AEROSPACE SAFETY

UNITED STATES AIR FORCE

AUGUST 1966

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AEROSPACE
SAFETY

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AFRP 62-1 VOLUME 22 NUMBER 8

Brigadier General Frank K. Everest, Jr., has been assigned Director of Aerospace Safety. A fighter pilot in World War II, General Everest is best known as a test pilot. In addition to testing most of the Century Series fighters, and several bombers, he flew the early experimental rocket-powered aircraft including the X-2 in which he set an unofficial speed record of 1957 mph, or 2.9 Mach.

During World War II, General Everest served in North Africa and Italy where he shot down two German aircraft. After returning to the United States, he instructed in fighters for several months then was assigned to the Chinese Theater where he flew 67 combat missions and destroyed four Japanese aircraft. In May 1945 his aircraft was shot down and General Everest was imprisoned until the end of hostilities. After the war he began testing aircraft at Wright-Patterson AFB and later Edwards AFB where he became chief of the Flight Test Operations Division.

General Everest succeeds Brigadier General C. B. Stewart, who retires 31 July after a distinguished career as an Air Force pilot, nuclear physicist and the Air Force's first Director of Nuclear Safety.

In assuming direction of the worldwide Air Force safety effort, General Everest will be responsible for the conduct of accident prevention and investigation programs in the aircraft, missile, ground, and explosives safety fields. ★

Modified Precision Approach...

THE
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Capt Clyde M. Slade
Hq Central Communications Region (AFCS)
Tinker AFB, Oklahoma

The IFR supplement has a notation for Little Rock and Bunker Hill AFBs which reads: "Modified PAR (MPAR) for B-58 type aircraft may be in operation. Other aircraft expect slight delay for PAR approach." Modified Precision Approach is more than just another attempt to solve an old problem. Its revolutionary concepts offer a breakthrough which may actually be the answer to high performance aircraft landing problems, while also benefiting conventional aircraft.

Historically, the average radar precision approach (PAR) system is configured with a 2½ degree glide path angle which intersects the runway at a distance of 750 to 1000 feet down the runway from the threshold. This point where, in theory, the aircraft should touch down is known as glide path intercept point (GPIP). If this theory held up in actual practice, we could have true zero zero landing capability by simply flying the aircraft right onto the runway at a 2½-degree descent angle. However, with the notable exception of the F-4C, contacting the runway with this rate of descent (575 to 880 feet per minute) exceeds maximum sink rate at touchdown for most normal gross landing weights. Thus, a pilot cannot fly onto the runway at GPIP, but must flare to reduce sink rate and bring his aircraft within allowable load limits for touchdown.

This then is the problem. As approach speeds increase, flare distance increases until in B-58, F-105 types, it exceeds a horizontal distance of 4000 feet. Where flare distance plus stopping distance exceeds available runway length, the results will be obvious. To try and beat this problem, the pilot descends below the glide path farther out on final to reach flare height sooner which in turn allows him to complete his flare and touch down closer to the runway threshold. This "duck under" maneuver is

THE GREATEST THING SINCE THE WHEEL

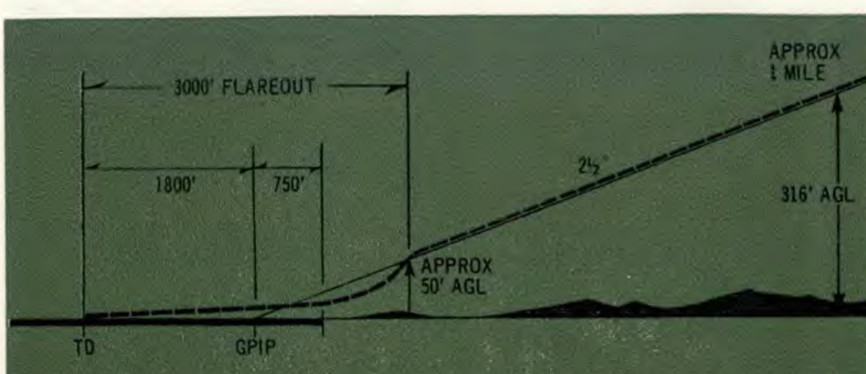
CONTINUED

easily recognized by a radar air traffic controller. At a point near one mile on final approach, the high performance aircraft will predictably go well below glide path (if in visual contact with the runway) and does not respond to instructions to "adjust rate of descent" to return to the glide path. In many cases, the controller must transmit, "If runway not in sight, climb immediately," because the aircraft has exceeded the lower safety zone limit on the radar indicator.

This has become an exercise in frustration for both parties. The pilot is where he wants to be, the controller knows the pilot is now in visual contact with the runway, yet he must alert the pilot that he does not have IFR obstruction clearance margin. This "duck under" maneuver sets up very high vertical energy from steepened angle of descent. The old physics law "for every action there must be a reaction" applies here and compensating for increased rates of descent on the order of 1300 feet per minute can get pretty sticky on short final. Failure to recognize the need for increased power requirements which have a high onset rate while the aircraft approaches the back side of the power curve, has had the unhappy result of transferring the accident from the departure end to the approach end. Obviously, improvement in the system is needed.

FAA, SAC and Central Communications Region of AFCS participated in tests to learn as much as possible about B-58 landing problems. Many theories were checked, including different glide path angles. Out of these exhaustive tests, came a proposal which may one day soon provide pilots of high performance aircraft with a safer instrument approach landing environment. Previous attempts to overcome the problem all stayed within the confines of the time honored classical precision approach, and simply relocated the GPIP closer to or at runway threshold. As envisioned by SAC and Central Comm Rgn ATC experts, the solution was to reconfigure the glide path to bring the aircraft to a point on final to coincide with the height at which the pilot would want to be if he were making a visual approach. Upon arrival at this point, the pilot should be assured of being in visual contact with the runway. From here, it's a simple matter to make a normal visual landing.

The theory of splitting the precision approach into IFR and VFR portions was tested at Little Rock AFB in Aug 1965 by B-58s of the 43d and 305th Bombardment Wings. Results were startling. Touchdowns within the first 2000 feet of runway increased 100 per cent. Over 95 per cent of the participating pilots used superlatives in favoring the new procedure. So convincing was the Little Rock test that SAC asked for and received USAF approval to place



NORMAL P A R

High performance aircraft maintaining on glide path until reaching flare height touches down approximately 2550 feet down runway. Note greatly increased angle of descent (duck under maneuver).

the MPAR into operational use for B-58s.

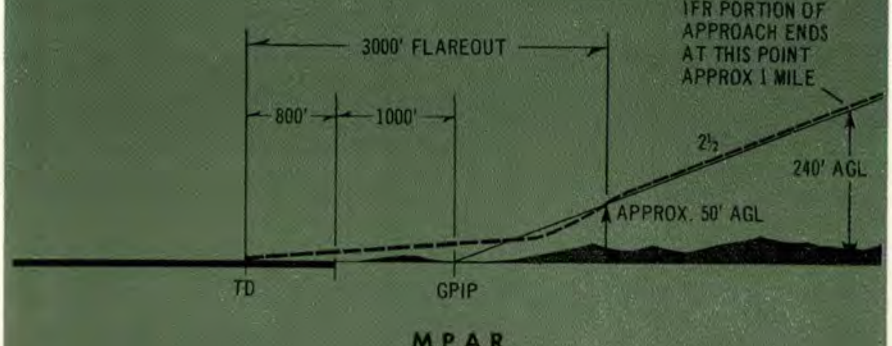
What then exactly is this MPAR animal? MPAR as finally implemented for operational use on 15 Feb 1966, can best be described by a comparison with the normal procedure. PAR GPIP is normally located 750 to 1000 feet inward from the runway threshold. MPAR GPIP is relocated up to 1000 feet *outward* from the runway threshold. The operational configuration at Little Rock and Bunker Hill has GPIP 1000 feet short of the instrument runway, but only 500 feet short on the reciprocal runway. While the 1000 feet displacement was tailored to the B-58s high approach speed, 500 feet also works well and has wider application at airfields with terrain clearance problems as well as for aircraft with slower final approach speeds.

Normal PAR minimum altitude is tied in with the ceiling minimums. For example, if 300-1 minimums were established, the precision minimum altitude would be 300 feet. With MPAR, minimum altitude for this ceiling is 240 feet. This is necessary to insure a clear-of-clouds condition, since whenever the cloud base is between 250-349 feet, the weather man calls it a 300-foot ceiling. This 240 feet minimum altitude becomes the key to the procedure. At 240 feet above runway elevation the instrument approach terminates and so do controller instructions. Because GPIP is well short of the runway, IFR obstruction clearance is possible only to precision minimum altitude. Here's where we pick up the benefits not possible with previous attempts to solve the problem.

The radar controller directs the pilot to a point in space where the pilot would position himself if flying visually. He's 240 feet above the runway approximately one mile out, whereas the normal procedure would have him 316 feet above the airport. The 76 feet gained by the MPAR reduces the "duck under" maneuver to a normal landing flare. The pilot is assured that the radar controller has placed him in a position from where he can see the runway (unless the reported weather has deteriorated while on approach). Then, the controller simply shuts up and lets the pilot concentrate on the business at hand—landing his aircraft. No more "if runway not in sight . . ." during that last mile on final. The pilot also has, for the first time, an opportunity to fly with some pretty realistic minimums. Where previously, some intrepid birdmen had "personal" minimums because they knew the cloud base might be slightly lower when reported as 300 feet, there was a tendency to "feel" a little, hoping to break out. Now with MPAR, if not in visual conditions when the radar controller says "Precision Minimum Altitude, take over visually," an immediate missed approach is the order of the day. Continuing established rate of descent on the glide path below 240 feet will bring contact with the ground well short of the runway, on the order of 10 seconds later.

The MPAR concept as applied to the B-58 works well. That it may also apply to other type aircraft is evidenced by a USAFE study on GPIP placement in July 1964 which stated "If we really wanted to position the pilot where he wants to be when he breaks out, we should site our GPIPs about 800 feet before threshold on 8000-foot runways!" It is significant that the USAFE study was not known to the B-58 group. Apparently all roads lead to the MPAR, a theory which has been proven in operational use for at least one type of aircraft.

MPARs are presently authorized for B-58s only, so don't go charging off to Little Rock or Bunker Hill hoping to try one on for size. SAC's operational experience with MPAR holds out much promise, though. The procedure has been flown by C-123, T-39 and KC-135 with good pilot comments. KC-135s will soon test the procedure for potential operational use. If it proves adaptable for the slower tankers, then I predict it will gain rapid acceptance until the day will come when PAR, as you now know it, will be remembered with the Adcock Range as a primitive instrument approach aid. It may not be the greatest thing since the wheel, but it's a big help in getting those wheels on the concrete at the right place. ★



High performance aircraft flies visually from 240 feet minimum altitude. Starts flare farther out at same height and touches down approximately 800 feet down runway. Duck under maneuver is eliminated.

DRAG CHUTES

Six hundred and fifty-five drag chute failures seem like a lot. That was the number of such occurrences reported last year. But as is frequently the case with numbers, this number — 655 — doesn't mean a thing without some more information.

First, there were about 896,000 landings by drag chute equipped aircraft, so a mere 655 drag chutes that didn't work would seem to indicate that we are doing quite well. But reporting of drag chute failures is not required by AFR 127-4; reporting is more or less up to the commands, therefore reporting policy is not uniform. Undoubtedly, the number of failures is higher than that reported. But assuming the number is somewhere in the ballpark, does it indicate a serious problem? We're going to be ambivalent and satisfy everybody. The answer is yes and no. No, because the percentage of failures is only a fraction of one. Yes, because a drag chute failure might mean an accident and has on several occasions.

As for accidents, we measure how we're doing by a rate, which is simply the number of accidents per 100,000 hours of flying. If we were to take the number of accidents as a percentage of the number of flights, or sorties, what would it be? There's no way of knowing, but obviously it would be a very small per cent. Even so, we consider every accident as serious. So let's think of drag chute failures as potential accidents and treat them with the concern they deserve.

Perhaps the experience of one organization is indicative of the size of the problem. Over a two-months period, drag chutes failed only about .02 per cent of the time. But *one-third* of all incidents were drag chute failures.

A review of the 655 failures reported Air Force-wide in 1965 shows that nearly half were caused by Maintenance; Materiel Failure took care of most of the other half, and pilots bought only 16. The two aircraft most associated with these incidents were the F-100 (286) and the F-105 (152).

Here are a few narratives, typical of the reports received:

- F-100D, pilot chute deployed but main chute pack hung up on bent door hinge of container.
- F-101A, pilot could not pull drag chute handle. Drag chute D-ring improperly installed, jamming drag chute door release mechanism.
- F-100D, drag chute failed to deploy. Bridle pin installed backwards.
- F-102A, drag chute fell from aircraft when pilot pulled handle. D-ring not properly secured in clamps.
- F-101A, as afterburner lit on takeoff roll, the drag chute fell out of aircraft. Drag chute door latch worn and out of adjustment.
- F-102A, drag chute failed to deploy. Ripcord spring weak. Ripcord pin could not be pulled for pilot chute cone because improper size bolt installed.
- F-102A (two the same day), drag chute remained in aircraft when handle pulled. Aircraft left outside overnight with drag chute installed and condensation froze.
- F-100D, drag chute handle could not be pulled out because horizontal and vertical cables kinked and rusted.

Successful landing with drag chute doing its job. When it doesn't, the pilot may face the barrier, or a trip off the end.

• F-105D, part of pilot chute forward of drag chute bag and pinned in by bag and striker plate.

A recent report states that the ripcord pin on an F-102 drag chute was safety wired which prevented chute deployment. And the pilot chute pocket flaps on an F-100 were secured with a cotter key instead of a ground safety pin with streamer. When the drag chute doors were opened, the pilot chute could not be deployed to pull the compartment liner door pin that would deploy the drag chute.

In North American's Operation and Service News for December 1965 there was a write-up on two F-100 outfits and how they went about solving their drag chute problems. Although different systems have somewhat different problems, we think the item is worth passing on to all drag chute users.

• "To date this month, 1891 hours were flown without a drag chute failure. We attribute the lack of drag chute problems to the maintenance system that is being followed here. The most important part of the system is that a group of drag chute system specialists maintain the system. They do all the work from packing and installing the drag chute to inspecting and checking the system for rigging and adjustments when the airplanes are in the dock after periodic inspection. We believe another preventive maintenance procedure that is worthwhile is changing the horizontal teleflex cable at each 100-hour postflight inspection: both the horizontal and vertical cables are changed at every periodic inspection.

"This system has been in operation about three months and since its initiation, there has been a steady decrease in drag chute failures."

° ° °

• "Drag chute system maintenance is divided into three general categories; routine servicing after each deployment, scheduled inspections, and unscheduled maintenance. Servicing after each deployment is accomplished by our crew chiefs, each of whom has been carefully schooled in drag chute installation procedures. Prior to installation of a drag chute, each crew chief must "set" the system and make a ground check, pulling the drag chute handle to "deploy" and to "jettison." Only after this check has been successfully accomplished, is the replacement chute installed. It is our policy that after each deployment, a Red Cross will be entered on AFTO Form 781A for the affected aircraft. After installation of a serviceable chute by the crew chief, a supervisory member of the team must inspect the installation and clear the Red Cross. This system of double checking assures that each drag chute is properly installed and the system is in rig prior to release for flight.

"During each periodic inspection, every drag chute system is completely disassembled and all components cleaned and checked prior to reinstallation. Marginal components are either repaired or replaced so that the system is returned to a 'like new' configuration upon completion. In addition, the aft section horizontal and vertical Teleflex cables are removed each 100 hours, the conduits and cables cleaned, the cables reinstalled, the system rigged and then checked for correct operation and proper drag chute handle loads. During each 50-hour postflight inspection, the system is again checked for correct operation and proper drag chute handle loads. Teleflex conduits are cleaned exclusively with an S/N AO37-71-62702, .50 cal. cleaning brush welded to a condemned Teleflex cable. Solvent, PS-661, is the only liquid authorized for cleaning of components of this system. Our procedures strictly forbid the use of lubricants of any kind on Teleflex conduits and cables and in the Teleflex control boxes.

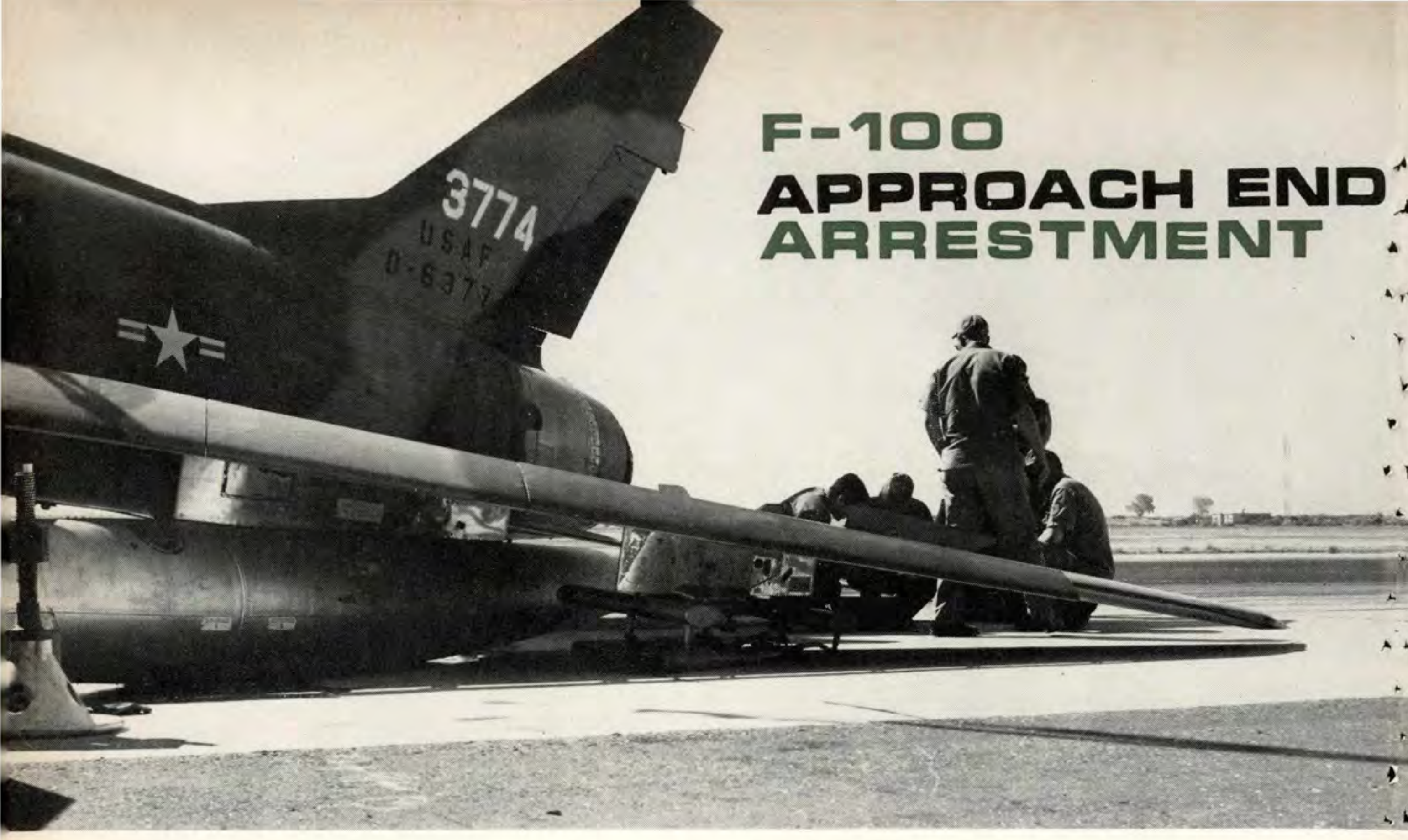
"The third step in our procedure is to thoroughly investigate each drag chute system failure so that the cause factor can be determined and the necessary corrective action taken. For this reason, we have developed a *"Drag Chute Failure Report"* form which is completed by the team following investigation of each drag chute system failure.

"Another reason for our successful operation is in our drag chute packing procedures. All drag chutes are inspected and packed by specialists who pay particular attention to the condition of all components comprising the basic drag chute. These carefully packed assemblies are the only ones used —packing by other personnel is not authorized. It is our policy that on cross-country trips to other bases, spare drag chutes from our station will be carried in the aircraft for installation at each station. The foregoing procedures have contributed largely to our drag chute system reliability. Detailed training and job specialization have made it possible for us to accomplish all of the special maintenance procedures with a minimum manhour expenditure."

What happens when a drag chute fails? This F-101 missed the barrier, went off the end during test at Edwards. Not many bases have lake beds for overrun.

These two statements indicate that drag chute problems, like any other problem, can be solved. And we are solving them; the small number of failures indicates this. But as long as we have any failures there will be pilots who won't feel that comforting tug when they need it most. ★

F-100 APPROACH END ARRESTMENT



The flight was a Stan/Eval check ride for Captain Paul Phillips who was completing Instructor Pilot upgrading in the F-100. The air-to-ground mission was briefed by Captain Phillips who had to lead the flight from the rear cockpit as part of his Stan/Eval check ride. The three wingmen who completed the flight would strafe, dive bomb and fire rockets.

The mission was uneventful up to the landing pattern. On the first pattern, for a touch and go landing, the left main gear of Captains Bell and Phillips' aircraft would not extend. Mobile was called to confirm the position of the left main gear. It was confirmed up and the right main and nose gear were down. An attempt was made to raise the landing gear, but it would not respond. The emergency extension was attempted next with no effect. G's were applied to the aircraft and still no effect.

A visual inflight check was accomplished by Captain Doug Henderson, another F-100 IP assigned to the 4517 CCTS. He also confirmed that the right and nose gear were down. The left main gear was up and the door was partially open and appeared to be hanging. All available means to get the left gear down were tried, but to no avail, nor would the right main or nose gear retract.

Three possible decisions were considered on how to recover the aircraft: Number one, ejection; number two, belly the aircraft in on the gear that was available; and number three, an approach end arrestment which was recently publicized in TAC Attack, TAC's safety magazine. The idea of ejecting did not appeal to either pilot. It would also result in the loss of the aircraft. Captain Bell had observed two other F-100s land with partial gear and he didn't want to attempt this sort of landing because, from his personal observation, it had not been too successful. About this time mobile control called and asked if an approach end arrestment was going to be made. Captain Bell decided that this was the best course of action because the IP sitting in mobile had also considered the same alternatives. An affirmative was radioed to mobile that an approach end arrestment would be made. (Captain Bell later found out that the assistant mobile control officer had also read the flying safety article on approach end arrestment. He was a Marine captain assigned to the F-104 program at Luke AFB and had suggested this alternative to the senior mobile control officer and supervisor of flying, Major Hannaman of the 4514 CCTS.)

The aircraft had pylon tanks and MA-2 rocket launchers installed. The decision was made to retain these for an approach end arrestment so as to cushion the impact and minimize the aircraft damage. The position of the rocket rails on the outboard station bothered Captain Bell. He feared the wing might drop prior to reaching the cable and allow the rocket rails to hook and produce a severe, if not fatal, ground loop. Fuel was burned down to 1000 lbs by this time and enough would be available for a go-around if the first engagement was not successful. Captain Phillips, in the rear cockpit, was in complete agreement with the decisions that had been made.

Captain Bell decided to make a minimum airspeed approach over the overrun so he could drag the hook on the ground prior to touchdown but still retain enough air-

(This account of an emergency in which one of the main landing gears could not be extended was contributed by the Safety Office at Luke AFB. It is a blow-by-blow description furnished by Captain C. P. Bell, who occupied the front seat of the aircraft. Ed.)

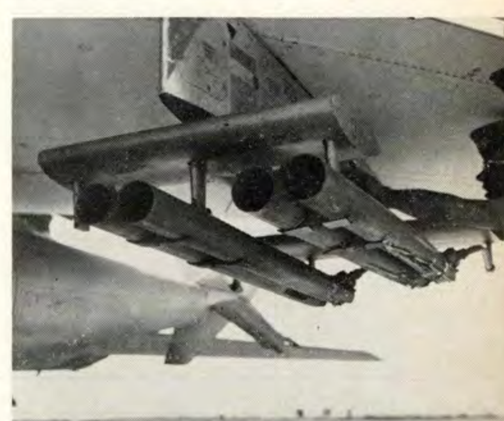
Right, cushions and an airbag under the left wing prevent further damage to aircraft.→

speed to fully control the aircraft until a positive engagement was made. In case the first attempt was missed, a go-around would be initiated. The following landing configuration was selected: The speed brakes and full flaps were selected for two reasons. The speed brakes would stabilize the aircraft and allow a higher engine RPM and thrust available to aid in an immediate go-around if it became necessary. Secondly, they might help cushion the shock in the event of a sheared gear following hook engagement and deceleration.

Mobile control had alerted the crash network; fire trucks, ambulance, rescue helicopter, and the Wing Commander were standing by. The MA-1A had been disconnected to prevent an inadvertent engagement of that barrier. The time from the initial trouble until touchdown was approximately ten minutes. The fire trucks had approximately three minutes prior notification so the runway was not foamed. Captain Bell did not feel that foam was a good idea, since hydraulic pressure was available and directional control could possibly be aided and maintained by

Above picture shows amount of angle off from center of runway. The maintenance people first hooked onto the aircraft very carefully in order to lift it high enough to get a jack under the left wing. Most of this turning took place just prior to aircraft's coming to complete stop after the wing dropped to the ground.

Right, close-up of the MA-2 launcher rail shows the small amount of damage to the outboard tubes. →



▲Reclamation officer directs aircraft be towed off the runway approximately 45 minutes after the landing. Estimated repair time was 20 direct manhours. The left tank had to be replaced, the left rocket launcher replaced, and a small amount of sheet metal repair to the tail hookup locking bracket fitting area.

◀ Photo of the left wing shows position of the gear as it was in flight. Note the left flap is full down and unscathed. Fluid on the ground is water from the fire trucks that washed away fuel to prevent fire hazard.

braking and nose wheel steering on a dry runway.

A two-mile straight in final approach was made, starting at about 170 knots and maintaining the descent with power. The aircraft was allowed to descend very slowly until the hook made contact with the overrun about 300-400 feet from the cable. Mobile control aided at this time by suggesting, "ease it down." Hook contact with the ground could definitely be felt and heard by both pilots in the cockpit and the aircraft was decelerating for a planned touchdown at or just past the end of the runway where the barrier is located at Luke AFB. This plan would prevent the wing from dropping prior to passing the barrier.

The aircraft touched down shortly after hook engagement. Airspeed at engagement was between 145-150. Observers said the right main gear was about two inches off the runway when the tail hook engaged the barrier. The nose gear came down smoothly on engagement. The deceleration was rapid and steady. Mild jerks throughout the entire deceleration were noticeable, but not violent. This was probably caused by the braking of the BAK-9 system. The aircraft started a mild left drift immediately after engagement. Right brake was applied and nose gear steering was used as an automatic reaction. The left wing did not contact the ground until shortly before the aircraft stopped. This was verified by the mobile control officer.

The engine was shut down about the time the aircraft came to a complete stop. Throughout the approach good positive lateral control was maintained over the aircraft with the configuration that had been selected. The deceleration of the BAK-9 was so rapid that Captain Bell did not have time to stopcock the engine prior to stopping. At hook engagement the throttle started forward and it took a positive effort to retard the throttle to idle because of these deceleration forces.

The MA-2 rocket launcher and the left 275-gallon drop tank acted as cushions and prevented the left wing tip and speed brakes from touching the ground. The aircraft was raised with a crane, left gear extended, safetied, and towed off the runway. The cause was determined to be a missing bolt.

Captain Bell suggests no firm procedure be formulated that would prevent a pilot from using a little personal judgment, because there are so many varied emergencies that no one procedure can be devised to cover them all. He feels it would be worthwhile to caution pilots about possible loss of aircraft control if touchdown is made prior to the barrier *without all* gear extended. When the three gear are in the extended position, and there is no fear of directional control loss prior to barrier engagement, the touchdown as recommended in the Dash One (400-500 feet short of the barrier) would be the best procedure for an approach end arrestment.

The crew added that prompt action by the mobile control officer and his assistant, and the response of reserve personnel were sincerely appreciated. ★

F-4 TIRES

Since publication of the article "The F-4 and a Wet Runway" in the June issue of AEROSPACE SAFETY, several queries have been received relative to the new tires for the F-4.

The article said that the old three-groove tire would be used stateside but that all overseas supply requests would be filled with the four-groove tire.

This has been changed and here's the latest chapter in the F-4 tire story: All orders will be filled with tires of the latest groove design, and they may have been built by any one of several manufacturers. Although the Goodrich tires appear to have narrow grooves when not inflated, the grooves are actually wider than those on the *old* three-groove tires. The uninflated groove widths for the new Goodrich tire are: center groove ¼ inch, outside grooves ⅜ inch. When the tire is inflated and up to speed these grooves open to ⅜ and ½ inch. This is in contrast to the old three-groove tire which had ¼ inch grooves.

There is no way of identifying the wide three-groove Goodrich tire by stock number. But any Goodrich tire stamped with date of manufacture after October 1965 will be the new wide groove design.

The important thing is that the tires supplied meet specifications regardless of the number of grooves or the name of the manufacturer. ★

DOWNED PILOT:

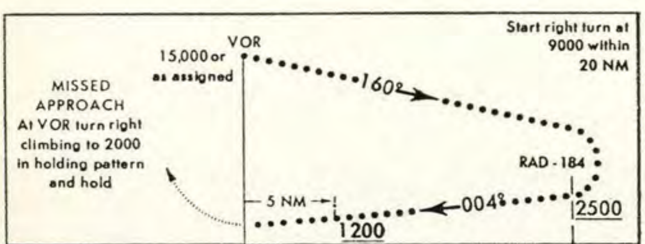
This photograph was taken from an H-43 at 500 feet during search for a pilot on the ground. Can you locate the pilot? **If not, turn to page 18.**

THE IPIS APPROACH

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

Q (Refer to the diagram below.) How do I know when I am five miles from the VOR?

A Numerous VOR and ADF approaches are published with altitude/distance restrictions after completing the penetration turn. All of them have one thing in common—it is extremely difficult to determine your distance from the facility when inbound. Therefore select another approach, if one is available. If you were forced to perform the above approach, you should consider average TAS outbound, penetration turn radius, average TAS inbound and wind effect. Begin descent from 1200 feet to minimum altitude based on your estimate of position.



LANDING MINIMA		
Straight - in Rwy 1R	NOT	AUTHORIZED
Circling	675 MSL	600 - 1

VOR

Q Some high altitude teardrop penetration procedures state: "Start right turn at half initial altitude." Does this mean half the published initial penetration altitude or half the altitude to be lost?

A Half the altitude to be lost. An easy method for determining this is to add the penetration altitude to the level-off altitude. Divide the sum by two and you have the penetration turn altitude. For example, penetration started at FL 200 with a "complete penetration turn" altitude of 3000. FL 200 plus 3000 equals 23,000 divided by two, results in 11,500 turn altitude.

Q Are the cruising altitude diagrams depicted in FLIP II (U.S.) based on magnetic heading or magnetic course?

A Magnetic course. For example, an aircraft VFR below FL 180 flying a course of 355 degrees and maintaining a heading of 005 degrees would select an even thousand plus 500 feet. For aircraft not flying a course, the pilot should select an altitude based on aircraft heading.

TRY THIS QUIZ

1. Radar traffic information is routinely provided to aircraft operating on IFR flight plans except:

a. When the pilot advises he does not desire the service.

b. When operating within positive controlled airspace.

c. When inflight visibility is less than three miles.

d. Both a and b above.

2. Radar traffic information is provided to aircraft *not* operating on IFR flight plans:

a. Normally, only when the pilot requests it.

b. Only in certain terminal areas where high density traffic makes the issuance of traffic information desirable.

c. Radar traffic information is provided only to aircraft on IFR flight plans.

3. True or False. Radar traffic controllers will normally provide an aircraft receiving traffic information with vectors to avoid uncontrolled observed traffic *only when the pilot requests it.*

ANSWERS: 1, d; 2, a; 3, True.

POINT TO PONDER

Deviated around any thunderstorms lately? AFM 105-5, Weather for Aircrews, Change B, 20 January 1966, states:

"Thus hail may be encountered not only in the thunderstorm itself but also (1) in the clear air six to eight miles on the windward side of the storm, (2) five to fifteen miles on the downwind side of the storm (depending on the winds aloft), and (3) underneath the overhanging anvil clouds. The only safe procedure is to give every thunderstorm a wide berth. . . ." ★

F-100 Hot Weather Operation

NAA Operation and Service News

No matter how well an airplane is designed, its degree of efficient operation is commensurate with the type of maintenance it receives. The systems and components of the Century Birds are designed to operate within a temperature range of −65°F to +160°F. Since the hot weather season is with us, let's consider some of the precautions necessary to ensure maximum utilization of the F-100 airplanes during this period.

CANOPY AND COCKPIT TEMPERATURE

The canopy will withstand temperatures up to 200°F without distortion. However, certain precautions should be taken in accordance with the following:

- When sand or dust is blowing the canopy should be covered for protection.
- The canopy should never be left closed when temperatures are above 100°F.
- When the temperature is above 120°F, the canopy must be open and the cockpit should be shaded from the direct rays of the sun, if possible.

NOTE

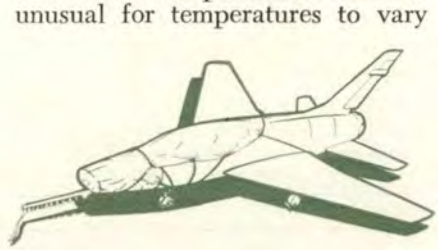
Rain entering the cockpit may damage the many electrical and mechanical components. Ensure that canopy is fully closed during wet climatic conditions.

TIRES

- Pressure of tires should be checked daily.
- During extreme hot weather, when possible, tires should be checked early in the morning or late in the evening, when the temperature is nearest 70°F.
- Tires should be checked for blisters after each flight. When blisters or damage to tire is severe enough to be dangerous to personnel, release air in tire before removing the wheel from the airplane.

CABLE TENSIONS

Cable tensions vary considerably at different temperatures. It is not unusual for temperatures to vary 30°F in a 24-hour period. Therefore, it is very important that temperatures be taken into consideration during rigging and tension checking procedures.



- Rig the airplane in the hangar or in the shade.
- Allow the airplane to remain in a constant temperature area as long as possible before rigging, to stabilize the temperature within the structure.
- Tension readings given in the F-100 Systems Maintenance Manuals are based on a temperature of 70°F and must be used in conjunction with a cable tension variation chart. Take temperature reading inside of nose wheel well.
- Do not rig to the extreme of any tolerance, but always as close to the center of tolerance as possible.
- If it is necessary to rig the airplane in the sun, point the airplane either directly into or away from the sun. (This is to allow the wings to heat evenly from solar radiation.) In addition, set the tensiometer for a cable tension equivalent to a temperature 5°F above wheel well readings to compensate for solar radiation. ★

The anti-exposure suit is a life-saver in the environment for which it was designed. It was not made for pacing the ramp on hot days.

OVERHEAT WARNING

Lt Col W. C. Kaufman, USAF, and A. C. Brown, Ph.D.
Aerospace Medical Research Laboratory (AFSC)

A routine gunnery mission in a jet fighter may seem far removed from space flight, but the man in each vehicle is the same. He does not become a superman simply because he climbs aboard a supervehicle. His limitations remain the same and may even be accentuated when he experiences the increased stresses associated with space exploration.

One of the most serious of the problems anticipated in the exploration of space is that of protecting man from the temperature extremes he will encounter during extravehicular activity. Fundamental to the solution of this problem is the development of a space garment that will provide him with his own little air conditioned environment while he may be exposed to the radiant heat of the 10,000-degree surface of the sun on one side and the cold of absolute zero of black space on the other. Such a suit is quite like the antiexposure suit worn routinely on overwater flights in fighter aircraft. Each garment must be provided with its own air conditioning system in order to function properly. Without air conditioning each can become a sort of pressure cooker in which the occupant may parboil due to his own metabolic heat production.

Several years ago the Biothermal Branch, Aerospace Medical Research Laboratory, began a program with the University of Washington's Department of Physiology and Biophysics to develop an electronic analog of man's temperature regulating mechanism. With this device it is now possible to predict with reasonable precision human response to any thermal stress. It will be particularly valuable in determining man's relationship to his temperature environment in space, an environment which cannot be readily simulated. With it we can also learn man's responses to thermal stresses too dangerous for experimentation.

The first practical problem for the biothermal analog arose recently as the result of an incident that occurred on an east coast fighter base.

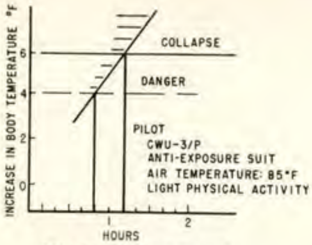
A pilot who was to fly a gunnery mission reported to his aircraft dressed in the usual anti-immersion garb because the range was over the ocean. After he entered the cockpit, a minor mechanical difficulty was discovered preventing takeoff but the crew chief stated it could be repaired shortly and the flight could proceed.

The day was warm and the airplane was parked in direct sunlight. The pilot paced nervously back and forth, more irritably and more vigorously, as additional small delays occurred. After about an hour and twenty minutes he said he did not feel well enough to make the flight and returned to the ready room. At debrief he looked pale and limp and remarked that he just didn't feel up to completing the mission.

Such symptoms as these are common among individuals experiencing heat illness. They occur regularly among new arrivals in the tropics, and have plagued troop movements into hot climates for centuries. They do not commonly occur in temperate climates except during strenuous physical exercise or labor.

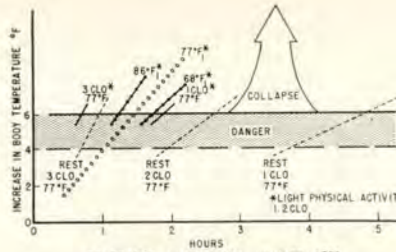
The symptoms of pallor, faintness, and nausea result from circulatory strain due to overheating. When a person becomes sufficiently overheated he will collapse and may die.

Man is a homeothermic animal; one that controls his body temperature automatically. Despite exposure to a wide range of environments, his deep body temperature stays within fairly narrow limits. He does this by sweating to keep cool and shivering to keep warm. A relatively constant temperature is advantageous to the chemical reactions and nervous transmission on which life depends. While this ability to regulate body temperature is necessary for a relatively constant body temperature, it is not always an advantage. It limits man to a temperature environment which will not overtax his regulating capabilities. He can be stressed enough to force body temperature to fatal extremes. Generally, man's mind directs his behavior so that he is provided with artificial means, clothing and shelter, which protect him from environmental extremes. Even the illness experienced under strain, when recognized by the mind as a signal to stop and rest, can be considered as protective in nature.



BODY TEMPERATURE CHANGE
FOR UNVENTILATED PILOT

Conditions of the problem are as follows: The pilot was dressed in an unventilated antiexposure suit and the usual undergarments. He paced the ramp (light muscular activity) waiting for a minor maintenance delay to be corrected. The environmental temperature was 85°F, and part of the time was spent in bright sun which would tend to shift the computed line of heat storage to the left into the shaded area to the left of the curve. When body temperature has increased about 5°F, men are likely to become ill. An increase of 4°F is the maximum that can be tolerated without measurable decreases in performance capabilities.



TOLERANCE LIMITS FOR UNVENTILATED
ANTI-EXPOSURE GARMENTS

The graph shows the computed rates at which the body temperature of a man will increase when wearing an unventilated antiexposure suit. The effects of increased clothing, increased environmental temperature and increased activity are also shown. The upper horizontal line indicates the level of body temperature at which faintness and nausea are likely to occur. The lower horizontal line shows the level below which no serious deterioration occurs.

Man's relationship with his thermal environment is continuously changing. The constancy of his body temperature depends on a more-or-less continuous balance of heat production and heat loss. All living systems produce heat. It is a by-product of the chemical activity which is the basis of life. A resting man produces about 90 kilocalories of heat each hour, enough to melt about two pounds of ice. During any physical activity this heat production increases so that with strenuous exertion a man may produce heat at a rate greater than 1000 kilocalories/hour. Generally this heat is lost in a temperate environment through the evaporation of sweat. If for some reason heat cannot be lost as rapidly as it is produced, the temperature of the body increases. We have learned from experimentation that normally healthy men will experience the symptoms of heat illness when the body temperature has risen about 5 or 6 degrees Fahrenheit. Some increase in body temperature occurs with all strenuous activity. This may increase the efficiency of chemical reactions. Additionally, it increases the rate of heat loss. We also know that in the healthy person symptoms of heat illness do not show until body temperature has risen more than 4°F.

The problem of the pilot in the antiexposure suit was put to the biothermal analog. It can be stated this way: under the following conditions will a man's body temperature increase, and if so at what rate?

- The air temperature is 85°F.
- He is wearing clothing with an insulation value of 2 clo, or about twice that required for comfort in a normal environment.
- His metabolic heat production is that of walking, about 2 times the amount of heat produced when resting.
- Since he is wearing an impermeable antiexposure suit almost none of the sweat he produces will evaporate and so it cannot cool him significantly.

The answer to the problem is shown in Figure 1. According to the analog, the pilot should have reached a critical increase in body temperature in 50 minutes and should have begun to experience symptoms of heat illness at about one hour and 10 minutes. This would have been the case had there been no sun to add heat. Since there was a bright sun, the computed line of temperature change would be shifted to the left and the danger zone entered more quickly.

When the conditions of the incident were checked more precisely it was found that the pilot spent about 45 minutes at temperatures estimated at up to 90°F. Part of the time he was in bright sunlight. An additional 30 minutes elapsed before he returned to the ready room. He refused his replacement aircraft after one hour and 15 minutes of thermal stress. Thus, this unfortunate incident was duplicated by the computer results.

Hypothetical pilots under a variety of temperature stresses, working at various levels of physical activity, and wearing light or heavy clothing, were also handled by the biothermal analog. The composite results are shown in Figure 2. A small amount of study shows that an increase in environmental temperature, physical activity or clothing will decrease the safe exposure time. Sun radiation, although not noted on this figure, will shorten safe exposure time even further.

The problem was well-stated by the flying safety officer, who brought this incident to our attention: "Antiexposure suits and equipment are here to stay and their effectiveness when pressed into the use for which they were designed is immeasurable. We realize that improved designs are on the way, but meanwhile, and that meanwhile gets very long sometimes, this office would like some yardstick . . . of an unventilated survival suit under various degrees of higher ambient temperatures and time."

Based upon the predictions of the computer, and checked from the incident noted, we can answer this query as follows:

Full knowledge of the possible consequences will limit the wear of unventilated antiexposure suits, at ambient temperatures greater than 70°F, to periods not exceeding 30 minutes.

Lt Col Kaufman is assigned to Aerospace Medical Research Laboratories, Aerospace Medical Division, AFSC, Wright-Patterson AFB, Ohio. Doctor Brown is on the staff of the University of Washington, Seattle, Wash. ★

Rex Riley CROSS COUNTRY NOTES

REX WAS REMINDED recently of a tragedy that occurred last summer when an airman on leave received fatal burns when he squirted starter fluid on an already burning charcoal barbecue fire. There was a flashback, the can ruptured and the airman's clothing was set afire. He died a week later. Others have been luckier—they received only hand and arm burns —if you want to call that lucky. This tragedy occurred as the result of either ignorance or carelessness. If you have read this far, there is no excuse for ignorance. Rex sincerely hopes that good judgment will prevail and that carelessness will not result in a similar fatal accident or serious injury.

THE FAA has a new film that Rex highly recommends for all pilots. It's titled *Wake Turbulence,* is in color and runs 16 minutes. Our FAA reps tell us that the film can be obtained from FAA facilities in your region or from the FAA Film Library, Aeronautical Center, PO Box 25082, Oklahoma City, Okla., 73125. In addition to showing it at flying safety meetings, safety officers might run the film at the next aero club meeting. It will be interesting material for both audiences.

REX DOESN'T KNOW how to take on the subject of gear up landings without parroting the same old clichés, which may or may not do any good. But we had another one the other day, so he feels obligated to tell you what happened and why in hopes that the mere mention will strike a responsive chord in a few heads. After a couple of touch and goes by a student, the IP took over for a full stop landing. On final approach he was explaining to the student how VASI works. Unfortunately he got so engrossed in his instructional responsibilities that he forgot the rollers. Apparently this was another case of altering habit patterns, which is almost always the cause of this type of mishap.

CORRECTION

Reference Page 6, Aerospace Safety, July 1966, Personal Equipment Notes, first paragraph and photos of batteries:

Numbers shown are date of manufacture, not date of expiration. SEG recommends shelf life not exceed two years from date of manufacture.

MOST USAF bases are free of the nemesis of the private airports—power lines just off the end of the runway. But helicopters frequently operate into areas where power lines and other obstacles can catch the unwary. This happened to the pilot of a UH-1F making a landing at a missile launch facility. Prior to landing inside the fenced area of the launch facility, he descended and hovered just outside the fence to take a look at the windsock, which he thought was not rotating properly with the wind. He then landed and later returned to home base where damage to the aircraft was discovered. Although neither pilot felt anything at the time, the damage to the main rotor blade and tail pylon fairing probably occurred during the hover over the windsock. This conclusion was based on the fact that a power line located near the launch facility was severed.

Hazards such as this need to be identified and approaches planned in such a manner to avoid them. Pilots should then fly the approach as planned.

UNDER A PROJECT commissioned by the U.S. Public Health Service, Dr. Donald F. Heulke, an anatomist, and Dr. Paul W. Gikas, a pathologist, both of the University of Michigan, reconstructed each of the 139 fatal accidents that occurred in the Ann Arbor area over a four-year period.

Here's what they found: Forty per cent (71) of the 177 persons who died in the accidents would have lived if they had been wearing a simple lap belt. (Of these, 38 were killed by being thrown from the car; 33 by "secondary collision" with some part of the interior of the car.) Twenty per cent (35) more would have been saved by a shoulder harness and belt. (Of these, 32 were killed in the "secondary collision.")

Thirty-seven per cent (66) would have died, regardless of belts, in most cases because the passenger compartment was greatly collapsed.

Dr. Heulke answers with cold statistics the occasional story of someone who survived an accident which would have killed him if he had been belted in: "We have had only one case of a survivor who owes his life to not wearing a seat belt. We have had at least 71 who owe their deaths to not wearing one. Anyone who doesn't wear a seat belt is stupid."

Another statistic speaks eloquently to those who stake their lives on their own skill and caution—their ability to avoid "the other guy." Of 93 victims in multiple-car accidents, 33 (more than a third) perished in the car judged not to be at fault.

8AF (SAC) Accident Prevention Bulletin

DID YOU HEAR about the pilot who was flying along in his trusty T-Bird when an aileron boost unit suddenly went ape? Seems that when he tried to roll out of a steep left turn the aileron wouldn't neutralize—stayed over to the left. Aileron boost was turned off and on several times but had no effect. The man tried valiantly, with both hands, but he couldn't get the wings back to level. However, he did get control, although with a 45-degree bank.

The back seat occupant of this bird was a non-rated airman whose aid was immediately enlisted. The pilot gave him some fast flight instruction and got him on

the stick—literally. Between the two of them they managed to level the wings. After checking flight characteristics, the pilot decided he could land. A straight-in approach was initiated with the airman holding right aileron with both hands. This enabled the pilot to free one hand to handle the throttle. After the successful landing, the pilot said he could not have landed without the airman's help.

Apparently this aileron boost malfunction was caused by contamination of the hydraulic filter element. The element was bulged, which indicated internal or back pressure. When the boost unit was connected to the hydraulic test stand, pressure set at 1000 psi and the return line partially closed, the condition encountered in flight occurred. However, no hydraulic contamination could be found by visual inspection. The reservoir filter and a hydraulic fluid sample were removed to be analyzed for contamination. ★

CROSSWIND LANDINGS

An Italian pilot demonstrating an aircraft at last year's Paris Air Show was called the world's best by some of the other participating fighter pilots. During his demonstration, he flew an inverted traffic pattern and rolled upright on final for his landing. Because of traffic, the tower had him take it around; he made a closed pattern into the wind. Unfortunately the crosswind was acting upon the aircraft throughout the closed pattern and the base to final turn was really tight. Too tight, because the aircraft snapped, crashed, and the world's best was killed by a sneaky crosswind. If it happened to "the best," it could also happen to any other pilot.

Maj James L. Foster
4510 Combat Crew Training Wing (TAC)
Luke AFB, Arizona

Unlike many other facets that make up the business of flying, crosswind landings always rank high in gaining the attention and respect of the pilot. Or, shall we say, "Let's hope they do!"

Generally speaking, a pilot learns early in his career that crosswind landings not only cause the inherent problem of lateral displacement during the landing operation, but also those problems related to such factors as the physical limitations of the particular aircraft, and the landing conditions.

This discussion is limited to crosswind landings from the standpoint of how they affect our flying at Luke in both the F-100 and F-104 aircraft. These basic procedures will apply to all other bases, but there are usually certain environmental factors common to each base that will also have their effect.

First of all, always be prepared to cope with a crosswind landing. It is not unusual to depart Luke under mild wind conditions only to return for landing an hour or so later with a brisk crosswind present. This is true for many Air Force bases.

If you know prior to flight that you'll be landing in a crosswind, review the procedures in your preflight briefing. This brings up a point directed primarily at IPs. When you check the forecast weather prior to briefing, consider the forecast surface wind conditions. Remember, also, that crosswinds present special problems involving formation flights. Some of these will be discussed in this presentation. Let's look at all phases of the landing pattern.

THE INITIAL APPROACH

If a crosswind exists, be aware of it no later than the initial approach. This is where you must plan your pattern and be prepared to make necessary adjustments. Therefore, know the direction of the crosswind, its velocity, and its resultant effective component.

Our conscientious senior controllers are aware when a crosswind is likely to cause problems in the pattern. They are careful to emphasize this to flights on initial, so pay attention, because the rest is up to you.

The crosswind direction on the surface will usually be present at traffic pattern altitude and at a slightly greater velocity. Knowing this in advance will permit you to make necessary adjustments on initial, during your break, and especially during downwind positioning.

As you come down initial, determine then and there if the crosswind is a potential "widow maker." By this we mean, "Will it force you into a tight base-to-final turn unless you make necessary pattern adjustments?" A good rule of thumb to use in making this determination is this: If the direction of traffic and direction of crosswind are the same, use caution. For example: Left—left. A left-hand pattern-left crosswind will cause a tight base to final turn unless you make corrections.

As far as flying the initial approach, crab sufficiently to avoid being forced inside or outside of your normal breaking point. This is particularly important if you are breaking into the crosswind. If you are forced outside or to the right of your breaking point while on initial, you will end up with a close-in downwind which will compound your problem when turning base to final.

If the crosswind is opposite the direction of traffic, i.e., left traffic, right crosswind, the potentially dangerous aspects of the pattern are reduced, *but*, unless necessary adjustments are made, it can cause some unnecessarily sloppy patterns, such as an extremely wide downwind and angling base to final turns.

THE BREAK

When breaking *into* the crosswind, loosen up your break. A normal or tight break will result in a close-in downwind. When breaking *with* a crosswind, a slightly tightened break will help keep your downwind in. The break is where the flight leader of a formation flight is really carrying the load. He must set the pattern up so the wingmen can follow suit. If the leader breaks shallow, each subsequent member should do the same by matching the bank angle of the aircraft ahead of him. This will result in a uniform downwind.

THE DOWNWIND

Crab into the crosswind while on downwind. A brisk crosswind of 15, 20, or 25 knots will take a sizable correction. While on downwind, it is better to use too much than too little since you can make up for it during your base to final turn. One degree of correction for each knot of effective crosswind is a good rule of thumb. Cross-check your position with the runway and if time permits, make necessary corrections.

THE BASE LEG

This is the part of the pattern that demands the most attention, especially with a crosswind from the pattern side. We'll approach it from that standpoint. If the corrections discussed previously were applied, your problems at this point in the pattern will be minimized. As you start your base leg turn, frequently crosscheck your position with respect to the runway centerline to avoid overshooting. Remember—the crosswind is tending to push you at a faster than normal rate toward centerline, so speed up your crosscheck. Keep your initial bank in until you're sure you are not overshooting. It is much easier and safer to shallow out your bank as you progress around the turn than to steepen up your turn at the last instant to avoid overshooting. In fact, it is this lesson that has proven so costly in pilots' lives and aircraft. Therefore, if you fail to detect the overshoot and suddenly find yourself steepening your bank and applying excessive back pressure, roll wings level, while adding power, and take it around from there. While flying base leg, be power and airspeed conscious—this will help you keep out of trouble.

THE FINAL

Up to this point in the discussion, the techniques apply to both the F-100 and F-104 aircraft. However, from this point on, the techniques vary slightly between aircraft (see the Dash One for your model).

As you roll out on final, correct into the crosswind and line up with the runway.

F-100s may use the crab or wing down technique.

F-104s may use the crab or wing down method or a combination of both.

F-100—If the effective crosswind is 25 knots or greater, make a "no flap" approach and landing.

This is the point in the approach where you will find that it doesn't pay to fly tight patterns. The patterns as described for *both* aircraft require a one-mile final. This final, especially in a crosswind, allows you sufficient time to kill your drift and stabilize your approach. Slow your aircraft to proper final approach speed, plus your crosswind factor. F-100s use one-half the velocity of the direct crosswind component. F-104s add five knots for every 10 knots of effective crosswind. It's really the same but stated in a different manner. This correction is also applied to the touchdown speed.

CROSSWIND LANDINGS

CONTINUED

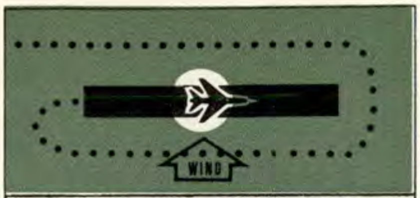
THE TOUCHDOWN

F-100s—If using the crabbing method down final, take out the crab and align the aircraft with the runway just prior to touchdown. If you find yourself taking the crab out too early and the aircraft begins to drift toward the side of the runway, apply rudder correction and lower your wing into the wind to check the drift.

F-104s—Maintain your crab or wing low approach during flare and touchdown. Be prepared to increase the crosswind correction as your airspeed is reduced for touchdown.

The most important point, which applies to both aircraft, is to lower the nose and engage nose wheel steering immediately after touchdown. Above all else, do *not* deploy the drag chute until you are sure nose wheel steering is engaged. F-100s: Occasionally some difficulty is encountered aligning the rudder pedals to pick up nose wheel steering. Be aware that this can occur and be prepared to align the rudder pedals with the nose wheel to pick up steering. Be prepared to use brakes for directional control and hold the nose wheel steering button depressed until steering is engaged. For this reason, the drag chute must not be deployed until positive nose wheel steering is attained. Premature deployment of the drag chute without positive steering can aggravate the situation beyond control.

F-104s have virtually the same problem except that the nose wheel steering button should not be activated until the nose wheel and rudder pedals are aligned. Again, do not deploy the chute until you are sure you have nose wheel steering.



THE LANDING ROLL

Maintain directional control with nose wheel steering and, if necessary, differential braking. If the crosswind is causing severe weathervaning with the drag chute deployed, to the extent that directional control cannot be maintained, jettison the drag chute.

A good follow-through technique during the landing roll to insure positive nose wheel steering is to hold forward stick pressure and trim nose down.

(This article was adapted from material presented by Major Foster during a flying safety meeting at Luke AFB. We are indebted to Major Bruce D. Jones, Chief of Safety, 4510 Combat Crew Training Wing, for his assistance in obtaining the material. Ed.) ★

DOWNED PILOT:

Spread canopy makes pilot easier to spot. Even better would be a move to the road where contrast would be greater and shadows would not be so confusing.

Missilanea

FALCONS DAMAGED during transportation, loading and unloading usually bring to mind the picture of a bird ruffled during loading on an alert aircraft, or during ground handling and movement from on-base storage to the alert aircraft loading area. The Falcon mishaps that have cost us the most, however, did not occur in this area of missile handling.

Mishaps that have been reported as occurring during interceptor aircraft loading/downloading have usually involved single missiles with minor damage. Procedures are well established with specialized equipment (trailers, tow vehicles, handling frames) to perform these functions. Crews are specifically trained for, and supervised in, the performance of these duties.

Falcons handled as cargo in the receiving and shipping area fail to receive the same quality of specialized handling they received in the alert area. Procedures frequently vary between bases. General purpose type vehicles (trailers and trucks) are often used for transportation between the receiving point and missile storage area. Motor pool and air freight personnel normally perform the loading and transportation. When mishaps occur they involve not one, but several missiles. Falcons dropped (spilled) from fork lifts, trailers, or other general-purpose handling equipment usually result in rocket motors being rejected for further use, guidance unit replacement, or return of the complete missile to the depot for major repair.

Let's look at just a few of the most recent mishaps of this nature:

• Incoming shipment of missiles was being unloaded from a flat-bed semi-trailer to a fork lift when two $11,686 Falcons in shipping containers slid from the fork lift and dropped approximately 10 feet to the ground . . .

• Twenty-six Falcons were offloaded onto a flat-bed trailer for transportation to the storage area. A motor pool driver was dispatched to exchange tractors prior to making a trip to the storage area. Before disengaging the tractor from the trailer, the driver cranked down the jack-pad on the right side but neglected to crank down the left jack-pad. When he drove the tractor from under the flat-bed trailer, the trailer tipped, allowing three $12,038 Falcons, and two $11,687 Falcons to slide to the ground. (Slide? They *crashed* to the ground!) . . .

• Forty-eight Falcon missiles were loaded on four pallets (12 per pallet) on a 40-foot trailer for transportation. En route with the load, the driver made a right turn onto an unpaved smooth dirt road. The load shifted, breaking the single tiedown strap on the third pallet. Nine of the twelve Falcons fell to the ground.

Corrective action was indicated with each report. All were caused by supervisory error and/or personnel error. These three mishaps within a six-months period seriously damaged 14 Falcons. More Falcons were damaged during these three mishaps than during all the hundreds of alert, training and mass loadings and related transportation for an entire year.

Air Freight and Motor Pool procedures, personnel qualifications, and supervision of missile and munitions handling need the special attention of the unit commander and his safety officer. Local procedures and practices should be evaluated and revised where necessary.

Lt Col Loren S. Tyler
Directorate of Aerospace Safety

HOUND DOG PUNCH. Approximately 30 minutes after AGM-28 power was applied, the Nr 1 warning light on the Navigator's Armament panel and the warhead light on the Navigator's launch panel illuminated. All power was immediately removed from the missile. After the aircraft landed, the Hound Dog was downloaded. All critical aircraft circuits were checked and no malfunctions detected. During checkout of the missile autonavigator compartment, four wires were discovered cut on the dummy warhead cable. Investigation revealed that, as the dummy warhead was being raised into the AGM-28, a sudden gust of wind raised the left aircraft wing and missile. As the missile lowered, it struck the dummy warhead. A visual inspection at the time revealed no damage to the missile or warhead. It is suspected that the cable was damaged when the missile lowered into the dummy warhead. This was not detected during the unload since the cut on the cable was under the clamp which holds the cable to the side of the warhead adapter.

TO 21M-AGM-28A-2-2 states that during AGM-28A/B loading and unloading operations in variable wind conditions, caution should be exercised to insure the aircraft remains stable. Stabilization may be accomplished by fueling or using tip protection gear support, tip protection gear jacks, or hangar runup ramps. When wind velocity is above 30 knots, load or unload only in case of emergency. ★

Maj E. D. Jenkins
Directorate of Aerospace Safety

WHY ENGINE STALLS?

E. L. Venturini, Manager

Technical Investigations Service Engineering, FPD, Cincinnati, Ohio

"I think the engine stalled . . . Would you check it over and, oh, yeah . . . let me know whatcha find?"

That's what Major Staller said to his crew chief after yesterday's hop. That was the same bird in which I had experienced a boomer no more than two days ago. I didn't write it up because I thought I'd goofed in my pull-up in a gunnery pass. But then my curiosity got to me so I called up an old friend, A. Grate D'Zeiner for some facts.

"Vell, da perfect comprezzor vould operate on an izentropic proceez. Now, an izentropic proceez resultz in a minimoom temperature ratio acrozz da comprezzor for a geeven prezzure ratio. Derfore da efficiency. . . ."

"Hold on," I interrupted. "In plain language, why does an engine stall?" Well, I still didn't get very far but I remembered some articles I'd seen in the briefing room.

First, let's clear up one point! All explosive sounds, whines and growls or similar sensations you might experience, are not engine stalls. But before we get into the recognition of an engine stall, it would help to know what happens and why.

We're all familiar with the way an aircraft wing stalls. When the angle of attack is increased beyond that required for flight, the drag increases causing turbulence in the airflow over the wings. Turbulence reduces the lift created by smooth flowing high velocity air. If the turbulence from a high angle of attack is great enough, the lift produced is no longer sufficient to support flight. Figure 1 shows a simplified airfoil and this effect. Since the axial flow compressor is made up of a series of specially shaped airfoils, the application of this principle applies as well to the axial flow compressor of a jet engine. I mention axial flow because most of our equipment these days is this type.

The compressor rotor has hundreds of fixed airfoils rotating like a propellor blade, each one creat-

Distortion of pressure profile at engine inlet from FOD, extreme maneuvers may cause engine to stall.

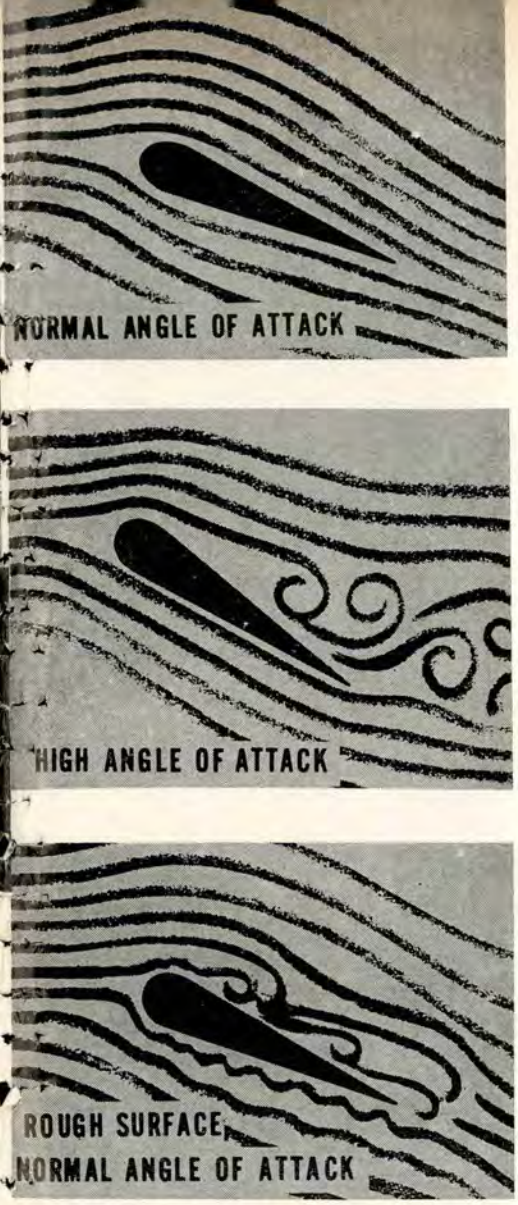


Figure 1

Figure 2

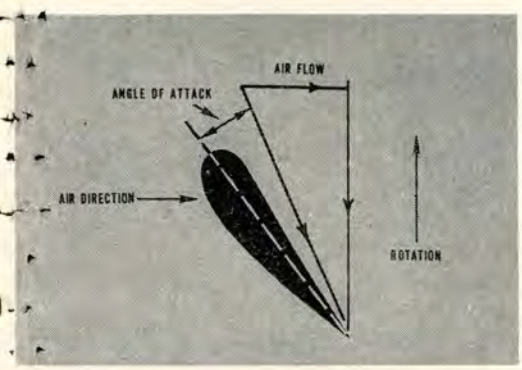
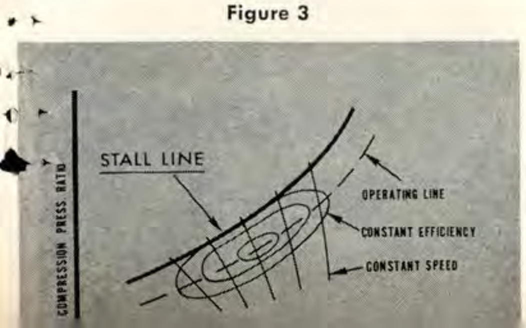


Figure 3



ing a pressure rise in the air being supplied to the combustion section. The compressor stator which is also comprised of hundreds of fixed airfoils directs the air during the compression cycles. In the process, either rotor or stator blades have the capability of stalling much the same way as the airplane wing. If you isolate one blade in the compressor rotor for a closer look, Figure 2, you see a cross section of a blade airfoil, its rotational speed vector, the air direction with its velocity vector, and resultant air vector relative to the blade.

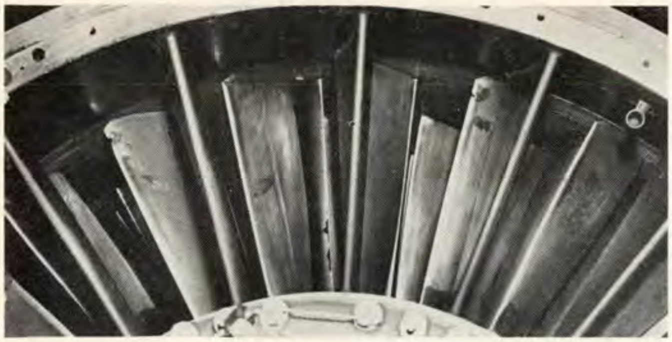
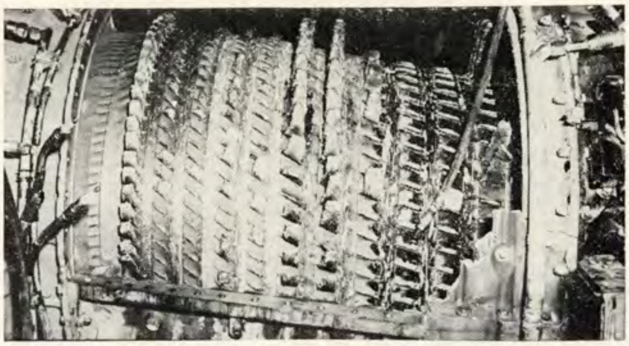
As in the case of an aircraft wing, if the angle of attack is too great, the airfoil will stall. It is not necessary that the entire airfoil be involved. A stall can initiate in the tip or hub area, persist in a localized manner or progress into a full fledged stall where the compressor ceases to function. Since the blade is fixed, what changes the angle of attack? There are four factors that influence this: (1) the air velocity, (2) the blade or engine speed, (3) the stator vane position and (4) the desired pressure rise.

The diagram in Figure 2 depicts one given condition, and a similar diagram can be shown for a stator blade. The compressor must be designed to function efficiently at an infinite number of conditions as set forth by aircraft speed and altitude and all kinds of weather. That is, inlet air temperature, pressure and humidity, as well as engine RPM and its condition.

As an example, let's consider a case where the engine is running at a stabilized speed. Air enters the compressor flowing axially; however, to the rotating blade it appears to be flowing in the direction of the resultant as shown in Figure 2. The air is compressed and in the process, exits each stage with a velocity somewhat in the direction of rotation. Stator vanes then turn the air to the proper direction or angle of attack for the next compression cycle, etc., through the entire compressor. Now that's for only one condition. As mentioned, in the design of a compressor many variables must be considered. The engine speed may vary from zero to several thousand RPM, engine inlet temperature from well below freezing to above boiling and operation at a wide range of altitudes. The compressor, irrespective of conditions, must produce and yet not stall.

How's this done? For every compressor design, a dimensionless plot or map can be made of compression ratio versus air flow. A typical compressor map is shown in Figure 3. The diagram also defines the constant speed and efficiency lines. Air flow increases with speed to get thrust. To gain efficiency and better performance, a greater pressure ratio must also be realized. The higher the pressure ratio, the higher the angle of attack and operation closer to the stall line. However, operation here is critical, and stepping over the line will lead to a stall. So what happens? . . . you devise an operating line which skirts the stall line with some degree of margin.

The operating line is the product of much development testing and engineering judgment. Operation of the engine along this path is accomplished in many different ways. In the variable compressor stator system, the early stage vanes are positioned as a function of inlet temperature and engine speed to maintain the proper control of the airflow. The pressure ratio is controlled by many parameters, yet fixed by the geometry of the basic engine. Dual spooled compressors accomplish much the same end by providing an RPM match between forward and aft states at all speeds points (higher speed ratio in aft stages during acceleration). A compressor bleed air system regulates the pressure rise in the transient speed range. The fuel scheduled for combustion during acceleration and the corre-

FOD is often the villain causing engine to stall.

sponding exhaust nozzle area, if variable, will affect the pressure level in the engine system. These schedules must be compatible. For example, if too high a rate of fuel is being burned, or for some reason the exhaust nozzle is closed, a high pressure will exist in the combustion section. This will raise the pressure ratio in the compressor and could cause a stall. Once a suitable operating line is established, intentional stall tests are conducted to evaluate the final

Figure 4

product. Now that's how it works, but why doesn't it always? I'm glad you asked! The conditions we've discussed were ideal with only some degree of provisions for changes in stall margin which may come about in the course of field operation. The compressor air flow characteristics will change as a result of airfoil corrosion, dirt and even foreign object damage. Control schedules or regulating valve operation can change with time.

When the airfoil surfaces of the compressor become rough from corrosion or dirt deposits, the airfoil becomes prone to flow separation, turbulence and eventually stall. See Figure 1C. Obviously the answer to this problem is corrosive resistant materials or protective coatings. Both approaches have shown significant improvements in the past few years and are being incorporated in the engine designs. Wash-oil and walnut shelling techniques have been developed to clean up the old designs and keep them going between overhauls.

Foreign Object Damage to compressors has taken its toll in causing stalls. It's not hard to understand why the disturbance generated, would cause a stall. See Figure 4. The turbulence created would be comparable to that of an iced wing or as in a high angle of attack.

Nothing's been mentioned about aircraft/pilot induced stalls. These occur from the ingestion of hot gases from rockets or guns, inlet ramp schedule failures, spins and other exotic maneuvers—all produce a distorted pressure profile at the engine inlet. The cases cited here have caused engines to stall which had adequate stall margin.

The symptoms of an engine stall may vary among the different aircraft; however, most common displays are a sudden increase in exhaust temperature, some RPM loss or hang-up, a thrust decrease and frequently an audible report. Compressor stalls are generally cleared by reducing power; however, one should refer to the appropriate manuals for the recommended procedures.

Now let's review. . . . Oh, there's the crew chief Sgt. Ringitout, on that bird Major Staller brought back.

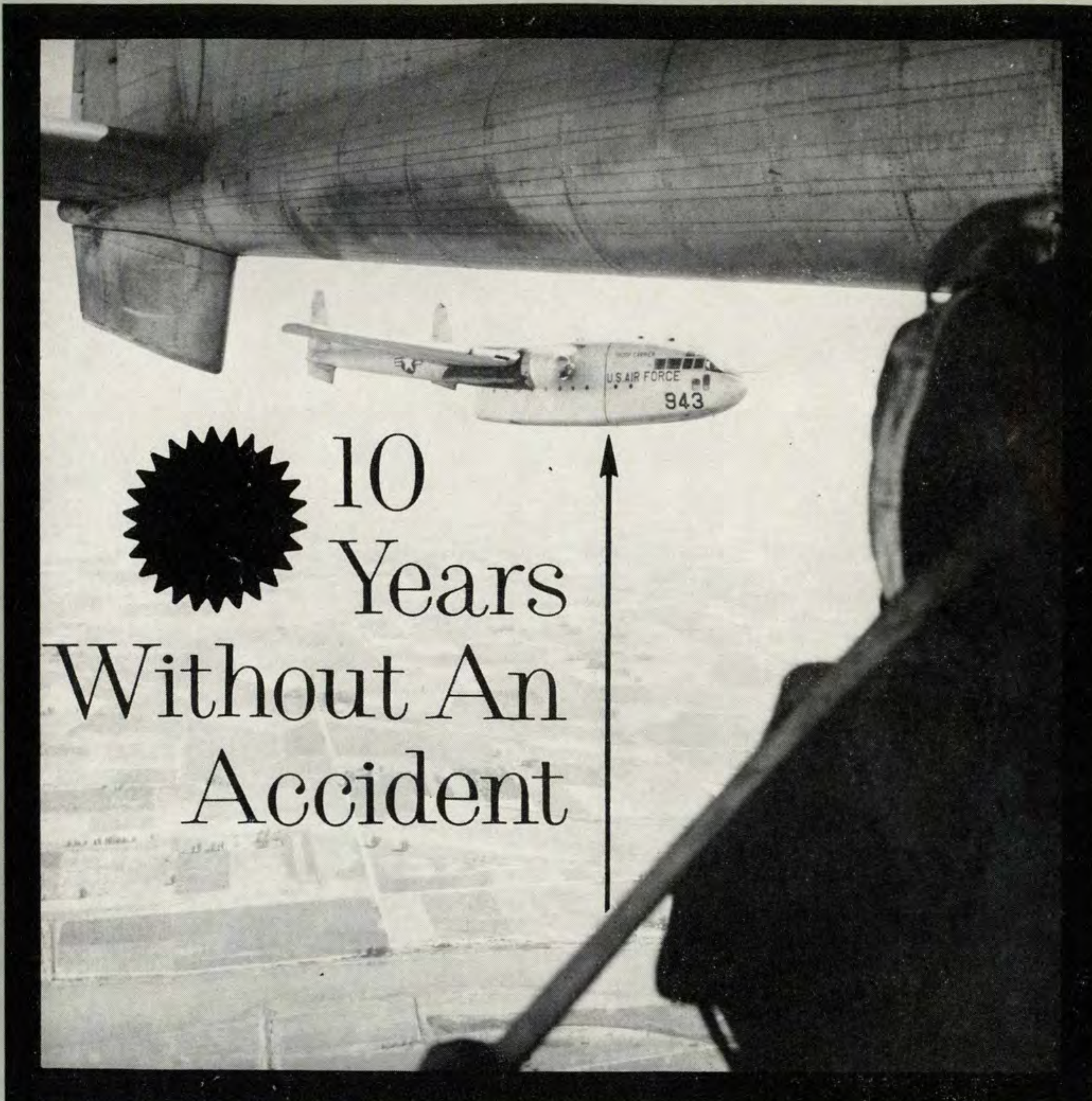
"Hey, Sarge, whadya find?"

"Afraid it's FOD, sir!"

FOD huh. . . . Wonder what they call FOD in foreign countries? Whatever it's called it's costly, and won't Staller be happy to hear the news, being the maintenance officer? What about maintenance? Can't we reduce the stall incidents with improved maintenance? No question about it. You recall the cause factors: Compressor corrosion, FOD, exhaust nozzle malfunction, fuel control schedule, inlet ramp failure. Many can't be foreseen it's true, but still a good percentage are not recognized during maintenance.

In summary, the best pilots are familiar with the recognition and proper corrective measures in abnormal or emergency conditions . . . keep ahead or at least current on engine stalls. And mechanics, your work should never stop in preventing stalls through good maintenance practices.

Don't forget, if you guess, you might be wrong and if you think you guessed right, you only thought you knew. ★



10 Years Without An Accident

Ten years is 120 months or 3650 days; and it can be measured in any other unit one desires. The 932d Troop Carrier Group measures this period of time by the number of accidents the group experienced from August 1955 to August 1965. The answer comes out ZERO. This is considered an outstanding accomplishment for any Air Force unit, however, the 932d is a Reserve organization comprised of citizen-airmen who perform their flying duties in addition to pursuing professional careers outside the Air Force.

"Safety First" has always been the motto of the unit at Scott AFB; however, the decade did not pass without its moments where quick and professional decisions were required to maintain the flawless record.

Binding elevator controls and a jammed gear threatened a crash landing on the night of 19 May 1958. While the C-119 circled over Scott Air Force Base, the crew sought to locate the trouble. Failure of the nose gear strut pin had caused the nose gear to become jammed in the wheel well. The condition prevented full retraction of the gear, caused the elevator controls to bind and prevented the gear from extending. After four hours of futile efforts to lower the gear, the flight engineer removed his parachute and as a safety measure, a strap was tied around his waist and secured to the aircraft. He then entered the nose wheel section, chained the gear in the up position with cargo chains to prevent its inadvertently extending, and the wheel well door rod was removed, letting the door free fall to the open position. This provided sufficient room, the chain was removed and the gear was then lowered and locked into position. A safety pin was installed but the problem was not entirely solved. The nose gear remained eight degrees out of line, raising the fear that it might collapse upon landing. At the request of the aircraft commander, ground personnel sprayed foam on the runway. The pilot's smooth landing brought a successful end to the hectic flight.

After the aircraft stopped its landing roll, gear pins were inserted and the aircraft was towed to the Reserve Area. The crew's efforts averted a major accident, possibly saving the lives of the seven men on board and the loss of an aircraft. The flight engineer received a Distinguished Flying Cross for "heroism and extraordinary achievement" which was believed to be the first instance where an Air Force Reservist, not on extended active duty, received the award; and the entire crew received a "Well Done" in Flying Safety magazine.

In another incident, during a massive exercise conducted by the Air Force and Army in North Carolina in 1960, quick-thinking by one of the pilots averted a possible accident. His C-119 from Scott AFB was preparing to drop an Army truck when a series of mishaps occurred. First, a small pilot chute malfunctioned and the two big chutes attached to the truck and platform did not leave the aircraft. The pilot ordered that the truck and its platform, weighing a total of 7000 pounds, be secured with chains. A few moments later, one of the big chutes popped out of the Flying Boxcar and opened, working like a brake to slow down the aircraft. Already slowed to 130 knots for the paradrop, the plane rapidly lost airspeed with the additional drag. The pilot ordered the crew to cut the big chute loose and the aircraft was landed safely at a nearby base.

Both emergencies were handled professionally by the aircrews. Other incidents which required immediate inflight decisions and sometimes unscheduled single engine landings, while not as dramatic, threatened to mar the record.

During the 10-year period, 932d crews logged 43,323 hours flying missions over routes nearly circling the globe, over all types of terrain and in a wide range of adverse weather conditions. For the first 20 months of the decade, the organization was a bombardment wing and most flights were in B-26s. In 1957 the C-119s arrived and brought with them many problems.

Only three pilots in the organization had previous time in the Boxcars and this was a scant number. Instructor pilots came to Scott from other organizations to conduct transition training. Maintenance of the troop carrier aircraft also caused a few headaches at the start. The Reserve organization was a Pilot Training Wing with T-28s and T-33s (the latter assigned for a very short period) prior to the transfer to Scott of the Bombardment Wing with B-26s. Therefore, the hangar did not accommodate the '119s and alterations were made to permit entrance of the larger aircraft. There was a shortage of maintenance platforms and special tools peculiar to the C-119 such as propeller and engine tools. Until proper tools were received, maintenance men employed ingenuity and skillfully used make-shift tools to accomplish certain jobs.

Flights by Reservists in the C-119s have been of a wider variety than was possible in their previous aircraft. They included overwater navigation missions to Panama, Puerto Rico and Bermuda; ferrying missions from Hawaii and France to Scott, and from Scott to India; airborne troop exercises in Alaska, the West Coast and southeast United States; paradrop missions over drop zones throughout the country; airlift missions to provide vitally needed supplies to the Dominican Republic and to flood-stricken areas in the Midwest.

A secondary mission was assigned to the Wing in early 1961, when it became the first reserve organization to augment the Air Force space capsule recovery operations. One crew from the 932d was trained by the AF Recovery Unit in Hawaii; this crew then trained an additional three crews for a total of four crews of "aerial outfielders."

The "Ready Now" concept under which the Air Force Reserve operates was tested by recall of the unit to active duty during the crisis in Cuba in October 1962. Designated the 73d Troop Carrier Squadron, the unit was one of 24 squadrons summoned in the no-notice recall. During a training assembly on 28 October 1962, the Reservists received word that they were on active duty as of that time for a period of 12 months unless sooner relieved. They immediately became part of the Tactical Air Command forces, poised for action over Cuba if the "hot line" call should so order. Due to its high state of readiness, the Scott unit smoothly and quickly became a part of the Nation's front-line defenses. The crisis subsided and the unit was released from active duty on 28 November 1962.

The 932d has provided direct support of the active duty forces on numerous occasions in the decade. These missions included Swiftlife and CON TAC, providing airlift augmentation to TAC through the execution of specific cargo and personnel missions; Ready Swap, providing airlift support for Air Force Logistics Command by transferring weapon systems material between AFLC depots; Swordfish, providing support to the Air Defense Engineering Services Systems test organization; and MAC Support, providing airlift on Atlantic and Caribbean routes in support of the Military Airlift Command. Most of these missions were accomplished by Reserve crews on short tours of active duty.

Flying Safety has been given a position of paramount importance in all missions during the 10-year period. In September 1955, the unit began a flying safety program involving weekly meetings of aircrew members. It stressed that flying safety could not be compromised in any peacetime mission. The program insured that proper actions were taken prior to each flight, that crews received proper rest, and that authorized procedures were followed. Commanders and Flying Safety Officers have continued to stress this at every flying period. Each member of the unit maintains a "flying safety attitude" by his conscientious efforts to keep current on Air Force directives, flying safety bulletins, aircraft procedures and flying techniques. Each man attends monthly flying safety meetings, alerts the unit to any hazardous incidents or tendencies he has observed, and maintains standardization in all flying and ground activities.

Colonel Allen A. Beaumont, 932d Commander, is quick to point out that the aircrews alone did not achieve the 10 year flying safety record. Excellent aircraft maintenance played an important part.

On-the-job training in the 932d was given credit for developing the skills of many airmen who helped produce the safety record. A large percentage of enlisted men had no prior service in the military. Most of the pilots, navigators and flight engineers had little or no experience in troop carrier operations when the unit converted to the C-119s or when they joined the unit. The work of instructors has brought these men to a high state of combat readiness.

One pilot, assigned in April 1962, had not flown since June 1949 and had only 120 hours of flying time in two-engine aircraft. In three years, he logged 1502 hours in the Scott C-119s and became an aircraft commander. The SEF Commander who entered the unit in 1956 with 1004 hours flying time, has now logged over 4200 hours. Another pilot came into the unit in 1960 with only 299 hours total time, including 261 hours as a student pilot. His progress in flying the '119s has been steady and he now has over 1600 flying hours and is checked out as an aircraft commander. Other pilots who are now in command of important airlift missions had a wide variety of AF backgrounds — in helicopters, jet fighters and jet bombers.

With 10 years of accident-free flying behind them, the men of the 932d realize that every flight presents a new challenge. They are not looking back to past laurels, but ahead to new threats. They pursue a continuing program of safe flying—in the cockpit, in meetings and briefings, atop maintenance platforms and in their homes. For these men, safety and mission accomplishment go hand-in-hand. ★

(The 932d's long accident-free record ended on 17 April 1966. During an emergency single engine go-around, failure of the remaining generator voltage regulator resulted in a major accident. Ed.)

AEROBITS

REEL NEWS – The following color films are available to your local film library or film servicing activity. Bases without such service may order from the address shown below, an Aerospace Audio-Visual Service (MAC).

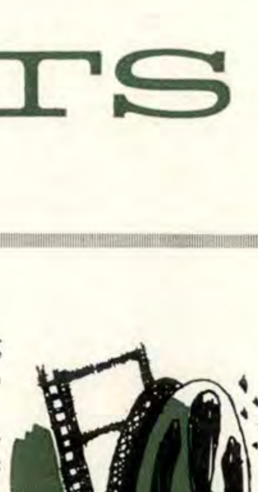
TF 5614 FOREIGN OBJECT DAMAGE, 16 min. Describes USAF's program to reduce costly jet engine damage caused by ingestion of foreign objects. Shows runway testing techniques which include debris patterns, vortex formations and tail blast effects.

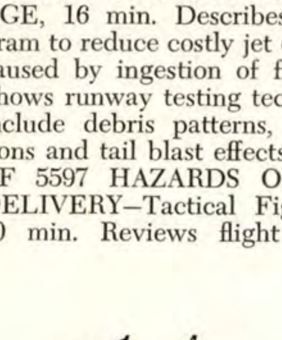
TF 5597 HAZARDS OF WEAPONS DELIVERY–Tactical Fighter Aircraft, 20 min. Reviews flight safety rules; points out critical dangers in exceeding safety margins; discusses dive angles, roll-ins, roll-outs, recovery time, etc.

TF 5656 EVACUATION PROCEDURES–C-141, 13 min. Outlines duties and responsibilities of crewmembers preparatory to ditching, bailout or wheels-up landing.

TF 5638 PETROLEUM TANK CLEANING SUPERVISOR, 34 min. Outlines principles and dangers of petroleum storage tank cleaning operations, tank preparation and safety rules.

AF Film Library Center
8900 So. Broadway
St. Louis, Mo. 63125





WHODUNIT – "Hello, Chief, . . . I have the whole story . . . saw the whole thing from my hideout in the F-4C wheel well. This mechanic started out okay; I think he was trying to do a good job but got just a little bit careless. First, he took everything out of his pockets and put it on the maintenance stand. Then he inspected the Nr 2 engine intake. After that he moved the stand to the Nr 1 engine, but in the process the engine book fell off the stand onto the ground. He picked it up and put it in his pocket, then, somehow, the book got into the Nr 1 engine during the pre-run inspection.

"Well, you know what happened. During the run, the book and its metal rings got chewed up by the engine – it was horrible, Chief. Fifty per cent of the compressor rotors were damaged, and 99 stators will have to be replaced.

"Chief, would you belive that it will cost almost $20,000, plus labor? Well, you'd better believe it. What's that? Sure I got a recommendation. Let's cut the pockets off the coveralls."

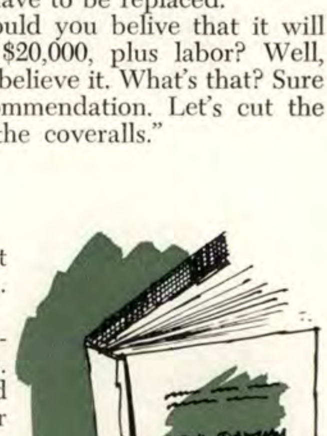
A NUCLEAR SAFETY correspondence course is now available through the Air University Extension Course Institute. This training course – Nr 01955, in three volumes – is designed for people who have direct or indirect responsibility or interest in nuclear safety. Those desiring to study this important subject should consult Part IX, page 9-ECI-3, AFM-50-5 USAF Formal Schools Catalogue, for course description, and Part I, pages 1-28, of the same manual for enrollment procedures and other helpful information.

Volume titles are:

Volume I: Organization and Management, valued at 12 hours or four points.

Volume II: Human Reliability and Safety Procedures, valued at 24 hours or eight points.

Volume III: Before, During and After Accidents, valued at 12 hours or four points.



BLOWN CANOPY — During shutdown of a T-33 at night, the canopy was jettisoned when the pilot's unzipped lower right pocket engaged the canopy alternate jettison handle. Although the primary cause of the minor accident was incomplete compliance with the T.O., which placed a guard around the handle, the quite experienced pilot had some cogent comments which apply to almost all cockpit situations. Among them are:

- Wear proper size flying suit and keep zippers closed.
- Use flashlight instead of contortions to make visual check of switches on night start-up and shutdown.
- When clothing or equipment gets hung up in the cockpit, check the trouble before pulling free.

Maj Guy J. Sherrill
Directorate of Aerospace Safety

CLOTHING AGAIN—Major Sherrill's item above brings to mind another recent occurrence. During air refueling of a B-52, the copilot got an inadvertent disconnect. The pilot reached over to make sure the throttles were retarded to idle and in the process caught the sleeve tightening tab of his flying suit on the airbrake lever. The extended airbrakes caused the aircraft to fly up into the tanker's jet wash, which caused plenty of control problems until the brakes were retracted and the aircraft descended below the wash.

There must be some way of designing flying clothing so that loops and straps and the trouble they frequently cause can be eliminated.

LIGHT REFLECTING off instrument windows has long been a nuisance to pilots and, on occasion, hazardous. Now something is being done about it on our newest aircraft, the F-111, C-141 and the forthcoming C-5.

The stuff that does the job is a multilayered, dielectric, antireflection coating called HEA. It was designed for use on aircraft instrument windows but is also seeing service on some spacecraft windows. It reduces glare by a factor of 10, and increases the light transmission property of glass so that when one looks directly into an instrument face there appears to be no glass there at all.

Probably your question now is, "If this is so good, when will I get it in the aircraft I fly?" Soon, we hope, but don't hold your breath. The coated glass is not a requirement at present for old instruments and we can't say if it ever will be — cost appears to be the problem. But there is a requirement for HEA on some of the new instruments, e.g., the new ADI and HSI being retrofitted into the B-52, the counterdrum-pointer altimeter that should soon appear in the F-111 and C-141 and is scheduled to be incorporated in the T-38 later this year.

HIGH EFFICIENCY — MAGNESIUM FLUORIDE — NO COATING

AERO BITS

DURING FLIGHT the crew of a T-37 smelled a pungent odor in the cockpit and decided to land. Maintenance, in going over the bird, discovered a three-inch metal clip — the kind used to hold checklists — in contact with the starter relay and the metal bulkhead back of the left seat. The clip caused a short during ground start. Heat generated burned a hole three inches long and ⅜ in. wide in the bulkhead and baked a portion of the fuel cell behind the burned area. Repair cost 50 manhours.

ATTENTION, AERO CLUBS — As of April, according to the FAA, the name of Periodic Inspection was changed to Annual Inspection. All entries in log books or aircraft records will be made using the word "annual" instead of the word "periodic." There will be no change in the scope of the inspection or by whom it is to be performed. The change is in name only. FAA forms such as the 2350, Aircraft Use and Inspection Report, and 2912, Inspection Reminder, can be used without changing the word "periodic" on the form. However, all log book entries or correspondence will refer only to annual inspection.

AT 1130 a pilot was assigned an F-102 for a 1330 scheduled takeoff. He was told to preflight and set up the aircraft and standby in the cockpit as a spare in case an aircraft on the 1200 mission should abort. This is a normal procedure during refueling training in order to obtain maximum training on each tanker mission. A thorough preflight was completed. When the aircraft was not needed to fill in on the 1200 mission, the pilot returned to Operations, leaving the aircraft set up. The crew chief went to eat lunch.

At 1230 the nitrogen system was serviced as directed by Maintenance Control, and the access door was closed but not secured.

At 1300 the pilot and crew chief returned to the aircraft for the 1330 mission. Assuming that it was still completely set up, they did not accomplish a walk-around inspection. Start and taxi were normal and a wing takeoff was made. Just after leaving the ground, the pilot saw the right forward (nitrogen filler) access door come open. He retracted the gear and climbed to a safe ejection altitude. At about 210 KIAS the door separated from the aircraft and the pilot heard two loud bangs similar to a compressor stall. He checked the engine instruments and all appeared normal, so he assumed the noise was the door hitting the aircraft fuselage. He came out of afterburner, climbed to 3000 feet and held the airspeed at 220 KIAS. Since he had never made a heavy weight landing in the F-102 and the engine appeared to be running normally, he elected to burn down some fuel prior to landing. No further problems were encountered, and an uneventful landing was made 20 minutes later.

This was a costly oversight; the left intake duct lip and boundary layer duct were dented and gouged. The engine swallowed at least part of the access door, necessitating an engine change.

Maintenance supervision was judged the primary cause because there was no procedure to insure access doors being properly secured after servicing. Contributors were maintenance personnel who failed to secure the door, and the crew chief and pilot for not making a walk-around inspection after leaving the aircraft for an extended period.

Needless to say, this unit began writing an OI designed to prevent this sort of thing. ★

☆ U. S. GOVERNMENT PRINTING OFFICE 1966 201-219/11

WELL DONE

FLT. LT. KENNETH A. HARVEY, RCAF

DEFENSE SUPPLY AGENCY, DETROIT, MICHIGAN

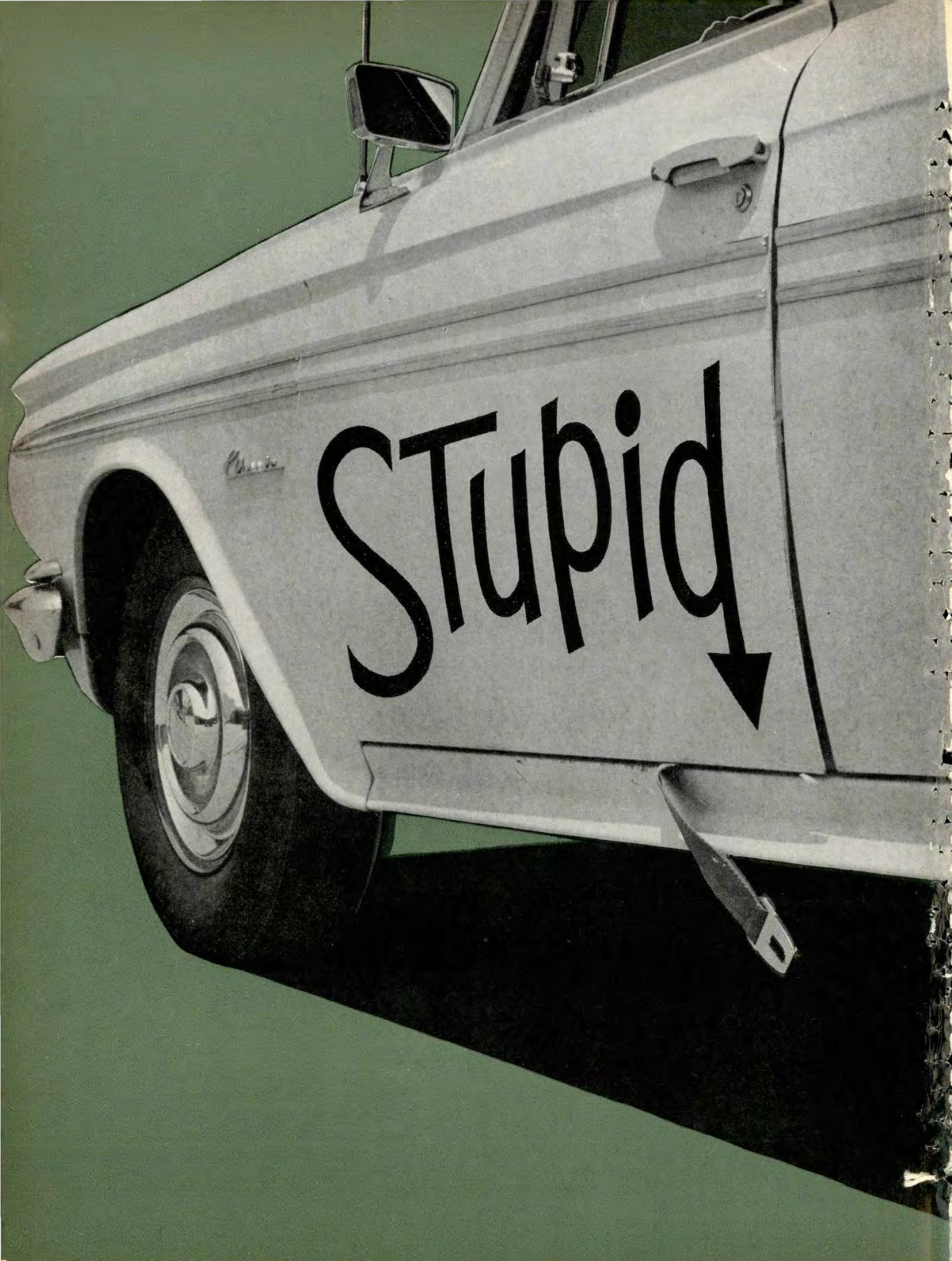
Flight Lieutenant Kenneth A. Harvey was returning to base during the test flight of an F-84F. About ten miles from base at 5000 feet, the engine started to bang and vibrate violently. The tailpipe temperature went to 800°C and continued climbing; engine RPM fluctuated between 50 and 85 per cent. Lieutenant Harvey declared an emergency to the tower at RCAF Station Namao and said he would land downwind since that was the closest runway.

Suspecting bearing failure, Lieutenant Harvey selected a power setting of 87 per cent to give longer engine life because, if the engine could be kept running, he would have sufficient power for the landing pattern without making further use of the throttle.

The vibrations became worse and at about five miles from the runway the engine seized. He immediately pulled the throttle back to the idle position, selected Emergency Hydraulics, hit the airstart switch and selected Emergency fuel ON, trying for a relight. Receiving no response, he selected fuel lever OFF, throttle OFF (the gear was already down), and made a successful landing. Immediately after touchdown, he deployed the drag chute and switched off the battery.

Lieutenant Harvey did not eject because he was so close to a highly populated area and could not bring himself to leave an aircraft under those conditions.

At the time of the incident, Lieutenant Harvey was a test pilot for Northwest Industries, Ltd., a Canadian firm performing IRAN under a United States Air Force contract. Although Lieutenant Harvey's flying time in the F-84 was very low, his skill in averting what might have been a serious accident resulted in the possible saving of lives and the aircraft. WELL DONE! ★



PHOTOGRAPH BY MSGT. BOB PARKER