.

a pilot turned off the anti-skid because "he thought he could do a better job of getting the aircraft stopped" or "'I thought it wasn't working since the aircraft wasn't slowing down very well."

The anti-skid installed in the Voodoo is a very good system, but as you "can't get blood out of a turnip," the anti-skid system can't do the impossible and provide braking where there is no braking capability.

The amount of aircraft deceleration you can command from the wheel brakes depends on an almost infinite number of variables. The only ones of real importance to you as a pilot are the weight and speed of the aircraft, and the runway condition. Take a theoretical case of continual, perfect, maximum braking: At heavy weights there's naturally more inertia to overcome, so the resultant deceleration will be less. Therefore, a stop from an aborted takeoff will naturally "feel different" than a stop from the same speed at landing gross weight. Since we are used to the feel of deceleration from a given amount of brake during everyday landings, it is understandable that a pilot might misconstrue the decreased deceleration force for the same amount of brake applied during an abort as some sort of brake failure or malfunction.

The second item, speed, contributes not only to the basic energy level but also to lift of the wing—the faster the speed the more the lift, the more the lift the less of the aircraft's weight on the gear, the less the weight on the gear the less decelerating force that can be generated by the brake. If you're thinking of increasing the weight on the wheels by "dumping" the flaps, don't! The drag of the flaps provides a higher decelerating force than you could get out of the brakes converting the extra weight on the wheels to decelerating force.

The problem of speed becomes more serious when our third variable comes up—adverse runway conditions.

Contrary to the dry runway condition, the coefficient of friction on a juicy runway decreases inversely with speed. As speed increases not only do we have progressively less weight on the gear, but also the conversion factor of the available weight to deceleration is getting worse.

The whole picture boils down to the fact that there are a lot of variables working on wheel braking effectiveness. The adverse variables all become much more severe with speed. Therefore, the nose high, aero drag technique, which is the best way to get the aircraft slowed to the 110-knot region under good conditions, becomes even more important as the landing conditions become worse. Remember, a wet or icy runway has no effect on the aero braking portion of the roll out since wheel brakes are not even used. If you try to use wheel brakes in this high speed region, they are going to be ineffective for the reasons explained above and the wheel will tend to skid very easily. The anti-skid system will get every bit of decelerating capability possible out of the conditions it has to work with but under extreme conditions it might be next to no decelerating force at all. So, why not use aero drag like you should have in the first place?

From 110 knots on down the over-all wheel braking effectiveness is getting better and, although the wet runway braking is inferior to dry surface conditions, it is still what I'd consider good. Regardless of the runway condition or the aircraft parameters, the anti-skid will protect the aircraft from wheel skid. It cannot, however, put on more brake than you are commanding. So, if under emergency conditions you're interested in getting stopped in the shortest distance possible with wheel brakes, keep enough brake on the aircraft so that the anti-skid is "working." This assures the max wheel brake decelerating force on the aircraft for the prevalent conditions.

From all this I hope you have decided that for any condition the anti-skid should be "on" and you should fly final at recommended speed, land and hold the nose at 10-11 degrees until 120-110 KIAS, then put down the nose and use whatever brake you need to stop.

An emergency or minimum run stop is the same except that the wheel braking portion is done with the brake pedals on the stops—and, oh yes, double check that the anti-skid switch is "on."

For those of you who have never been called upon to make a minimum run anti-skid landing, you'll be amazed at the stopping power available in the brake system of the aircraft. From the time you get the brakes on, you'll only "have time" for about four or five fairly severe-feeling cycles before you're stopped. As the aircraft comes near stop, you'll want to ease off the brakes a tad to prevent gear chatter.

In closing I would like to ask the impetuous ones among you to please refrain from using this article as an excuse for making your next landing a minimum run, full anti-skid just for kicks. Rather, use it as a basis of discussion of the landing phase of the aircraft and the capabilities and operation of the brake system. A lot of Voodoos are missing from roll call because of a lack of complete understanding in these areas. ☆

Pilot-Forecaster weather information is a . . .

Two Way Street

By Lt Anthony Williams, Det 6, 9th Weather Sq, Malmstrom AFB, Montana

We in Weather deal in a service. The surprising thing is that weather is only half of that service. A satisfied customer is the other half. To most forecasters it is easier to put out a forecast than to give the actual briefing on it – especially in bad weather.

Here is where our two-way street enters. The best way to illustrate it is to set up a hypothetical pilot-forecaster situation. Some or all of these incidents have happened to you at one time or another when receiving your weather briefing.

Fcstr: What can I do for you?

Plt 1: How about filling out my weather data sheet?

Fcstr: I see you've left off your ETA, ETE, and altitude.

Plt 1: Let's see, it's 1430Z now. We'll be off at 1500Z and I'll give you our ETE and altitude as soon as you give me the altitude for best tail winds and how strong they are.

Fcstr: The altitude for best tail winds is 40,000 feet, 290 degrees at 180 knots for an average.

Plt. 1: How about the 10,000-foot winds? You see I'm flying a U3A.

Fcstr: I'm sorry, sir. I didn't look at the 175 close enough. The 10,000-foot wind is 290 degrees, 50 knots.

Plt 1: Let's see, that means three plus thirty enroute.

Fcstr: EXCUSE ME, Sir, I have to put out a SAGE Trend forecast.

Plt 2: (Busting in) Excuseme,butwhat'sitgoingtobein thelocalareatomorrowat1000?IhaveastandboardandI need1000localtakeoffdata,surfacewinds,temperature indegreescentigrade,dewpointindegreesfahrenheit, specifichumidity,climbwindsto10,000feet,temperature deviationduringclimb,flightleveltemperatureand deviation,and10,000footwindswithinfiftymilesof Malmstrom.I'minahurry!

Fcstr: One moment, sir. I'll be with you as soon as I finish a SAGE Trend Forecast and this gentleman's 175.

Fcstr: Sir, the Omaha forecast is 5000 broken, 25,000 overcast, 10 miles visibility with light rain showers, winds two zero zero at 15, altimeter 29.65.

344.6: Great Falls Metro! Great Falls Metro! This is Boo Boo 11, over.

Fcstr: Excuse me, Sir . . . Boo Boo 11, Malmstrom Metro, over.

BB 11: Ahhh . . . Malmstrom Metro, 11. We're entering the Lazy Susan Oil Burner Route at 2200Z and would like forecast altimeter setting, D values, and any significant route weather.

Fcstr: Roger, 11, Lazy Susan at 2200Z. Stand by, over.

BB 11: Roger, 11.

Fcstr: (To himself) Where in creation is Lazy Susan? He wants a forecast for about eight hours from now. This is gonna take at least five minutes and I have two pilots and a TAFOR to get out. HELP!

Plt 1: Say, how about back here about midnight?

Fcstr: No sweat!

Plt 1: Well . . . O.K. . . . Thanks.

ANALYSIS – Both the pilots and the forecaster showed less than adequate communication technique. The forecaster should always look the 175 over carefully to know what the pilots desire. The pilot should expect to have delays during his weather briefing and should plan to accomplish as much preflight planning as possible before handing a 175 to the forecaster.

An incomplete 175 may not be spotted by the forecaster. He may not pick out operational stops, enroute delays, etc. If you have not completed your sections of the 175, please bring it to the attention of the forecaster. It may save his time and yours.

A forecaster has priority of duties and a 175 is down on that list quite a ways. Be patient with him if something comes up that interrupts the briefing.

Sometimes he may do some lower priority duty (such as answering Plt I the last time) or answering the telephone. These things will only be done if, in his judgment, it would be more expedient to remove that problem than to have someone wait a long time on a very simple question.

If your request would take a large amount of time, please keep in mind that a higher priority request may occupy his time before your request is dealt with.

When receiving the actual spoken briefing, a pilot should expect the forecaster to give:

- Takeoff data
- Climb weather
- Enroute weather
- Descent weather
- Destination weather
- Alternate weather

If all of this information is not received, ask for it. If the briefing is interrupted often, ask to have a complete repeat so that the full flight picture can be seen.

If the pilot wants an outlook for a return flight or some future flight, expect a general answer from the forecaster. If, however, the answer does not satisfy you ask for clarification.

Some pilots would be insulted if the forecaster gave a very formal, finely pinpointed forecast for an outlook. The "scattered Cu," "broken middle clouds," or "no problem" answer may be too informal and lack the preciseness the pilot wants. Please clarify any doubts you may have. He doesn't want you to walk away half satisfied. ☆

BULLDOGGING the BULLPUP

By Major H. M. Butler, Directorate of Aerospace Safety

Down at the County Fair and Rodeo the other day, there was a real fine demonstration of precision and professionalism. I first noticed a group of cowboys huddled near the chutes and at a casual glance they appeared completely relaxed, but you could tell they were intent and not one word the leader said was missed.

When they mounted their horses and began warming up, you could easily tell that each man knew precisely what to do, how to do it, and when to do it, indicating constant instruction and persistent practice. With the public address system announcement of the first bulldogging event, this team wheeled into position with the smoothness of a panther stalking its prey. The bull was turned out of the chute and the team sped into exact position and performed each move with the precision born only of strong desire and long practice. Both the men and their horses seemed to anticipate and respond to every move of the bull. The action was so smooth it didn't look hazardous, but a bull's horn in the gut or a broken leg are the constant hazards of carelessness or unprofessional performance in the rodeo arena. In a matter of seconds, the bull was on the ground and the judges' flags went down. This team took the top money.

Now, there is a parallel between bulldogging a bull and bullpupping a Bullpup (AGM-12B). The parallel is the precision, care, and exactness with which each operation must be executed if they are to be safely completed.

There are also some areas in the performance of both tasks where there should be absolutely no similarity. The bull, to be properly dogged, comes plowing to an abrupt halt. The cowpoke twists the bull's grass-eating head until he flops over with his legs in the air and says "uncle." On the other hand the Bullpup, to be properly "pupped," must be carefully handled—no twisting or wrenching—legs must not come off the ground, and the missile must be slid smoothly onto the rails and locked in place.

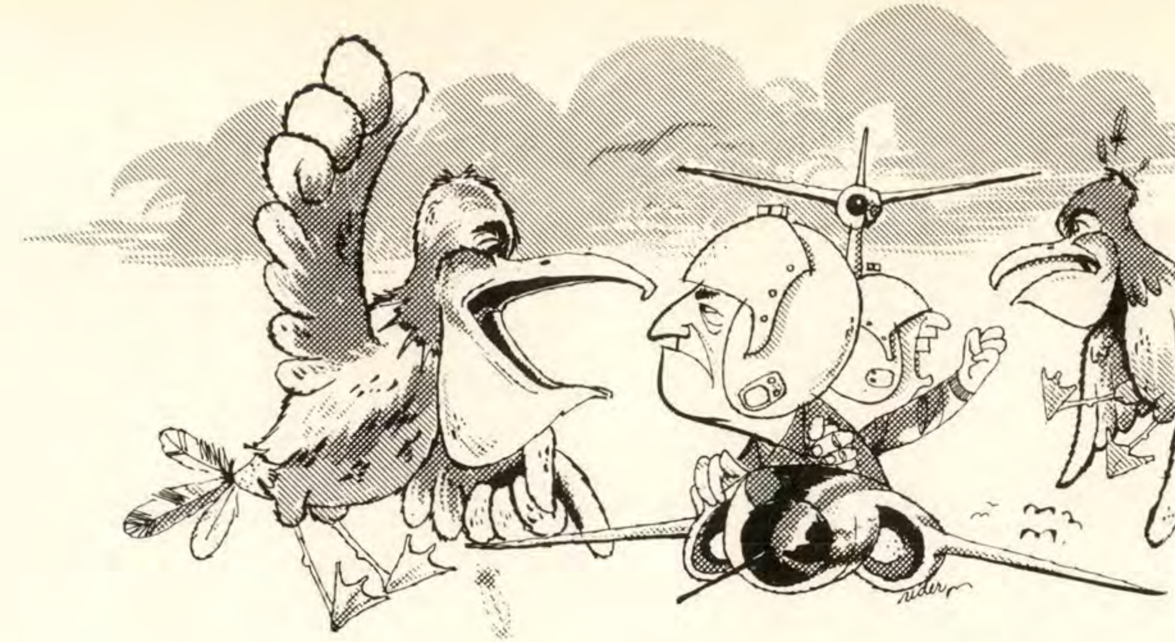
Just recently a bunch of the Bullpup cowboys were whooping it up in the old bunkhouse about how they had really bulldogged a Bullpup. It seemed that like all good cowpokes, they had bunched up and had a briefing (by the checklist) about how they were going to handle this Bullpup.

They had all the steps in order: Desert Pete would unstrap the Bullpup from the trailer; Cactus Joe would take his horse (MJ-1), haze the Bullpup into position, and ease it down on the cradle where Wyoming would twist it around. Montana was to undo the MJ-1 strap so that Cactus Joe could position his horse on the other side, and California was to see that every detail was right. Well, everything went fine. The tools were checked, checklists brought out, test gear positioned, and everything made ready for the Bullpup's arrival. The trailer load of Bullpups arrived in fine shape and the operation began. The first Bullpup was unstrapped from the trailer and the MJ-1 strap secured around it before it was lifted from the trailer. Then Cactus Joe eased the Bullpup up and over to the cradle and gently set it down. Montana unhooked one side of the MJ-1 security strap and signaled Pete to move away. As he did, the security strap on the MJ-1 snagged the Bullpup stand and tipped it over. The fall was too much and the Bullpup plowed into the ramp with a shuddering thud, gasped once, rolled over, and died! The fall had broken the Bullpup's back.

Montana said it wasn't his fault because the Bullpup came off the trailer wrong and had to be shifted. Besides that, it was Wyoming's fault because he didn't make sure the straps were clear before his pony (MJ-1) shifted sides. Wyoming said it was California's fault for not stopping the show in time and then the discussion really got hot and heavy as each man tried to justify his position.

Well, when the judges' flag went down, there stood Desert Pete, Cactus Joe, Montana, Wyoming, and California with a dead Bullpup on their hands and the "Flying Bull" team lost the prize to the precision "Bullpup" team. In addition to possible physical injury, the health of the team members was jeopardized by possible gas leaks out of the Bullpup. The boss was sore about the whole affair because it cost him one of his high-priced "Bulls."

Although these men were not injured, the hazards associated with the Bullpup can be just as deadly to Bullpup handlers as those a novice or careless cowboy could expect in the rodeo contests. Only by flawless knowledge of the task and hardware and by constant alertness during training and actual loadings can Bullpup teams achieve the smooth response, exact performance and precise movements which are so necessary to turn in consistently safe, top notch loadings. ☆



Boy, have I got a splitting headache! I was flying down the coast when, with no warning, some idiot fired this big shell at me. It must have been 100 feet long. It was spewing fire from the tail and my ears still ring from the thunder it made. I did a violent 90 and it missed, but it like to of scared me to death.

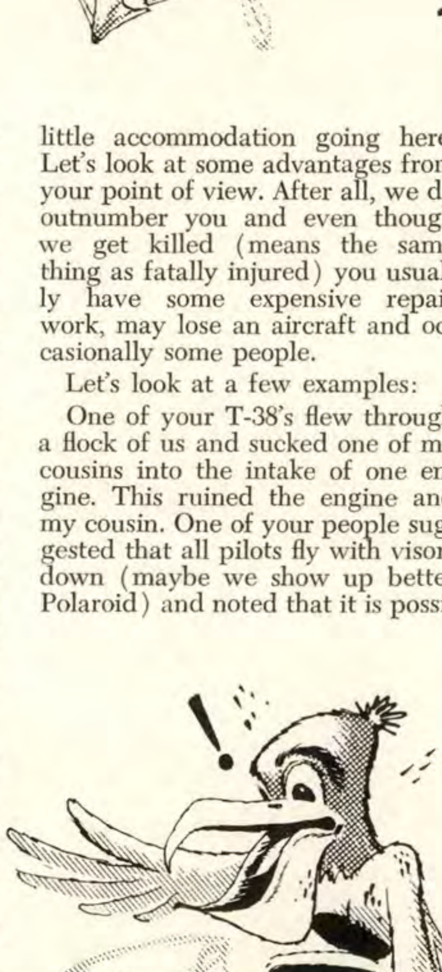
Now, the only reason I can see for shooting at me is that men seem to think we birds are always trying to fly into their airplanes. I've seen some of their reports — broken windshields, dented wings, torn up engine turbines, smashed landing lights . . . and they're all written like it was our fault. Ever stop to think what happens to us birds? Zap—a dab of guts and feathers, that's all. Brrrr, if that thing had hit me this morning.

It ain't fair, really. A bird hatches, eats things, grows, flies around, drops things, eventually he dies. No problem to anybody, really. But you men have got to keep bothering us. You have burned rubber tires near our roosting places, you have fired cannons to try to scare us away, you have cut down some excellent roosting trees near airbases and drained some of our favorite swamps. I can just hear someone saying, "Look at that crazy scrambling pelican," when that building-sized bullet missed me this morning.

So . . . o . . . o while I soak my singed feathers, how about a truce? Interested? Maybe we can get a little accommodation going here. Let's look at some advantages from your point of view. After all, we do outnumber you and even though we get killed (means the same thing as fatally injured) you usually have some expensive repair work, may lose an aircraft and occasionally some people.

Let's look at a few examples:

One of your T-38's flew through a flock of us and sucked one of my cousins into the intake of one engine. This ruined the engine and my cousin. One of your people suggested that all pilots fly with visors down (maybe we show up better Polaroid) and noted that it is possible to ingest birds in both engines simultaneously.



One of your '105's met a large bird nose to nose. Part of the bird ripped a 12-inch hole in the radome and the remainder went into the left engine intake.

While flying almost due east a B-58 completely disrupted an orderly formation of ducks and swallowed one in the No. 4 engine. Goodbye duck, of course, but he raised hob going through the grinding wheels and you had to dump 35,000 pounds of smelly kerosene to get down to landing weight.

Just heard that one of my near-sighted kin became involved with the oversized blades of a helicopter. Slicing was successful—my kin became next-of and the helo operator filled out an OHR.

One of your F-105 troops reported that, on his third low level, high speed run a big bird, believed to be a duck, struck the aircraft just to the right of the windshield. Ridiculous. The legalized buzzer of yours struck the duck. Believe me, we get out of the way when we can. But in the last few years you've taken to sending high altitude bombers screaming along just above the tree tops and some of your fighters through faster than their sound can travel. Still, you have the gall to say the duck hit the '105. Whale feathers.

One night you were blasting one of your eight-engine jobs along just above the tree tops, probably just so's you could scare us out of our

WE WERE HERE FIRST!

By A. Bird

wits. Pow, you hit and killed one of my fellows with the right windshield. A little later and, pow again, you killed one with the left windshield. You guys were lucky. Sometimes the glass breaks and it is possible, especially if you plow through a whole flock of us feathered types, to lose one of your airplanes.

There are many more examples, all point up the fact that we *both* lose in bird-aircraft encounters. Let's cooperate and minimalize (this word stolen from the military) this mutual hazard. But we must be realistic about it. I've studied some of your propositions and a few are downright silly. For example, ". . . that every pilot, regardless of type aircraft being flown, make a supreme effort to avoid collision with birds and other small objects during flight, commensurate with air safety and discipline." This may mean something, but not to an ordinary bird like me.

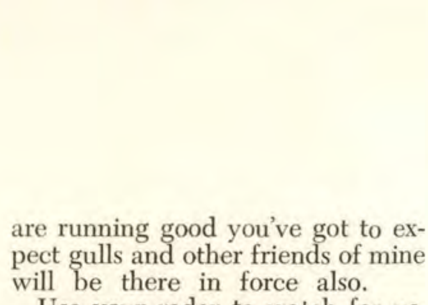
Here are some suggestions:

Don't fly at dawn and dusk. As soon as it is light enough we like to start searching for chow and as darkness approaches we beat it back to favorite roosting spots.

Fly up high whenever you can. We have to flap hard and breathe deeper the higher we go so most of us stick close to the ground.

When you have to fly at low level, go where we aren't. If you insist on practicing landings at a coastal base just when the herring are running good you've got to expect gulls and other friends of mine will be there in force also.

Use your radar to watch for us. We like to fly formation too, and you've finally learned that what you thought were "noise" or "angels" are really us birds. Here's where that accommodation bit can work. If you see we are coming down the east side of the field, have your aircraft fly on the west side. They can turn one direction as well as another. Sometimes, too, those fellows you have in glass towers



should be able to see us and can direct aircraft the other way. Unfortunately, we have no way of knowing which direction one of your planes will go next or, I can assure you, we would get out of the way.

It's none of my business really, but collision potential is proportionate to exposure. If you'd come right in and land, not spiral down from way above the clouds, not circle around like a dog does before he finally decides to lie down, well, this would help.

If you want to fool around with shooting of guns, racing up and down in cars, blowing horns, installing artificial distress calls, burning those stinking rubber tires, go ahead. If the fishing is just as good somewhere else we will probably move. If it isn't, we will most likely put up with such nuisances. You can shoot us (I suggest you use something smaller and faster starting than you tried on me this morning), but we have your Audubon Society and our natural reproductive instincts on our side.

Move your garbage dumps away from airfields. This doesn't affect me, but a few of my poor relations will eat anything.

Go ahead and spray your trees and our roosting areas near your airfields. Most of us will move, but if our survivability goes up we don't mind.

Slow down. The farther away we can hear and see you, the more time we have to get out of the way.

Try and avoid our airways. Many of my relatives have migratory routes, particularly along coasts, and in the fall we generally fly south when we have a tailwind, and in the spring north with a tailwind. So . . . o . . . o, watch out.

Now how about a little cooperation. We are doing our part to try for coexistence. This is more than fair, I figure. After all, we were here first. ☆

Why Investigate?

By Capt Charles G. Russell, Hq Air Proving Ground Center, Eglin Air Force Base, Florida

It was Monday, the 27th, just nine days since the accident. A pencil, rapping on the conference room table, indicated the business at hand was about to begin. Colonel Wagner, seated at the head of the U-shaped group of tables, cleared his throat in that peculiar way of his when he wanted immediate silence in the room.

"Gentlemen, the board will come to order. Let the minutes reflect that all of those board members present at this meeting were also present at all other meetings; and you are again reminded that the purpose of this board of officers is to investigate the major aircraft accident which occurred here on the 18th."

The Colonel glanced at the papers in front of him and continued, "We have interviewed the witnesses, taken the necessary statements and accumulated the data we thought we needed. A copy of each document has been placed in the folder located on the table in front of you. Our problem is this: Even with all of this data we have been unable to determine a primary cause for this accident."

Colonel Wagner paused to light his pipe and concluded, "Because of this, I feel we must back up and take a fresh look at the whole situation. I suggest a review of the entire accident from the beginning. What do you think?"

Heads nodded reluctantly and a weak "Yes sir" was heard from the back of the room.

"Major Roberts," the board president said, since you're the investigator, perhaps you had better start the review."

"Yes sir," Major Roberts said, as he slowly opened the folder in front of him. Here we go again, he thought to himself. This doggone investigation is going to run on forever. Why, I haven't even had a chance to fly since the miserable thing started. I still say the cause is obvious, the airplane was just stalled in on the final turn.

Major Roberts spoke out loud now, letting the boredom creep into his voice a little more than he intended. He identified the pilots, then picked up the History of Flight and began reading the details of the preflight, engine start, taxi, and takeoff. For the sake of brevity, he reduced some paragraphs to shorter sentences of his own, " . . . and everything was normal about the flight up until the time of landing. Ground witnesses testified the T-33 pitched out in a normal manner and rolled out on downwind at the usual place. The Mobile Control Officer observed the gear extension at this time, and all three gears appeared to be down and locked prior to the base turn. He couldn't be sure if the flaps were also lowered then, but probably were since they were fully extended at the crash site.

"The turn to base also appeared normal to both Mobile Control and other ground witnesses. About halfway through the final turn, which was later classified as a little low—about 400 feet above ground level—the aircraft bank attitude increased momentarily from an estimated 45 degrees to 80 degrees. At this time, the nose went down sharply to about 60 degrees below the horizon, and the aircraft continued to go down until it struck the ground one-half mile short of the runway. The aircraft was completely destroyed and both pilots were killed. Fuel on board at the time of the accident was estimated to be between 200 and 250 gallons."

Roberts placed the History of Flight back in the folder and withdrew the partially completed Investigation and Analysis. "We discovered that the engine was running at approximately 50 to 60 per cent RPM at time of impact, and a breakdown of the engine failed to reveal any inflight problems. As everyone knows, we concentrated on examination of the flight controls, but we didn't get anywhere there either. All of the remaining components, which included the most important ones, checked out okay."

Captain Sanders, the pilot member of the board, interrupted at this point. "What about the possibility of runaway trim, sir? Have we definitely ruled that out as a possible cause?"

Major Roberts looked at the Captain sharply and spoke as he might to a naughty child, "Sanders, you know that everything in the trim system was all right. We checked those parts that Saturday we had to work all day." He emphasized the word "Saturday."

Colonel Wagner looked up, disapprovingly, but said nothing. He turned to Dr. Rock. "Doc," he said, "as Flight Surgeon in this case, do you still think incapacitation of either pilot was not very probable?"

"Yes, I do, Colonel," the doctor answered. "The medical records didn't indicate any prior physical or emotional problems with either man; and examination of the remains did not indicate a heart problem. The oxygen system checked out good, too. Of course, tissue samples were sent to San Antonio for analysis; but I don't anticipate a positive finding."

"Thanks, Doc, I think that covers the medical situation all right; however, we must be sure to check thoroughly all personal equipment items for our report."

Colonel Wagner then returned his attention to Major Roberts. "Well, Major, that seems to bring us right back to where we were during our last meeting."

"Yes, sir, it does," the investigator answered. "I still can't help but think that we're trying to make something complicated out of something simple. Let's face it; the jocks just sucked the bird around the final turn because of that 15 knot crosswind, and stalled out. That's all there is to it. With all due respect to the board, Colonel, I think we've just been spinning our wheels."

Colonel Wagner allowed the silence to settle around the room for a full 30 seconds after the investigator finished speaking. At last he spoke, his voice serious, "Gentlemen, it's apparent that some of you fail to fully realize your obligation as a member of an accident investigation board. I am sure you want to carry out your duties, but we must never sacrifice thoroughness for speed. I want to set the record straight right here and now. Any aircraft accident is serious business, no matter what type plane is involved — and it's doubly serious when there are associated fatalities. The cost to the government for this accident is $123,000 for the T-33, approximately $200,000 in survivor benefits for the pilots' families, and another $50,000 for the cost of this investigation. This totals $373,000 and doesn't even reflect the tremendous cost of training replacements for those pilots."

The president cleared his throat again while he let the impact of what he had said sink in. He continued, "Now multiply this figure by 360, the number of days in a year, because that approximates the annual number of USAF accidents—and mentally throw in a few expensive B-52's, F-105's, etc., that are a part of the total—and the cost comes to roughly $1,300,000 per day. This, in itself, is ample reason for a thorough investigation; but the most important aspect of the whole business is accident prevention. If we didn't find the real cause of accidents and apply that knowledge to prevent other accidents, we would soon be losing airplanes faster than the manufacturers could make them—and pilots would take a dim view of their life expectancy to boot. This is why I must require a complete investigation of this accident. Before we decide that two very experienced pilots stalled the bird while turning on final, we are obligated to thoroughly exhaust every possibility. Our assessment of the cause factor must be substantiated by factual, accurate and fully documented data. We must present a complete picture to the reviewing authorities." The Colonel paused, looked directly at Major Roberts, and concluded, "Do I make myself clear, gentlemen?"

The maintenance officer, Major Smith, half raised his hand at this point and said, "Sir, since it's getting late in the day, I'd like to be excused so that I can re-examine the wreckage in relation to the T.O. compliances. There are a couple of items I'm not sure of yet."

"Good idea, Jim," the Colonel answered, "and Sanders, I'd like to be a little more familiar with the flying habits of the pilots. Will you and Major Roberts look into that, please? And Doctor Rock, let's you and I go down and look over the cockpit area again. The meeting is hereby adjourned until 0800 tomorrow morning."

The next morning was dark, rainy, and cold; but as the accident board members filed into the room, Colonel Wagner wore a cheerful expression on his face. He opened the meeting and said, "Major Smith and I found something yesterday that might well be the cause of the accident. Now, we can't be sure yet, but it has definite possibilities. Jim will you give the board a rundown on what we discussed?"

"I'll be glad to, sir," the mainte-

nance officer said as he shuffled some papers in front of him. "I don't know why in the world we didn't notice before, but the pilot seat separator was actuated in the front cockpit, while the one in the rear seat was not. We thought that this most likely occurred during impact, but after closer examination we found that the roller bar was bent down tightly on the strap after the take-up reel had completely actuated. To further substantiate this theory, we discovered that the initiator that actuates the lap belt and seat separator in the front seat had fired, while the rear seat was still live when EOD reached the scene. A check of the aircraft record showed us that T.O. 1T-33A-615, which is the one for installation of man/seat separator in conjunction with the rocket seat, had been completed at IRAN the week before and that this was the first flight since the aircraft returned."

"To be sure we are on the right track," Colonel Wagner explained, "the Wing Commander gave an order last night to ground all T-33's that have the separator installed until a one-time inspection can be made of the system. We will be notified of the results as soon as they are completed, so in the meantime, let's think about this logically and see if we can find any other data to substantiate this theory."

Captain Sanders spoke up immediately, "This may not mean anything, Colonel, but I've flown with the pilot perhaps more than most pilots on base and I've noticed that he had a habit of raising the seat all the way up on base leg. I remember I asked him about it one day when we were shooting landings because I could hear the seat actuate each time we approached the runway. He told me that since he was a little short he preferred to have the seat all the way up for landing, but liked it about halfway up for other phases of flight. Also, to further reduce the possibility of accidentally stalling on final, the stanboard pilot told me last night that the pilot was used to flying century series aircraft prior to coming here, and that his traffic patterns were always wide with plenty of airspeed. Power was never reduced below 60 per cent until after crossing the fence. In addition, he had stated on several occasions that he didn't believe in performing power off patterns which, as we all know, some T-Bird pilots still do occasionally in spite of what is in the Dash One."

Major Roberts spoke up at this point, "Colonel, prior to today we—I especially—placed a lot of emphasis on the crosswind. Before coming to the meeting this morning I listened to the tower tape again, and I now think it's significant to note that the pilot asked about the winds twice prior to his pitch. I now feel certain in my own mind that since he was concerned about the wind we should assume—in the absence of any information to the contrary—that he compensated for it in the proper manner. In addition, I think we can safely conclude that the pilot was in control of the aircraft at the time since it was he who made the radio transmissions, and the copilot would not be allowed to land from the rear because he was not an IP. As you recall, the pilot was a stickler for regulations."

At this point the Colonel was called from the room. Five minutes later he again faced the group. "That call was from Quality Control. An inspection of the T-Birds revealed that the seat/man separator T.O. called for an unprotected cable to be run along the rear left of the seat. This cable extracts the seat pin from the lap belt and seat /man separator as the seat leaves the aircraft. They said that it was quite possible for the cable, due to its position, to become loose enough to catch in the lap belt when the pilot straps in and be pulled when the seat is raised. It appears now, that such was the case in this accident, and that when the pilot raised the seat the initiator was accidentally fired. This automatically opened the lap belt and actuated the seat separator, forcing him into the instrument panel and control stick. There was not sufficient altitude remaining for him to recover before striking the ground. If every one agrees, our immediate action will be to notify Headquarters USAF, Directorate of Aerospace Safety and the AMA concerned recommending a redesign of the seat separator installation."

As the Colonel paused briefly to light his pipe, he could see a glow in the faces of the men that comes from realizing that one has accomplished something worthwhile. He blew out his match and continued, "Before we break for lunch, I'd like to say that I know this has been a lengthy investigation and that it has required that you be away from your normal duties for a long time; but had we been satisfied with our first analysis and not pressed to investigate all of the facts, we may very well have been the indirect cause of other accidents and fatalities. As it turned out, we can be proud of our efforts and each of us can know that because we did demand a complete investigation we have fulfilled our purpose in preserving the combat potential of the Air Force."

As the board members filed out of the room each man was smiling, but perhaps the biggest smile was on the face of Major Roberts, because his haste had brought him the closest to making a disastrous mistake—but the mistake hadn't been made. ☆

Missilanea

PHASEDOWN PROFESSIONALISM — With the accelerated phasedown program for our ICBMs being implemented on relatively short notice, the display of professionalism by all agencies is noteworthy. Those Strategic Missile Squadrons affected are: 567 SMS, Fairchild AFB; 577 SMS, Altus AFB; 578 SMS, Dyess AFB; 569 SMS, Walker AFB; 851 SMS, Beale AFB; 850 SMS, Ellsworth AFB; 568 SMS, Larson AFB; 569 SMS, Mt. Home AFB; and 451 SMW, Lowry AFB. All are deserving of special recognition!

Personnel from the Missile Safety Division, Directorate of Aerospace Safety, have visited several of these units during phasedown and reported favorably upon all activities observed. After receiving the executive order for deactivation of selected units, and working with only broad guidelines, each missile organization concerned has developed and executed a comprehensive phasedown plan.

Emphasis on safety must be paramount during any operation of this magnitude, regardless of the disposition of equipment being removed. For the preservation and maintainability of potential combat capabilities, highly skilled and trained personnel involved in this task must not be unduly exposed to hazards.

Lt Col A. C. Eggleston
Directorate of Aerospace Safety

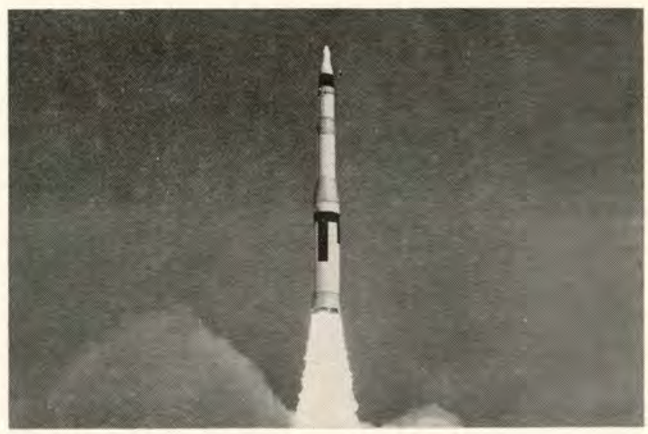
CROSS CHECK—How many words have been written about technical data? How many conferences have been held to re-write technical data? How many hours have been spent validating technical data? How many AFTO Forms 22 have been submitted on technical data changes? How is it, then, that potentially serious inconsistencies in technical data can exist throughout the life span of a weapon system and not be discovered until the phaseout cycle?

Case in point: A weapon system using different series missiles in different configurations utilized a common piece of ordnance. Yet, technical data for one model called for this piece of ordnance to have a shorting plug installed prior to shipment, and technical data for another series called for the same piece of ordnance to be removed and placed in a separate container prior to shipment.

If this ordnance is hazardous enough to require its removal from one series, then why isn't it hazardous enough to require its removal from another series of the same missile?

It is recognized that the troops using technical data for one series would not necessarily be familiar with technical data for another series. When like weapon systems, but different series are used, it might be wise to screen for discrepancies. This would be applicable in aircraft as well as in the missile field.

Lt Col C. N. Mozley
Directorate of Aerospace Safety



GUIDANCE AND CONTROL COOLANT CONTAMINATION—Sodium chromate coolant was found to be leaking from a Minuteman missile guidance set during unscheduled maintenance in the Launch Facility. The Guidance and Control set was removed and replaced. Due to a faulty connection, some leaking occurred around the G&C umbilical head interface. Four mating and demating operations of the umbilical were accomplished before a good connection was assured and no further exterior leaking was observed. The following day the G&C set was removed to permit a downstage test to be performed; approximately one-half cup of coolant was discovered at the top of the third stage rocket motor, inside the raceway cover and around the jamb-nut (B-nut) inside the G&C container. No exterior leaks were found either at the umbilical interface or anywhere else on the missile.

OOAMA has established a materiel improvement project to evaluate the problem. T. O. 11G2-10-5-3 gives the procedures for installing the flexible coolant hose assembly.

Major R. L. Mahynske
Directorate of Aerospace Safety

♂ MAN

***A**ccidents, basically, are caused by only two factors, people and things. The simplest kind, as has been repeatedly demonstrated, usually involve things. Things can often be modified to the point that their reliability becomes extremely high. When man is considered, however, it has become popular to indulge in long erudite discussions of the fact that he was the same, is the same, and will remain the same and that his inherent failings are such that no real hope exists for either explaining or decreasing his contribution to accidents.*

THE MAN AND THE MACHINE

The entire field of human engineering has grown from the recognized fact that, in addition to basic functional reliability, the machine's operation must be compatible with man's ability. Aircraft cockpit designs have developed through both logic and trial and error to the point that many of man's frailties have been specifically considered in the design of the equipment. It is agreed that controls must be within reach, instruments visible, presentations meaningful, and known incompatible inter-relations between instruments and controls avoided. The fact that man's span of attention is limited is recognized and its parameters reasonably well documented. In the light of this known information, if a cockpit should be designed which contains 114 warning lights, it can only be said that the designers are inviting accidents for there is no evidence to indicate that man was ever capable of adequately monitoring such a number. If painfully developed knowledge is flagrantly disregarded certainly accidents must increase.

THE MAN IN AN ENVIRONMENT

The man and the machine, either separately or as a unit, operate in some environmental setting. This setting always involves two features, one of which is location and the other is time.

The fact that man operates in time is one of his most important limiting factors. This is brought most forcibly into focus in the area of see and be seen flying. Space can be covered so rapidly in high performance aircraft that by the time an on-coming collision object can be physically seen it is too late to initiate the actions required for its avoidance.

Some years ago a simple, unpublished experiment was conducted in which a slow moving C-47 was used to avoid a collision with a vertical light beam from a theodolite. The pilot who was to avoid the collision was given control of the aircraft at various known distances from the beam. The unequivocal findings, of great surprise to both of the experienced Air Force pilots involved, was that a mimimum of nine seconds was required for successful avoidance even with the ideal conditions under which the experiment was conducted. When high performance aircraft are converging at rates well in excess of 1000 miles per hour, this nine seconds means that the avoidance of a midair collision cannot be left up to either pilot.

Midair collisions continue to be experienced. The requirement that a pilot with his limited vision be responsible for enroute avoidance is completely unrealistic. The fact that accidents will continue to occur in this area results not from lack of knowledge but from the failure to accept information which is well known and well documented.

Time as a variable is not always a matter of split seconds. It is documented that the day of the week is a factor in accidents. In aircraft, lower rates are experienced at the beginning of the week with a gradual increase toward the end. Accidents reach a high plateau on weekends with a sharp drop for the beginning of the next week.

Another time variable of importance results from the fact that man has built-in psychophysiological cycles of sleep and wakefulness which cannot be violated with impunity. Disruption of these built-in physiological rhythms which follow the rapid crossing of many time lines creates disruption of rest cycles, fatigue and consequent inefficiency.

Time also plays a factor when an individual is in a hurry to accomplish some often unnecessary end such as getting home at a specified time or a more important one such as getting an aircraft prepared for an operational mission. In either case the attempts to crowd too many activities into too short a time period result in difficulties.

Implicit in most time considerations are space factors. Space as an environmental consideration varies from the often extensive external operating environment of a vehicle to the sometimes highly restricted work space which the operator must occupy in its operation. The hazards of high altitude as an operational environment are well known. The fact that man needs certain terrestrial equivalents is equally well known. Modification of the outside environment makes meeting these requirements more difficult but does not change them.

Not all operational environments are as glamorous

the known factor

By Anchard F. Zeller, Ph.D., Research Psychologist, Asst. for Medical Services, DTIG

as space. The mechanic in the machine shop is surrounded with many hazards, yet his most frequent injuries involve broken toes and strained backs. Individuals exposed to toxic environments certainly need protection, yet the most prevalent difficulties relate to common hydro-carbon compounds rather than the far more toxic materials to which they may be exposed.

In terms of work space itself, it is axiomatic that this should be adequate. Yet, cockpits are designed which make it almost impossible for the individual to operate adequately if he wears the available protective clothing, such as pressure or survival suits, which is required because experience indicates that the machine itself may not be reliable.

These things are known. Also known is a great deal about the man himself.

MAN'S LIMITATIONS

Some of the things about man which have been clearly documented are quite abstract, others much more readily measurable. It is known, for example, that man reacts to rewards and punishments. He finds punishment distasteful, but needs and is encouraged by rewards. He has other abstract needs; the need, for example, for relaxation. This need can lead him into many accident producing situations. When associated with sports activities it increases his potential for accidents, particularly if these involve activities for which he is not prepared.

Man also becomes inefficient from the results of his own activities. Although controversy rages as to what fatigue is and how to measure it, there is certainly no question that it is a very real phenomenon and that common sense rules can result in greater efficiency with less possibility of accidents. The human body is also impaired at times because of illness which produces inefficiency in varying degrees. Sometimes the very medication aimed at restoring the individual to health results in additional impairments which greatly increase the individual's potential for accidents.

Aside from the psychophysiological limitations which can be reasonably well documented, man has a variety of functional limitations. The human visual system does not estimate vertical height nor rate of closure with a great deal of accuracy, yet every landing requires that these estimates be made. The result is that periodically over-shooting, hard landings, or other mishaps occur. Mechanical aids are definitely required in this area. They vary from the simplest which merely require that the individual land with sufficient leeway so as to take his inefficiency into account, to the much more sophisticated coupling systems which may eventually accomplish the landing process with man acting as a monitor.

There are other functional limitations. Some individuals have greater aptitude for some types of activities than others. Greater efforts at defining the function to be performed and selecting the individual to perform it can certainly contribute to improving efficiency and decreasing the number of accidents. Functionally, man does not ordinarily perform well without training. Training cannot be geared to the most competent individual in a class, nor even the average, but must be aimed at the least capable if there is to be any validity in the assumption that the information presented has been learned. Once training is accomplished it is of no value unless employed. An individual trained in one specialty and utilized in another can certainly not be expected to be particularly efficient or safe. Memory is not perfect. In any activity, review is necessary, whether it be the problem of currency in flying, the launching of a missile, or loading munitions. If the activity is not accomplished with sufficient frequency, both the knowledge of how to perform the activity and the skill with which to do it will decrease. Some people can not learn some things, but even if the activity can be learned, the human system cannot be overloaded. A current problem relating to the number of different munitions which an individual can load points up this clearly. Although learning any one of the systems is completely within the capabilities of the individuals concerned, to expect such an individual to remain proficient in loading a great number of different kinds at the same time is completely unrealistic.

Training is ordinarily associated with close supervision. It is also associated with high accident potential. Learning is not accomplished without errors. The most hazardous period, however, often immediately follows the release from training. Pilots in their first operational assignment, released from the supervision of the training command, and expected to fulfill the mission in the manner of an accomplished pilot, face the highest accident potential of their entire flying career. This is the period which demands the greatest attention.

Not only is original learning fraught with accident hazard but so is the transition period. Transitions bring habits into conflict with each other which produces mistakes which cause accidents. With the passage of time rank increases and assignments change. An active pilot may find himself a desk pilot. An active mechanic

MAN (continued)

may find himself a supervisor. People in these categories who attempt to resume their original function will find that inefficiency has crept in. It is easily documented, for example, that desk pilots have a higher accident potential than pilots who fly the mission aircraft regularly.

The Air Force has a system of read and initial for literally mountains of material. The man's initial implies that he has read and understands the material and on the basis of some unheard of ability is expected to remember it. Information is not absorbed in this fashion. As long as safety is based upon blind faith in methods so completely in opposition to known human abilities, accidents will inevitably continue to occur.

In addition to all of man's other limitations, he has emotional disturbances. Although the exact effect of these upon efficiency remains a subject of discussion, there is certainly no doubt that an individual with known emotional disturbances should not be expected to continue in his normal functions, particularly if these involve high risk situations. Every one has a breaking point and although the individual who has been relatively stable is quite likely to remain that way, this cannot be accepted as an operating principle. Even as machines wear out and break, so does the human body and the human mind. There must be a constant surveillance over all people at all times. It should also be accepted that men are much the same whether they are supervisors or workmen. The supervisor must not only recognize the limitations of his men but recognize that these same ones apply to him.

Systems don't just happen. They have to be carefully designed, put in motion, directed and maintained. Very careful supervision of all facets of an activity is required if it is to remain in effect.

What are the implications of this, by no means exhaustive, listing of man's assets and limitations? It is aimed at demonstrating only one point. A great deal is known about the human. There is flagrant disregard for much of what is known. Accidents will continue until these known features are taken into active consideration.

MAN IN THE FUTURE

Regardless of the area considered, it appears that the future will involve no decrease and in all probability an increase in potential for accidents. Fortunately, however, it is the same man about which a tremendous amount is known. If this knowledge is applied, and if additional knowledge is developed, accidents can certainly be prevented. If systems are set up which are in direct conflict with what is known about man's limitations and safe procedures, accidents will surely result. To hold a safety officer responsible for no accidents under such conditions is as unrealistic as directing that no accidents occur. Man has been and must continue to be the focal point of the accident prevention program. If there is a realistic desire to prevent accidents his limitations must be recognized, accepted, and incorporated into the overall plan. If this is done accidents will inevitably be prevented. ☆

WHAT HAPPENED?

By Maj R. G. Clithero, 801 Air Division, Lockbourne AFB, Ohio

The photo inside the front cover shows a wrecked automobile, but it doesn't give any clue as to what happened. The picture here should give you a good idea. However, there's a story behind that blown tire that caused the automobile to leave the highway and roll over at least three times: the owner traded off the original tires for a pittance of cash. But he must have learned something from his experience.

When we arrived at the scene we were informed that the owner, who luckily wasn't hurt, had gone to the hospital for a checkup. But he never showed up at the hospital, and at the police station, home, squadron headquarters, duty section no one knew his whereabouts. Where was he? Turned out the man had reported to the base theater just in time to see and get credit for the mandatory holiday safety movie.

Last year started out pretty well for us. During the first seven months the base had only one military auto death. It was caused by a young man who went to sleep at the wheel after a hard day's night of drinking and driving.

In the last five months of 1964, we experienced or investigated (because they occurred in our area) eight airman private vehicle fatalities. Here are some interesting statistics on these eight fatals.

- The drivers' ages were 18, 20, 20, 20, 21, 21, 27, and 30.
- Five were driving borrowed or unfamiliar autos.
- Five were suffering from the effects of fatigue or drink—or both.
- Five were speeding.
- Five would have survived if they had had seat belts and had used them.
- Three were in violation of pass limits.
- Three were single vehicle accidents.
- All eight died by their own hand through childish, immature acts. ☆

Rex Riley's CROSS COUNTRY NOTES

HISTORY REPEATS—"On downwind he (the pilot) noticed the nose gear light was out. He made a low go, and mobile reported gear appeared to be okay. The pilot then changed the bulb but the light was still out. Then the aircraft flamed out and could not be restarted. After steering the machine away from a farm house, the pilot successfully ejected—at 350-400 feet. It was determined that he inadvertently turned off the master switch with the side of his hand while changing the light bulb. The switch protrudes 1/8 inch beyond the guard . . ." The above is quoted from AEROSPACE SAFETY Magazine, February, 1962.

Same song, second verse: The following is extracted from the investigation of an accident that occurred in September, 1964: ". . . Primary cause is pilot factor in that pilot inadvertently and unknowingly activated engine master switch to OFF position, resulting in fuel starvation and flameout. (Engine master switch controls main fuel shutoff valve.)

" . . . Master switch is not adequately guarded and protrudes 3/16 inch beyond present semi-guard."

This accident occurred on final approach and the pilot was in the process of changing the landing gear warning bulb. Fortunately, even though at low altitude, he managed to eject successfully.

SERMON TOPICS. A couple of old, old, old subjects, always good for another sermon, are merely going to be mentioned this time—Rex can't think of any new way of putting the words together. First one: gear up landings. A century series jock scraped to a halt on a 10,000 foot southwestern strip. Visibility was 60 miles. Cause of accident: pilot forgot the gear.

Second subject: access doors. About two minutes after takeoff the refrigerator compartment access door came off, struck the vertical stabilizer and caused minor damage. In another case flight was normal until the second firing pass when a thud was heard and a fluttering vibration was felt. When something flashed past the left side the fluttering ceased. The mission was aborted, armament switches safetied and, when fuel was burned down, an uneventful landing was made. All sorts of fixes have been proposed for such incidents as this, but it should be remembered that there is no problem if work is proper and complete and preflight inspections are diligently accomplished.

DISRUPTIONS, DISRUPTIONS. When Uncle Sam bought the Air Force CH-3C's Rex shook his head and predicted it would just be a matter of time. Here's how it happened. The two pilots had been out for over two hours, doing local transition and instrument work. Returning to base for termination landing the IP cut an engine on downwind for a simulated single engine approach and landing (disruption No. 1).

On the turn to base the pilot asked the tower if Ops wanted them to shutdown after returning to the ramp. Tower advised, "Stand by." (Disruption No. 2, or 2 plus.)

Pre-landing checklist was then started, but interrupted when the tower called with a traffic advisory

and to relay information previously requested. (More disruptions.)

The pilot acknowledged the advisory and reported gear down. He was cleared to land. Approximately one foot from touchdown the tower called and advised the gear was not down. Max power on the "good" engine and immediate addition of power to the simulated failed engine didn't quite hack it. The anti-collision light lens was broken and the bottom of the bird slightly scraped.

Habit pattern interference r'ared its ugly head again, plus the fact that helicopter pilots have long been used to not having to lower gear. Besides, they have no gear-up warning devices as on conventional aircraft. And you guys in the tower—holler at 'em a little sooner, please. ☆

Can A Tiger Change Its Stripes?

By Bob Harrison

Squirming awkwardly in her chair, the pert blonde secretary futilely tried to stretch over her knees a skirt that was designed for the very opposite purpose.

"Read that last sentence back," said Captain C. Z. Chumley.

"Yes, sir. Let me see . . . 'Furthermore, we will no longer tolerate these late shipments. We will . . uh, uh, have . . uh . . to take action if this . . . uh . . continues. Our aircraft belong in the . . uh . . sky . . not on the . . uh . . ramp and without these parts . . uh . .' That's as far as we got, sir."

"Well, just add, 'we can't keep them there, so please look into this matter immediately. Sincerely, etc., etc.' Now, if you'll get the morning mail, Miss Schaep, we'll see what's to be done this afternoon."

A few moments later the girl returned with a fat bundle of papers and envelopes which she deposited in the IN basket on Chumley's desk. Most of the material went into the waste paper can but one item made him pause. He read, "Capt. C. Z. Chumley, etc. Congratulations on attaining another anniversary. It is my pleasure to notify you that you are scheduled to attend instrument refresher school beginning next Monday, the 16th. If this date is not convenient, please feel free to contact me. I should point out that the commander is concerned with the proficiency of all pilots on this base, particularly in view of the limited number of available flying hours. He is determined that pilot proficiency will not suffer and that training schedules will be adhered to in all cases." The message was signed by the operations officer.

Grumbling about having to cancel a trip he had planned for the following week, Chumley dialed and got the training chief on the phone. "Jack, this is Captain Chumley, would it be convenient to juggle your schedule a bit and put me in school beginning the 23rd instead of next week?"

"Sure thing, Chum, except that the old man must approve each request for rescheduling. Just get that and send it along and I'll set you up for any time you like."

"Well, thanks, Jack, see you Monday."

On Monday morning Chumley sauntered into instrument class somewhat past the hour. The instructor was discussing holding procedures. Chumley was amazed at the number of brother pilots in attendance; only one vacant seat was apparent.

"Good morning, Captain Chumley. Here's your kit, please take a seat."

As Chumley settled into the chair he glanced around to see who was in the room. The commander himself and several other older Air Force types sporting eagles on their shoulders were in attendance.

"Now, assume you are told to hold west of Dipstick intersection at 21,000 feet in a C-130. What would be your maximum permissible airspeed and length of the legs in the pattern? How about you, Captain Chumley? Can you answer this?"

"Why that's simple. Hold at 180 knots indicated and one-minute legs." Ask me a hard one, Chum thought to himself, thinking this a good opportunity to make impressions.

"Sorry, Captain, you're thinking of *below* 14,000 feet. But you were incorrect even there. The correct answer is 175 knots indicated and one and one-half minute legs. Better brush up on that before the examination."

Chumley considered arguing, decided against it and pulled himself up into what he considered to be an alert, eager, sitting position. The next question that came his way he fielded deftly, but there were two more during the morning he could not answer. By the end of the morning session he was tired, frustrated and feeling a little foolish. "That dern instructor was determined to make a fool out of me. Oh, well that's the way some people get their kicks."

That afternoon he was scheduled in the simulator, but there too he ran into trouble, this time with a different instructor. Climbing out of the machine, he quipped: "Well, here I am in New Awluns. Which way to the Mardi Gras, friend?"

The instructor didn't see anything funny in the remark and decided he'd take the ebullient Chumley down a bit. "Captain, I don't doubt that you think you're in New Orleans, but you are still here at good old Weedpatch. Take a look at this tracing. You were supposed to fly from here to Dipstick intersection, arriving there at 15,000, then climbing to 30,000 at Cowlick. Your cruise altitude was 34,000 at Candlestick, then a penetration and over the outer marker at 8000 descending to 2500 passing the middle marker for a landing at Emory AFB.

"You were off on your times, heading and altitude. You arrived at Dipstick on time but at 14,000, not 15,000. At Cowlick you were 1500 feet high and two minutes late. Where were you, sightseeing over the Grand Canyon? Then instead of 34,000 feet, you varied from 32,900 to nearly a thousand feet above your assigned altitude. Then at Emory you were at 10,000 over the outer marker. How you made it to the middle marker at the right altitude I'll never know, but they say miracles can happen.

"Now, what if you were really flying that route. Throw in a little weather and an instrument approach at minimums. How do you think you would have made out?"

Chumley squirmed and reddened. For once his bravado was gone. He had to admit the instructor had something. How *would* he have done in weather? What would happen the next time he caught one of these tough ones—lousy weather, MOCP, have to get there?

Back at his office, Chumley breezed by Miss Schaep's desk and closed his door. A moment later he stuck his head out, "I don't want to be bothered the rest of the afternoon—something very important to do and I don't want to be bothered."

Once when the girl opened the door to ask a question she noticed that her boss was reading a manual of some kind.

That night Chumley lugged the manual home with him. His spouse wondered why the diligent reading and frequent note taking. She suspected her frantic breadwinner was in some kind of jam, but past experience had taught her this was no time to offer wifely solace. He stayed up far after she had gone to bed. The next morning he wasn't his usual brash self and left the house half an hour earlier than usual.

This was a different day . . . and a different Chumley. He volunteered to answer questions, and he knew the answers. That afternoon in the simulator he made very few mistakes, and only minor ones at that. The instructor was amazed.

"What happened to you, Captain? Yesterday you were flopping around all over the place; today you're right on the money. Guess you must have gotten over your hangover."

"Well now, let me tell you about it," Chumley replied. "I just decided to have a little fun with you guys. Of course, I fly an airplane like I flew your tethered torture chamber today. Yesterday I was just checking you to see how alert you were. Actually, ol' Chumley can fly one of these things with his hands in his pockets, one eye closed and legs crossed. Tell you what, I'm going to start dropping in on you guys every week or two for a couple of hours in the old box just to make sure you keep on your toes. Ta, ta."

Later in the week his flight check pilot was amazed at the thoroughness Chumley showed in preflighting the aircraft. This was no tire kicking, skin tapping inspection. Every item was carefully checked. Several times he spoke briefly to the crew chief about various items. The IP couldn't believe what he saw. This couldn't be Chumley. He'd ridden with him before and well knew his reputation.

During the flight the IP seldom had to utter a word. The flying was superb, technique flawless, planning and judgment nearly perfect. *What* had happened to Chumley?

Soon the word got around. Pilots all over the base shook their heads in wonderment. Where they previously marveled that Chumley managed to stay on flying status, much less alive, they now wondered what miracle had been wrought. They had been in the habit of carefully checking every aircraft they knew had been flown by Chumley on his previous flight. Now those airplanes were clean, any discrepancies were carefully noted, in detail. OHRs signed by Chumley began to clog the mail channels. He even visited the tower for a brief time and congratulated the personnel there for their fine work. He began to attend flying safety meetings without escort and usually had a comment or two to make.

Heavy lunches at the club gave way to a can of Metrecal at his desk. The evening round of martinis was replaced by a single beer.

Such radical change finally reached all the way to headquarters and the commander began to wonder. Finally he could stand it no longer and called his newly hatched paragon into the office.

"Chumley, I don't know what happened. I don't want to know. In fact, my instinct tells me I had better not even try to find out. I just want to say that your behavior lately is amazing nearly everyone on the base and to me is a matter of great satisfaction. After all those lectures I gave you, finally one took hold. Against my better judgment I'm going to ask which one it was. I may want to use it again."

"I don't know exactly what you are talking about, sir. Lectures? Behavior?"

"Captain Chumley, you haven't goofed in two months. You fly by the book. You haven't frightened any other pilots or control tower people, or the AO for weeks. You frequently spend an hour in the simulator. You have changed, man."

Chumley thought for a moment. Then, "Well, sir, it's this way. I've been writing a book and I'm playing a role. After all you can't just imagine how someone else is. You have to *be* him. Thank goodness, that book is almost finished. As a matter of fact, I think I can wind it up this afternoon. Would you care to stop by the club for a few martinis?"

The colonel declined, dismissed Chumley, and for several minutes sat in deep thought. Finally he muttered, half aloud, "Well, at least I won't be in doubt from now on — and can count on more headaches from Chumley." ☆

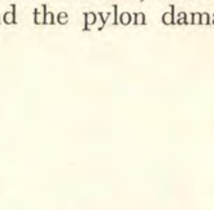
Aerobits

LIGHTNING STRIKE—There's been a lot of talk about lightning during the past year or so. Here is another report: A C-130 transporting a crew and chopper to an aircraft crash site was struck on the radome. There was a subsequent explosion in the left pylon which began to burn and continued until shortly before landing. After the aircraft was on the ground, inspection revealed a six-to eight-inch hole in the radome, radar antenna damage, and the pylon damaged beyond repair.

HOW ARE YOUR SUNGLASSES? Credit the airlines for pointing up a hazard that design-changes in sunglasses have produced.

A pilot is highly dependent upon his peripheral vision to acquaint him with the presence of others in air space. If the pilot wears corrective lenses in the form of spectacles or if he wears sunglasses, the frames of either of which block out his peripheral vision, he is depriving himself of nature's radar, his physiological early warning system.

Many of the styles of today's sunglasses have either taken on a certain wrap-around effect or employ the use of extra wide temple pieces that become, in effect, blinders . . . and THAT'S the hazard.



One airline already has added a paragraph to its Flight Manual, prohibiting pilots in flight wearing sunglasses or spectacles having wide, nontransparent or vision-restricting temple pieces.

Are you a stylish hazard, or a good "old fashioned" see-it-all?

FSF Safety Bulletin 64-206

THE SUPREME SACRIFICE—For the little mountain town on the cross-country highway it had been a normal winter day. Snow had been falling, and it continued on into the evening. Wind swirled the snow into a ground blizzard. The curve at the outskirts of town had become quite treacherous. The road was icy. Several local officials, familiar with the road, had skidded into the west-bound lane while rounding the curve—and they were driving at reduced speeds. Had there been traffic westbound, they knew they wouldn't have been able to avoid a collision.

Early that morning an airman had signed out PCS at an Air Force base 900 miles away and headed toward this curve. His intended destination was on east. To reach the curve on the edge of the mountain town shortly before midnight he had averaged 53 miles per hour for 17 hours. He was alone. According to investigators he was traveling about 50 miles per hour coming into the curve. He didn't have a chance at such speed. He lost control, skidded into the west bound lane and collided head-on with a semi-trailer creeping along 18 to 20 miles per hour, due to road and weather conditions. The front wheels were knocked off the truck in the impact; it went off the road and turned over. The airman's car was demolished. Death was instantaneous.

(*Ed. Note*: *PCS travel, TPA authorized, is predicated on* 275 *miles per day. This airman had crowded more than three days driving into* 17 *hours.*)

IT WENT THATAWAY—We will agree that an airfield at night can be very confusing, more so when it is a strange field. The following incident involved a T-33, with two pilots aboard.

On a predawn departure, the pilot taxied to the south end of runway 32. At the end of this runway there is a large paved area with four taxiways intersecting the runway. As the pilot approached takeoff position, he had the runway clearly in sight. Upon reaching the runway, he turned left and proceeded toward the approach end in order to use all available pavement. Entering the five-way intersection, he observed an object in the darkness which he thought to be the MA-1A webbing. What he observed was actually a row of flags which were in place to indicate that this taxiway was closed. The pilot maneuvered toward the flags, lost sight of the runway lights, and aligned himself with the unlighted taxiway, assuming this to be the runway. He was positioned at the end of runway 32 and in the darkness it was not possible for the tower operator to determine that he was not properly oriented. After rolling approximately 1000 feet, the pilot realized that he was not on a runway. He initiated an abort, but was unable to stop on the remaining pavement. The aircraft passed through a floodlight installation and barricade, crossed 50 feet of soft sod and stopped on a gravel road.

Fortunately, this turned out to be a lucky day for these pilots and the Air Force; there was only minor damage to the aircraft. It does not tax the imagination to picture the catastrophic results that could have been, due to the elimination of one simple cross-check—COMPASS HEADING VERSUS RUNWAY HEADING.

Major S. R. Smith
Directorate of Aerospace Safety

B-66 TAKEOFF HAZARD. Arresting gear can be very useful for stopping an aircraft, but when it's engaged while the aircraft is taking off—well, that's another story.

On takeoff the tail skid on a B-66 engaged a Navy abort arresting gear. Fortunately, the skid is not stressed for stopping purposes. It pulled loose, causing scratches and dents in the dragchute doors and chaff dispensing tail cone and a couple of small holes in the tail cone radome.

Takeoff was on a runway with a .59 per cent slope. The aircraft climbed but the runway climbed faster. The pilot and crewmembers said the liftoff looked and felt normal. The tower officer stated that the entire takeoff appeared normal. The most probable cause of this mishap was that the aircraft settled or failed to climb after liftoff from a still-rising upslope runway.

Under the right circumstances, this hazard could apply to many aircraft, particularly those with steep lift-off attitudes. Pilots must be aware of all obstacles to takeoff, and performance of both the pilot and the aircraft must be equal to the situation.

Lt Col Eugene J. Budnik
Directorate of Aerospace Safety

BAGS AWAY! While cruising at 35,000 on a cross-country from Tyndall to England the armament rotary door on an F-101 inadvertently rotated to the primary side, then closed. In the process the crew's luggage—one B-4 bag and one plastic suit bag—were dropped. These "soft bombs" had been hung on the primary side of the door. Armament panel configuration at the time was: arms switch, safe; arm selector, viz ident; ejector racks, locked. The pilot notified Atlanta Center of the incident and continued to destination for RON. Post flight investigation failed to reveal the cause of the malfunction. Door creep from a hydraulic defect hadn't occurred and radar personnel were unable to produce an inadvertent fire signal. Civil authorities have been asked to be on the lookout for two bags.

Aerobits

WEBBED FINGERS—As the pilot of an F-100D began pull-up during a LADD delivery the aircraft pitched down sharply. This was caused by inadvertent nose down trim induced by the pilot as he held the pickle button down on the run-in. Turned out the pilot's gloves were too small for him and a web was formed between his right index finger and right thumb. This web forced the trim button to the nose-down position. Of course the pilot didn't notice this until he moved his hand slightly to start pullup. Bet this man's first stop was at the PE shop for some new mittens.

APPROACH END ENGAGEMENT. He lined up in wing position, everything checked, he acknowledged Lead's signal, they began to roll, he went into burner, felt the reassuring "whap" and the smeared tire marks began to blur as he accelerated. Suddenly, at about 100 knots, his bird decelerated and Lead left him. He thought he'd lost burner. Mobile advised what had really happened. The jolt when the afterburner had cut in had jarred the arresting hook loose and it caught the BAK 9 barrier. No further difficulty was encountered in aborting the takeoff. Cause was attributed to a worn tail hook shackle assembly.

(Ed. note: We trust the fix was not "bolted in stowed position" as was done in one case when the tail hook wouldn't remain in the stowed position.)

ROUGH AIR—Aircraft commanders of transport type aircraft often have to make the determination as to whether or not to turn on the seat belt sign. On takeoff and landing, when cumulus clouds appear ahead, when flying over deserts at low altitude in summer, these situations are easy: always have the seat belt sign on. But when a few tremors tickle the plane, the weather has been smooth and it's clear ahead, what then? Will the turbulence increase, or is it to disappear altogether in seconds? Should the pilot be alarmed, especially if, a few hours previously, when the forecast was written on the Form 175 there was a dash drawn through the turbulence block?

About the only answer can be: If in doubt, turn on the seat belt sign. Okay, if *always* in doubt in a case like this, *always* turn on the seat belt sign. Then hope that all passengers comply, immediately! Let's take a case.

A VC-47 pilot planned a cross-country, obtained a weather briefing by drop line and was given a no-turbulence forecast. Passengers were briefed, including the use of seat belts. Takeoff and climb were uneventful and cruise at 13,000 was smooth. Over Wyoming, and nearing destination, descent was made to 11,000. At this time light to moderate turbulence was encountered. The aircraft commander turned the seat belt sign on and almost immediately severe turbulence was encountered. A passenger who had not yet fastened his seat belt was thrown to the floor of the aircraft and chest pack chutes and chute harnesses were dislodged from overhead racks, striking the fallen passenger. He suffered a scalp laceration and concussion and was unconscious for three or four minutes. The pilot radioed ahead and had a doctor and ambulance meet the aircraft.

One other point: Loose items must be properly stowed, and coats only should be stowed in overhead coat racks. Brief cases should be shoved under seats or stowed with luggage and all cargo should be properly secured with tiedowns.

WELL DONE

SMSGT DONALD D. DIXON

319 TROOP CARRIER SQUADRON, HURLBURT FIELD, FLORIDA

Senior Master Sergeant Donald D. Dixon, loadmaster on a C-46, has been selected for the USAF Well Done Award.

During a flare dropping sortie in support of an A-1E night gunnery mission, it was Sergeant Dixon's duty to arm and load the flares in the dispenser installed in the door of the aircraft and to release them on the pilot's signal. The flares being used were MK-24's of two million candlepower.

Sergeant Dixon had three flares armed and loaded for immediate release. Upon the pilot's signal, he actuated the release mechanism. Two of the flares released normally, but the third jammed part way down the launcher tube when the metal coupling of the lanyard wrapped around a brace of the flare dispenser. Sergeant Dixon immediately recognized that the five second delay feature of the flare's explosive parachute ejection system had been initiated. The potential danger to the crew and aircraft permitted only seconds to act. Sergeant Dixon, with no regard for his personal safety, first attempted to loosen the entangled lanyard. Unable to do this, he pushed the flare out by hand. As the flare cleared the dispenser, the parachute ejection system exploded, causing deep lacerations and first degree burns to his right hand. However, the jammed flare fell free of the aircraft before igniting.

Sergeant Dixon's prompt decisive action prevented further development of a dangerous situation which could have resulted in the loss of six crewmembers and a valuable aircraft. WELL DONE! ☆

For Meritorious Achievement in Flight Safety for the period 1 January through 31 December 1964, the units listed here have been selected to receive the Air Force Flying Safety Plaque. The stringent criteria insure that each recipient has achieved an outstanding flying safety record while maintaining mission capability.

Flight Safety Awards

AAC	• 5017 Operations Squadron, Elmendorf AFB, Alaska
	• 317 Fighter Interceptor Squadron, Elmendorf AFB, Alaska
ADC	• 4780 Air Defense Wing, Perrin AFB, Texas
	• 328 Fighter Wing, Richards-Gebaur AFB, Missouri
	• 4603 Air Base Group, Stewart AFB, New York
AFSC	• Air Force Flight Test Center, Edwards AFB, California
ATC	• 3510 Flying Training Wing, Randolph AFB, Texas
	• 3500 Pilot Training Wing, Reese AFB, Texas
MATS	• 9 Weather Reconnaissance Group, McClellan AFB, California
	• 1611 Air Transport Wing, McGuire AFB, New Jersey
PACAF	• 315 Troop Carrier Group, Tan Son Nhut Air Field, Viet Nam
	• 6091 Reconnaissance Squadron, Yokota Air Base, Japan
	• 15 Tactical Reconnaissance Squadron, Kadena Air Base, Okinawa
SAC	• 5 Bombardment Wing, Travis AFB, California
	• 43 Bombardment Wing, Little Rock AFB, Arkansas
TAC	• 12 Tactical Fighter Wing, MacDill AFB, Florida
	• 474 Tactical Fighter Wing, Cannon AFB, New Mexico
	• 612 Tactical Fighter Squadron, England AFB, Louisiana
USAFE	• 20 Tactical Fighter Wing, RAF, Wethersfield, England
	• 526 Fighter Interceptor Squadron, Ramstein Air Base, Germany
AFRES	• 349 Troop Carrier Wing, Hamilton AFB, California
	• 442 Troop Carrier Wing, Richards-Gebaur AFB, Missouri
ANG	• 158 Fighter Group, Burlington Municipal Airport, Vermont
	• 140 Tactical Fighter Group, Buckley ANG Base, Colorado

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