AEROSPACE SAFETY

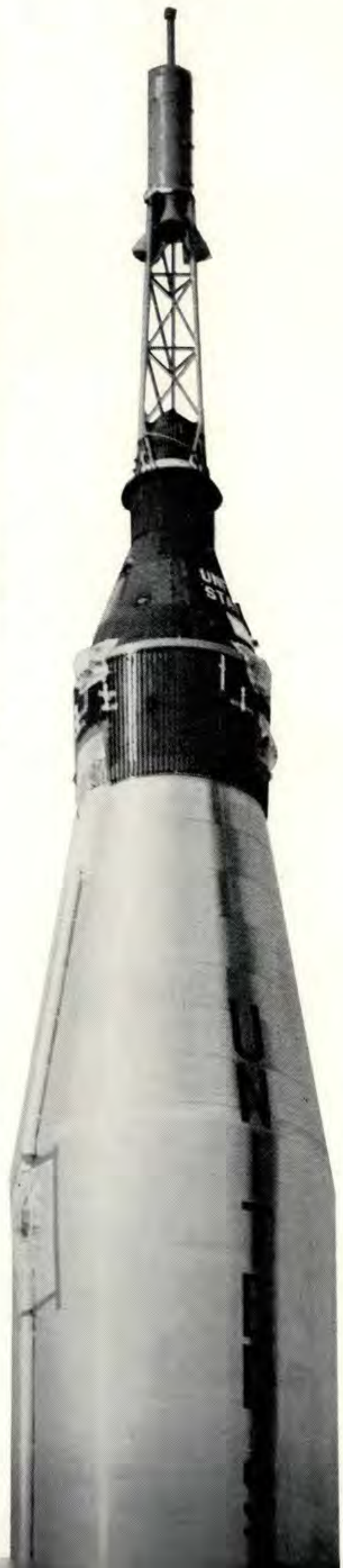
UNITED STATES AIR FORCE

AUGUST 1962

3rd ANNUAL USAF SAFETY CONGRESS

MEN, MACHINES AND SAFETY

Lieutenant General William H. Blanchard, The Inspector General, USAF



IN THIS AGE OF PUSHBUTTON AUTOMATION we tend to over-emphasize machines and overlook the importance of men. Regardless of what the engineers and scientists dream up for the Air Force of the future, man is the single, basic component which must be considered in everything they develop.

Today we fight wars with machines, but people design and build them, adapt them to strategic uses, operate and maintain them, modify them and design their replacements. In all our progress, MAN is the only unchanging element.

The X-15 was just a glamorous piece of shining machinery until man took its controls to make it perform the function for which it was designed. Major Robert M. White accelerated it beyond Mach 6, at a speed record of 4093 miles per hour. Joe Walker pushed the X-15 up to some 246,000 feet, almost 50 miles high.

Late in Lt. Colonel John Glenn's first orbit, the automatic control system of his capsule malfunctioned. He took over manual control for most of the remaining flight, and later he said, "The idea that I was flying this thing myself and proving in our first orbital test that man's capabilities are needed in space was one of the high spots of the day."

Man's capabilities and concern for safe operations also are the key to our flying safety programs—the whole team of men who operate the aircraft in flight and the maintenance and repair personnel on the ground who keep it fit for safe flying.

And this holds true whether the vehicle concerned is a Mercury capsule, an X-15 or even a C-47. In fact, careful maintenance and the self discipline required to operate within the design flight envelope can be just as important in conventional aircraft as in the more exotic space craft. We have C-47 accident reports in the files at Norton that prove this very point. And such accidents are not limited to C-47s—I pick that just as an example. Any other aircraft could be used to make this point.

I am convinced that men, more than any other one factor, determine the effectiveness of our operational and safety posture. I believe I can sum up this importance in two sentences.

The safety record combines the efficiency of industry, the brains of our aeronautical engineers, the supervision of our managers, the talent of our crews, the dedication of our airmen. No one record or statistic better identifies the quality of MEN and their professionalism. ★

IN THIS ISSUE

THIRD ANNUAL USAF SAFETY CONGRESS

SANDIA BASE, ALBUQUERQUE, N.M. Three hundred Air Force commanders and safety officers from all over the world will be on hand here by 30 July. Theirs will be the sobering job of analyzing safety problems of the past few months and planning a program for 1963 that is designed to save lives and weapon systems from loss through accidents.

This is a multimillion dollar project. The dollar cost of a life lost in a PMV accident, a U-3A or an F-105 is impossible to assess. The hardware cost in a Titan failure, a B-58 crash or inadvertent jettisoning of a GAR can be figured. But this may not be the real cost of such losses. The lost Titan, B-58 or GAR may be the one that would have hit a critical target should that future possibility become a reality. The fact that such hardware may not be available for the intended purpose, because of an accident, is the basic safety challenge.

In all four safety areas—flight, ground, missile and nuclear—emphasis is to be placed on improved personnel procedures. An aspect of this thinking is depicted on the back cover of this issue.

The job facing these conferees is not easy. Materiel failure is the greatest accident cause factor in aircraft. And, as aircraft become more complex and highly sophisticated missiles take over a larger proportionate share of the weapon systems inventory, there is every indication that ferreting out and eliminating materiel cause factors will continue to be a major task for safety experts. This is one of the major areas to be probed by conferees this year.

Nuclear safety specialists will grapple with the problems of continuing to maintain the perfect safety record of no accidents in which nuclear yield has been a factor.

More automobiles, more specialized support equipment, more exacting tasks as the technology of national defense advances will try the skill of ground safety delegates.

The safety congress will have more to do than just analyze past accident experience and come up with recommendations. As has always been the case with nuclear yield accidents, and as it is becoming ever more a reality in missile and aircraft weapon systems, the *first* accident is too expensive. This is particularly true when, as past analysis has so often disclosed, the *first* accident could have been prevented.

How successful will the conference be? Only the ensuing accident rates will be the true indicators. But, as past conferences have disclosed, the recommendations that will come out of the 1962 Safety Congress will be the best that dedicated men can provide. With their monitoring and guidance, application of these recommendations during 1963 should have a marked effect on conservation of our defense resources. ★

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SABRE liner

THE EX-GOONEY BIRD DRIVER couldn't keep from smiling as he walked toward operations. Behind him was parked a sleek little twin-jet utility transport. In it, after a short period of transition and ground school, he had made a tremendous step. He had graduated to a high speed, high altitude, twin-jet utility transport. As expected, he had to make more adjustments than former F-86 jocks, for example, but he had encountered no real problems. The nose high landing and lift off attitudes soon become familiar, and training and study take care of other swept wing characteristics for the straight wing folks.

This pilot's pleased acceptance of the T-39 Sabreliner is fairly typical. Nearly half of the Air Force buy of 149 has been delivered and a representative cross section of pilots from most commands have now had a chance to try their hands at the controls. The bird performs as advertised—better than expected by those who anticipated such things as deficiencies at high altitudes from a no-boost control system. But, like any new piece of complex equipment, the T-39 takes a bit of understanding. And, being an airplane, it has some bugs. The understanding requirement centers primarily in the flesh-and-blood servos on the flight deck; the debugging process is being handled by mods.

For comments on the bird, good and bad, we talked with pilots and maintenance personnel. For evaluation of these comments, and particularly for explanation of problems and what is being done, we talked to the men at North American who build the airplane.

• DESCRIPTION

The T-39 is a twin-jet utility transport powered by two Pratt and Whitney 3000-pound thrust J60-P-3 engines mounted in pods on the aft fuselage. It is designed to carry two crewmembers and up to four passengers. In appearance it resembles a miniature airliner with its round fuselage and swept back wings and tail. The wings are equipped with flaps and ailerons on the trailing edge and leading edge slats which open at low speeds.

Entrance is through a door on the left side forward of the wing, and there is an in-flight escape hatch in the floor midway of the fuselage. To open this door an inner access panel is raised and an actuating handle is pulled to operate an explosive device that blows off the outside door. In addition to providing an opening for escape, this system extends a speed brake ahead of the door which acts as an air baffle to protect persons bailing out. The system also retracts the main gear wheelwell doors, if the wheels are down, so that the person bailing out does not strike the doors.

So far no bailouts have been necessary, but dummy drops indicate that the system performs as designed. Recently a pilot was demonstrating how the system works and pulled the handle while the aircraft was parked on the ramp. It worked all right—the door flew off. Fortunately no one was under the aircraft at the time.

Both the entrance door, which contains steps for entry, and the in-flight escape hatch have inflatable seals to maintain cabin pressure. Caution should be used in adjusting the main entrance door or excessive wear and premature failure of the seal may occur.

• WINDSHIELDS

Since the aircraft was designed for civil as well as military use—and has recently been certified by the FAA under Part 4b of the CAR—there are certain features which carry over into the Air Force version. One of these is the requirement for a birdproof windshield. Tests indicate that the windshield meets the requirement for withstanding the impact of collision with a four pound bird at a relative velocity of 350 knots.

The windshield, therefore, is of special sandwich construction. Some delamination has occurred as well as cracks in the outer layer. These may cause a break in the heater element which in turn might result in overheating. The first indication of this is bubbling, which should immeditaely alert the pilot to turn off the heat. In some cases frosting may occur around the temperature

T-39

sensor but this is no problem, merely obnoxious to look at.

• CONTROLS

Although the T-39 is a relatively high speed aircraft, an all mechanical control system provides adequate control while insuring maximum simplicity and reliability. Trim systems are operated by electro-mechanical actuators. As would be expected, heavier control forces are experienced at high speeds, especially at lower altitudes.

• NOSE STEERING

The aircraft has nosewheel steering which is engaged by a button on the control wheel. This button is pushed and released to engage the steering mechanism. To disengage, the same procedure is followed. In any case, when the button is mashed and held down nosewheel steering will be engaged. Bumps that cause the nosewheels to leave the ground will disengage the steering only while the wheels are off the ground. If all gear leave the ground, steering will have to be re-engaged.

In early airplanes a hard over signal would cause the aircraft to veer off. This has been corrected by a modification with a schedule completion date of mid-1963. Beginning with the 49th aircraft green lights have been installed above each instrument panel to indicate that nose steering is on.

• ENGINE INSTRUMENTATION

Cockpit indications of thrust are presented via three instruments: Tachometer, EGT gage and P_{T5} (exhaust total pressure gage) which measures the thrust level of the engine. Don't exceed the maximum on any one of these three instruments. To avoid exceeding the maximum on the P_{T5} the pilot will have to throttle back during climb; if it is desirable to maintain military power precisely, frequent recomputation of engine thrust is necessary.

New computers for figuring P_{T5} are now in the field and the old J-201 prototype computers should not be used. The word "prototype" does not appear on the new computer, and it has printing on both sides. The old computers are not to be used, even if the new ones haven't been received. Instead refer to the charts in the Safety of Flight Supplement (1T-39A-SF-1-23).

If computed P_{T5} can't be achieved one of four things is wrong: the computation was wrong, the engine is out of trim, you have a sick engine, or something is wrong with the indicating system.

Another gage that has generated questions is the oil pressure gage. Normal oil pressure is 40-50 pounds and if oil pressure falls as low as 35 psi, the engine concerned should be shut down. At 28 psi a low oil pressure warning light illuminates. The light is a last warning if the pilot hasn't recognized the gage indication. The difference (35 to 28) makes allowance for the tolerance band of the switch that operates the low oil pressure light.

• ICE PROTECTION

Ice protection equipment is comparable to that used on all-weather fighters and is designed for penetrations of icing conditions for short periods only, as in climbout and descent. Systems include: heated windshields, heated pitot heads, anti-ice spray mats on wing inboard leading edges to prevent ice from forming that might break off and be ingested by the engines, heated engine inlet and guide vanes (for the same reason), fuel heaters to prevent or remove ice formation in fuel filters, and a heated cabin conditioning system air inlet in the dorsal. Each engine also has an ice detector to show ice formation.

Essentially, all systems are anti-ice systems and must be turned on prior to entering areas of visible moisture in the +5 to −20 temperature range. It is extremely important to give systems time to come up to temperature before penetration. Engine damage has occurred when the systems were not turned on in time.

The pitot tubes on the first 48 aircraft were found to be deficient. These are being replaced with plug inlet tubes. Modifications are also being made to the static systems in the early aircraft because inadequate moisture drainage occasionally caused loss of these systems.

T-39 SABRELINER

• SINGLE ENGINE

At 17,760 gross, single engine rate of climb approximates 1500 feet per minute at standard day, sea level conditions. Of course single engine performance, as in any aircraft, degrades as field elevation and temperature increase.

With engines located close to the center line of the fuselage, as in the T-39, very little rudder correction is required at normal flight speeds. Rudder requirements increase, of course, as speed decays. At recommended handbook speeds adequate directional control can be maintained with no difficulty. Adequate cabin conditioning can be maintained on single engine, even at 40,000 feet at any power setting. (Engineering's comments were, "I don't know how we stay there on a single engine. After reaching that altitude on two engines and losing one, it is an advantage to maintain adequate air-conditioning until a lower altitude can be reached where single engine straight and level flight can be maintained.)"

• ENGINE FLAMEOUTS

Some chronic flameouts have occurred, usually at high altitudes and low airspeeds. Improper fuel scheduling appears to be the problem.

A safety of flight supplement has been issued and research is under way to find a fix. Restarts have been no problem.

• FLIGHT DIRECTOR SYSTEM

There have been some problems with the flight director system, and/or pilots' understanding of this system. Here are some suggestions:

If you suspect a malfunction, check the compass slave indicator in straight and level flight. If the needle is in the center and wiggling, the compass system is operating normally. If not, this should be taken as an indication that the compass may be precessing. Cross check with the standby compass, and if precession is occurring, try manual slaving. If this is not effective, select manual position and align with the standby compass heading.

At all times, with properly functioning equipment, there should be general agreement between the copilot's heading card and the pilot's horizontal situation indicator and the standby compass.

A faulty compass indication can lead pilots to believe TACAN and OMNI are inoperative because bearing indications, as read off a faulty compass card, would be erroneous.

Some of the earlier aircraft experienced standby compass error when the standby inverter was used. This was traced to return currents through the windshield framework. Standby inverters are now being insulated to minimize this. Standby compass errors have also been noted when pitot heat is first turned on. This is under study. Early experimenting disclosed this to be on the order of 10 degrees initially, then dropping to approximately two to three degrees.

A reminder: When flying TACAN the selector switch must be in TACAN position. (VOR position when on VOR.) Remember, no OFF flag will show when the pilot attempts to fly a TACAN course with VOR selected. Essentially, this is analogous to attempting flight on a radial of one VOR with a different VOR tuned in.

Possibility of additional equipment installation, such as ADF, is receiving some consideration.

• ELECTRICAL SYSTEM

Loss of the main inverter results in loss of IFF, TACAN and copilot's instrument integral lighting. This does not happen very often because of inverter failure; But in the first 36 aircraft, loss or shutdown of a DC generator caused the main inverter to shut down and the smaller standby inverter to start up. Beginning with the 37th aircraft, this is being changed so that when a DC generator fails or is shut down, the spray mat will go out rather than the main inverter. The first 36 aircraft will be modified. A second independent vertical gyro system was added for the copilot at T-39A 14 and subs. Loss of the main inverter results in loss of the copilot's vertical gyro in airplanes 14 through 36. Airplanes 14 through 36 will be modified to the 37 and subs configuration where loss of the main inverter does not result in loss of the copilot's vertical gyro.

• FLIGHT CHARACTERISTICS

Generally, flight characteristics are excellent in all regimes and configurations. The T-39 has met rigid Air Force safety requirements as well as FAA requirements similar to those of commercial jets.

During initial climb, considerable longitudinal retrimming is required because fuel is first burned from the fuselage tank located aft of the cabin and a considerable distance from the aircraft CG. Most pilots don't even notice this characteristic.

At low speeds a nose-up pitching moment is experienced as power is advanced. The solution here is to advance power gradually, or expect and be prepared for a moderate trim change.

• LOAD LIMITATIONS

The T-39 is an airplane that should be loaded carefully according to the handbook. The load list in the book was designed to keep the CG within the stability limits of the aircraft. Misloading may permit the airplane to stay within the stability limits in level flight attitude, but prolonged flight in another attitude might put the CG out of limits due to fuel shift in the swept wing.

Limits on the weight permissible on the aft floor should be carefully met. Neither the floor nor the aircraft structure is designed for excessive weight in this area and overloading might cause structural damage.

• FUEL IMBALANCE

Wing fuel imbalance has been experienced. A fuel crossfeed and tank selector switch provide a simple solution should imbalance occur. Early aircraft (prior to 60-3483) without this system are being modified. Balancing can be done on the ground or in flight, but, in any case, no faster than the engine fuel consumption rate.

As stated initially, the T-39 is an honest, pilot-liked high performance airplane. Where deficiencies have been found, modifications are underway.

More detailed information is to be found in the Dash One—always recommended reading. ★

YOUR DECISION

THIS WILL, WE HOPE, BE A THOUGHT PIECE. If it achieves its goal, you will read it, consider what you would have done and apply the results to future decisions.

One thing more. Visualize yourself as the pilot in command in each case. As each situation is presented decide what you would have done—not should have, necessarily, but would have—then go on and see what happened in the actual case.

• You are pilot of a twin engine, radar equipped, transport type aircraft. You are on the east coast preparing to depart for your home station on the west coast. You have been out all week. It's Friday morning. You and your passengers are all anxious to get home. Several of the passengers have indicated that they hope you can make it all the way. There is a line squall in the midwest, followed by a cold front. Both extend from border to border.

In this case the pilot planned and flew a flight to an Air Force Base short of the cold front, RON'd, and cleared out the next morning.

• The pilot of a light personnel transport planned a flight over mountainous terrain. The weather was unfavorable—severe turbulence and thunderstorms. He had no anti-icing or de-icing equipment. He was well qualified in the aircraft. There was a possibility of getting through VFR.

In this case the pilot decided to go. A routine position report over an Omni station along his route was the last ever heard from him. No trace of pilot, plane or passengers.

• A pair of non-Air Force pilots checked weather. The planned route of flight would take them through a severe weather warning area. Thunderstorms, and tornadoes existed. Conditions were not expected to improve for several hours.

They flew their flight planned route; that is, they did until they got into the area of bad weather, then something happened. Both were killed in the crash.

• The crew of a twin engine transport checked weather during a refueling stop at Albuquerque. Weather was clear, except for roll clouds over the mountains and a 2000-foot ceiling at destination. Severe turbulence was forecast at all altitudes from the surface to over 20,000 feet. Ground stations along the route were reporting surface winds up to 50 knots.

This crew and all passengers spent the night in Albuquerque.

• Forty passengers were on a four engined transport due to arrive at destination within a severe weather warning area before noon. Indications were that it would be possible to vector around the areas of turbulent weather and get in before the weather got too bad.

This trip operated, but not quite to planned destination. Short of destination the pilot could be heard calling for routing to a base north of the intended landing area because of turbulence that was being encountered. He made it.

On the basis of what you have read so far, it might be concluded that this was no day to fly. Actually, not so. Many flights were made. Most, as is usually the case, operated uneventfully. Possibly several even operated in the severe weather warning area without incident.

This brings us to the crux of our story. There is a point at which the pilot must make a decision. This we could depict as a balance point. Sometimes—a 200 mag drop, binding controls, high EGT on start—the decision is simple. Sometimes—mag drop of 70 instead of 65 maximum, a slight stiffness in the controls, EGT just slightly above normal—the decision isn't so simple. After all, we only have to live with our own conscience in such cases. We are almost on the balance point. A little thing—the engineer shakes his head, we won't go, he shrugs a "no sweat," we go. If we've just been called from the office to fly a part to another base, the slight stiffness may cause an abort; if we've delivered a part and this is the going home leg, the stiffness would probably have to be more pronounced. The EGT decision is going to be affected the same way.

Now let's go back to the real examples we used in the beginning. Except for one instance, all these events happened on the same Friday. Are homeward bound crews and passengers a little more prone to press on on Friday than on, say Tuesday or Wednesday?

Let's consider the light utility plane pilot. A crew from his same base had crashed and killed themselves not six months before trying to fly VFR in marginal weather. Are pilots egotists? Do they believe the bad things always happen to the other guy?

And the two pilots killed in the crash when they attempted flight through the thunderstorm area. How bad was the weather, really; was that what got them, or did they experience some other emergency that, coupled with the weather, was too much?

The pilot with the 40 passengers found out the weather was bad. He found out by flying into the area, then calling for Metro to help him find a route out of it and a destination where he could land.

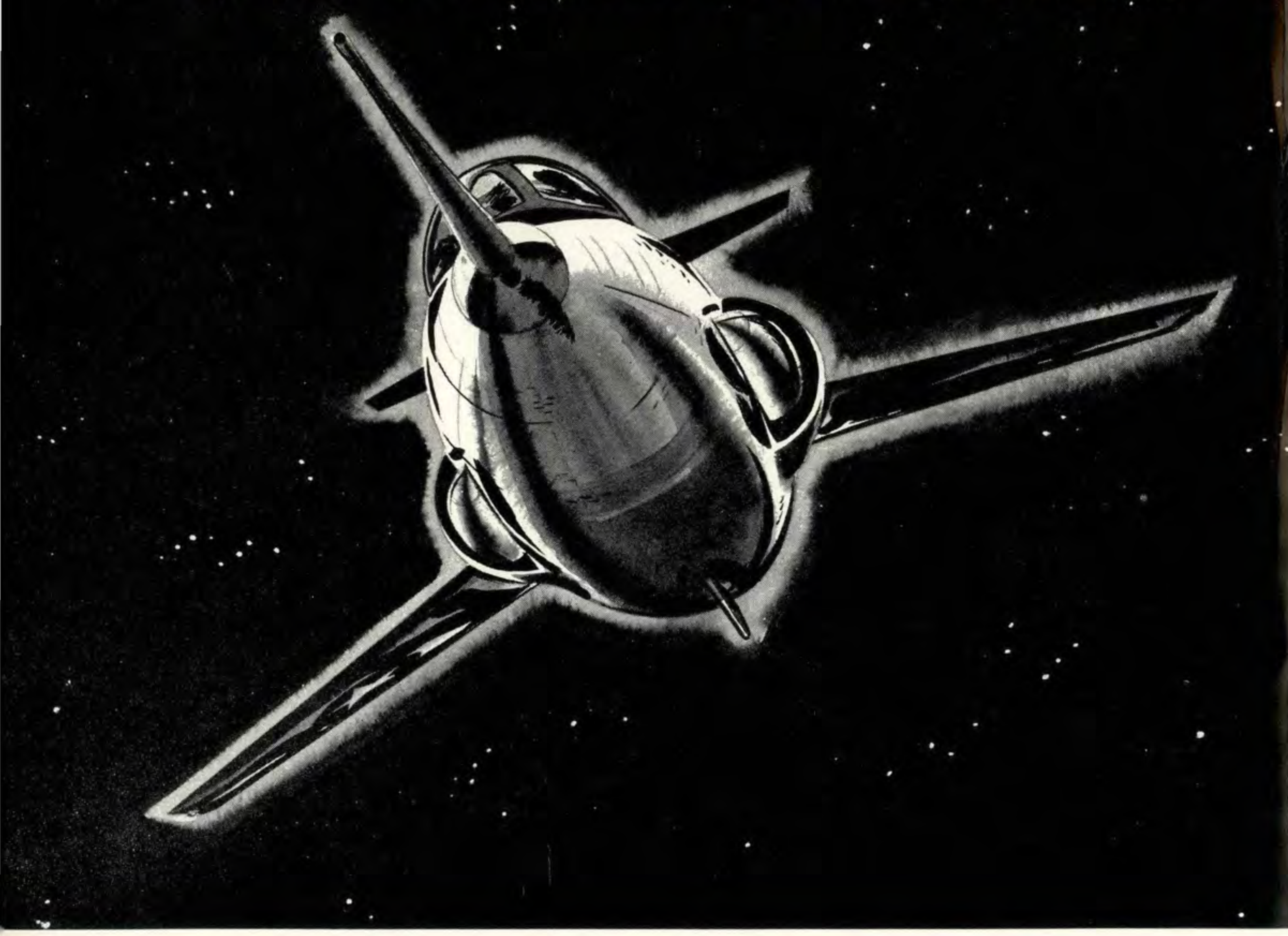
What causes one pilot to go—another to stop; or the same pilot to go one time, when, another time, he wouldn't under the same set of conditions? Do you consider facts, then base your decision on facts alone—no emotion, no whim, no outside pressure or influence?

There were only two accidents. We will hear more of them than of all the other flights combined. But there could have been more. Transient traffic through Albuquerque dropped to almost nothing. Other aircraft stopped short of the front. Several were stored in hangars, just in case.

Several flights were late; some hours, some one day, some two. They were uneventful. There isn't anything dramatic to report on these. Sure, we care about them, but we know we don't have to slant safety stories their direction. ★

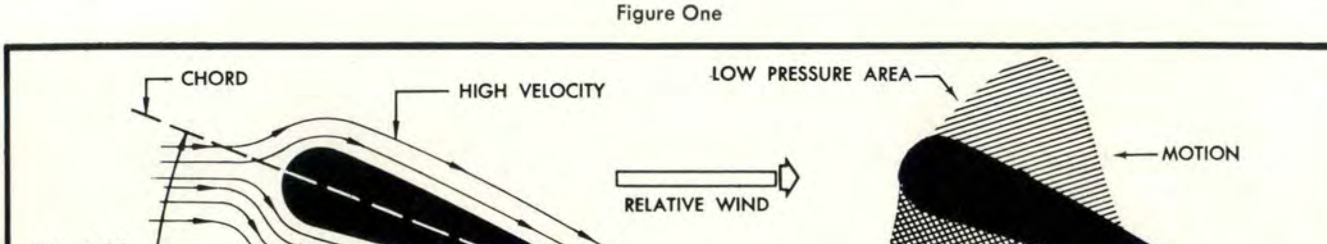
Colonel Carlos J. Cochrane, Director, Flight Safety, Norton AFB, California

COMPRESSOR STALLS



John M. Fritz, Test Pilot, General Electric Co., Edwards AFB, Calif.

Figure One



...their cause, symptoms, and cure.

As Gertrude Stein might have said—"A stall is a stall is a stall is a stall . . ." In the past years we poor F-104 jocks have been bombarded with hot stalls, cold stalls, rotating stalls, hang-ups, engine surge, high and low corrected speed stalls, duct stalls, cold shift stalls, ad infinitum. I don't intend to define or discuss the merit of these terms; instead, I would like you to forget you ever saw them while we get down to basics.

We have all been told that a jet engine compressor blade is like an aircraft wing, and like an aircraft wing, it can stall. But why? Well, the compressor blade generates air flow the same way a wing creates lift—by causing a region of higher velocity, lower pressure on one side of the airfoil and lower velocity, high pressure on the other side. (Figure 1). The result is airflow from the front of the compressor to the rear, at ever-increasing pressure, so that it can be delivered to the combustion chamber, heated, and exhausted out the nozzle at a greater velocity than it had when taken aboard at the inlet, producing thrust. Stall occurs whenever this airflow interrupts its normal rearward path and slows or stops at some stage in the compressor.

The answer to the $64 question—why does the air flow stop—is the same as for an aircraft wing. The axial (front to rear) velocity of the air through the compressor is reduced to the point where the critical angle of attack of the airfoil-shaped compressor blade is exceeded; the blade can no longer induce flow, and it "stalls." (Figures two and three.)

The answer to the next question—why does the airflow's axial velocity slow to the point where the blade's critical angle of attack is exceeded?—is many-sided; compressor FOD can destroy the blades' shape and eliminate their ability to pump; corrosion on the compressor blades and stators can reduce their capability to pump air at ever-increasing pressure, the same as frost on an aircraft wing can destroy its ability to create lift. If the engine acceleration fuel schedule on a throttle burst is too high, pressures in the combustion chamber may rise to the point beyond which the compressor cannot pump its air—as a result the axial velocity of the air slows to the point where the blades stall. Or if, in the case of the J79, the inlet guide vanes should be too wide open for a given engine condition, the front of the compressor will pump too much air or *over-flow* the rear of the compressor; as a result the air tends to pile up in the rear, axial velocity slows down, and the compressor stalls. Other factors, such as high aircraft G load and high angle of attack with its resulting inlet distortion, or operation at high Mach numbers and CIT's outside the handbook limits can also lead to engine stall.

Now that we have some idea of stall cause factors let's get to the part that directly concerns us pilot types—how do we recognize stalls, and what do we do about them? Most of us are familiar, either from personal experience or overhearing the big boys at the bar, with the rumble, "bang-bang," or vibration associated with a stall. While these sounds and sensations are usually good indicators, they are not always present; and when they do exist these seat-of-the-pants clues should always be confirmed by the gages. The EGT gage should be the first instrument checked when a stall is suspected; if it is abnormally high, a stall probably exists. In a low altitude stall, the RPM will also be unwinding or *hung-up* in the 70-80 per cent range, even though the throttle is calling for higher power. Combined with the high EGT and unwinding or hung-up RPM, will be a wide open nozzle. The nozzle is open not due to a nozzle malfunction, but because it is attempting to reduce the overtemperature accompanying the stall. For the following reasons EGT, RPM, and nozzle must always be consulted to properly diagnose a stall: 1) Noise, rumble or vibration may not be present to a noticeable degree. One pilot who had a stall shortly after takeoff stated that he would have thought he was flamed out if he had not seen 750°EGT! 2) A wide-open nozzle might mislead a pilot into thinking he had nozzle failure, unless he checked and saw EGT going overboard. A hapless jock

Figure Two

Figure Three

suffering from tunnel vision proved this point, and the handle he pulled after the nozzle closure handle was the D handle between his legs.

The procedures for stall clearing in the current F-104A and F-104C Handbooks are up to date and are the best methods which field and test experience can produce. The "Stall Clearing Below 15,000 Feet" procedure is the most critical, due to the proximity of the ground while the airstart is being executed. That the procedure does work, and work rapidly, has been proved several times. One sharp lieutenant in an F-104C had a stall at 400 feet terrain clearance, 325 knots, just after takeoff. He went through the complete low altitude stall clearing procedure, including letting the RPM unwind below 60 per cent (as required before the advent of the P-1 Main Fuel Control), regained normal engine operation, and pressed on. He did suffer, however, from a nagging flight commander, who chewed him out for a slow join-up. Not to be outdone, an ANG troop in an F-104A played the same game on a night, weather, ILAS final approach when he experienced a stall just prior to extending the landing gear. He verified the F-104A Handbook requirement of allowing the RPM to unwind to 60 per cent after stopcocking before re-advancing the throttle to Military for the air start. On his first attempt, being the nervous type, he reopened the throttle above 60 per cent, and following light-off, RPM hung-up around 80 per cent. He again stopcocked, and, as RPM hit 60 per cent, advanced the throttle to Military. The engine accelerated normally. During these two attempts he lost approximately 600 feet of altitude and 60 knots of airspeed. He was graded down on his approach, however, when the GCA monitor noted that his flight path deviated somewhat from the prescribed three degree glide slope.

These two incidents are cited not to imply that the pilot should stick with the aircraft regardless of the situation, but rather to demonstrate what a sharp pilot, having recognized his problem, can accomplish using the present Handbook procedures "by the numbers." If in your judgment you can afford 15 seconds for a stall clearing attempt, and still eject safely if the engine fails to recover, then perform the clearing procedure exactly as stated in the Handbook. If, however, using this much time would jeopardize your bailout capability if the stall is not cleared, then eject immediately. As the saying goes—"When in doubt, bail out."

Having knocked all the descriptive phrases applied to stalls in the first paragraph of this effort, I will now exercise poetic license and create some titles of my own. These categories are based on the area of the aircraft operating envelope in which they occur. They are:

- Low Altitude—Subsonic
- High Altitude—Supersonic
- High Altitude—Subsonic

Let's examine them individually.

• LOW ALTITUDE STALL

The low altitude stall (below 15,000 feet) normally begins with a *chug* or *pop*, followed by mild vibration, as opposed to the loud banging characteristic of a high Mach stall. Thrust loss is immediate and evidenced by rapid aircraft deceleration. The engine gages will give positive indications of the stall:

1. EGT will be 700-800° or higher,
2. RPM will drive down and hang-up in the 70-75 per cent range,
3. Nozzle will indicate 9-10 units as nozzle goes wide open in an attempt to lower EGT.

Engine response to throttle manipulation will not be normal, and a throttle advance may only increase the overtemperature and the intensity of the vibration felt by the pilot. Note that this simultaneous existence of high EGT, low RPM, and wide open nozzle is conclusive proof that a stall exists. Stall is easily distinguished from open nozzle failure, in which case the open nozzle is accompanied by low EGT and normal RPM response. The "Engine Stall Clearing Below 15,000 Feet" procedures should be applied to cure this ailment.

• HIGH ALTITUDE—SUPERSONIC

The high altitude, supersonic stall usually occurs only at Mach numbers above 1.8 Mn. Any factor which causes a large disparity between the amount of air the duct is recovering and the amount of air the engine requires can contribute to a high Mach stall. These cause factors include a deteriorated compressor, foreign object damage, late T_2 reset, failure of by-pass flaps to open fully, and exceeding the CIT limit. Distortion of inlet flow, such as that caused by a refueling probe, gun firing, large yaw angles, or negative G can also reduce stall margin. If the aircraft Mach limit and the engine CIT limit are not exceeded, and negative G is not induced, a normal engine-airframe combination should not stall anywhere in the high-Mach envelope.

The supersonic stall is often preceded by duct rumble, which you can detect by an intermittent muffled rumbling and mid yaw pulses which coincide with the irregular rumbling. Engine gages will be normal at this time. As any of you who has experienced one will confirm, the actual engine stall is marked by severe, loud banging, accompanied by aircraft vibration and deceleration. EGT fluctuation between approximately 550-700°C will occur concurrently with the banging. You should use procedures listed under "Engine Stall Clearing Above 15,000 Feet" in your Pilot's Handbook to clear the stall.

If the stall occurred in A/B, a retard out of burner and subsequent aircraft deceleration may cure it. If the stall reoccurs with the throttle below Military, an advance to Military may help; if that fails, retard to Idle. EGT must be monitored continuously, and if the engine is experiencing steady-state overtemperature, stopcock. An immediate airstart can then be made, without waiting for any particular airspeed or windmilling RPM. On one occasion following a stall at 1.8 Mn on an F-104 equipped with a refueling probe, I went through the clearing procedure, including an airstart, and was back in full A/B operation by the time the aircraft had decelerated to 1.6 Mn. So stopcocking does not commit you to several minutes of glider time. While accomplishing the clearing procedure, you may also help the situation by pulling moderate positive G—this will often restore normal duct flow. Generally, however, a high Mach stall will clear itself in spite of pilot action as the bird slows down, and stopcocking is usually not necessary.

• HIGH ALTITUDE—SUBSONIC

A third type of stall, the high altitude, subsonic stall, may not be recognized as such by the pilot since an

immediate flameout usually occurs. This stall will usually occur only if aircraft flight speed is decreased below minimum level flight speeds at altitudes above 40,000 feet and engine transients, such as a throttle burst, A/B light or switchover are made. If angle of attack is high, and a large pitch rate or yaw angle is induced, inlet duct distortion may be raised to the point where the engine will stall. These conditions might be created when trying to top a thunderhead or simulating combat maneuvers at low subsonic speeds.

If the aircraft is not operated at speeds less than the "Thrust Limited Ceiling" boundary denoted on figure 6-7 of the F-104A and C Pilot's Handbook, this phenomenon will probably never occur. If you are going to operate near this minimum speed line, it is best to use full A/B rather than partial A/B, since full uniform afterburning will not blow out anywhere in the steady-state maximum thrust envelope shown on the aforementioned chart. If partial A/B is used at these extreme high altitudes and low speeds, the A/B might blow out and the resulting engine transient cause a stall.

Since this stall is usually followed immediately by an engine flameout, it is quite easily recognized. You will hear a slight bump or pop followed by silence and a sinking sensation. RPM will be unwinding rapidly and EGT will be low (as opposed to high when the engine is operating in stall). An "Engine Air Start" procedure should be initiated immediately. If you are fast enough on the airstart switches, there is a good chance of getting the engine started before RPM drops below 90 per cent, thus avoiding the discomfort of an explosive decompression. If your stall occurred on an A/B light or throttle burst to Military, retard the throttle out of that position so you don't repeat the fiasco after the airstart. And, most important, since slow airspeed and high angle of attack led to the situation, drop the nose to pick up best glide speed—it's not necessary to drive faster than this, however. As speed increases and altitude and angle of attack decrease the engine re-enters the envelope where it can function normally.

• *"HANG-UP"*

If you were slow on the Air Start Switches and RPM unwound to below flight Idle before you got ignition on, a "hang-up" may occur at about 70-75 per cent following light-off. EGT will be moderate but rising abnormally, and you will feel a slight buzzing or high frequency vibration. If the throttle is momentarily stopcocked and RPM allowed to drop approximately two to three per cent before re-advancing, the stall will clear and the engine may accelerate normally. This procedure is actually a part of the "Engine Air Start" procedure under step 2. "If immediate relight is not obtained, or *RPM hang-up occurs following relight,* Throttle — Positively Off, then move immediately to Military." Hang-up occurs because the engine minimum flow is slightly high for the high altitude and low airspeed existing at light-off. It usually occurs only above 35,000 feet, and as your aircraft descends at best glide speed, start conditions rapidly improve.

Flying with the RAT extended can also induce stalls, especially above 30,000 feet. The emergency section of the Pilot's Handbook gives some good scoop on this condition. I would like to emphasize, however, that even below 30,000 feet the throttle should not be handled as casually as under normal conditions. Since a throttle retard below 90 per cent brings a normal engine closest to the stall line, it's not a bad idea to avoid this maneuver during critical phases of flight, such as landing. If VFR, I would consider making a precautionary pattern, so that power changes during the pattern would be unnecessary. If you are committed to an instrument approach, or prefer a normal 360 degree overhead approach, try to fly the pattern so that the throttle can be kept at or above the 92-94 per cent power range. Since this power setting is about equal to that required on initial or on a final approach, it should be no problem. If stall does occur, normal stall clearing procedures, depending on altitude, should be applied. I don't mean to imply that stalls are likely at low altitude with the RAT extended; I just believe in using whatever factors I can control to stack the cards on my side as much as possible.

In the final analysis, three areas of knowledge are your best protection against stall:

1. Knowledge of aircraft maneuvers and engine transients which can contribute to stall, and knowledge of the areas of least stall margin in the F-104 envelope.

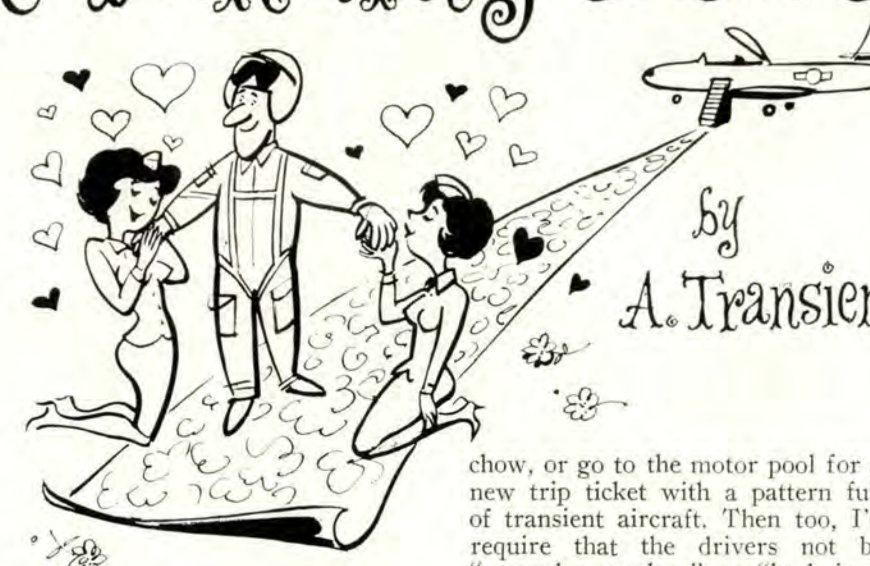
2. Knowledge of engine symptoms which identify stall.

3. Knowledge of correct stall clearing procedures.

This knowledge will help you to avoid certain stall areas, if possible, and will allow you to recognize a stall and take proper corrective action if one should occur.

On the preventive side, by carefully performing the prescribed pre-takeoff engine checks, you are doing all you can as a pilot to insure that your engine is in good shape prior to brake release. The maintenance people are giving each engine the periodic stall check to make sure that an engine with unacceptable stall margin does not get into flight status. And back on the home front, the engineers are developing and testing new compressor and stator blade materials and coatings to see if corrosion can't be eliminated as a stall cause-factor. As these improvements which increase stall resistance are brought into the field, the pilot who is forced to practice airstarts just after the wheels are in the well will be as rare as a bomber commander at a fighter-pilot picnic. ★

If I were running BASOPS

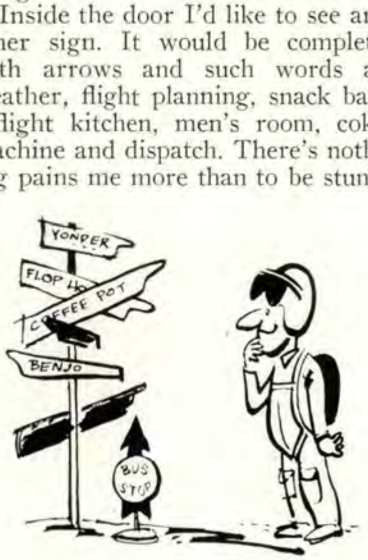


by A. Transient

If I were the BASOPS Officer there are lots of things I'd change.

First of all I'd do something about the signs, especially that big one I see from the dark confines of the crew taxi after my usual wait in the boondocks. It's kind of insulting really, after all these years of never landing at the wrong base. And field elevation, as advertised on this sign, is a worthless throwback to biplane days. Pressure altitude we could use; show that, along with temperature, dew point, altimeter setting and the correct time and we'd have information worth something.

Inside the door I'd like to see another sign. It would be complete with arrows and such words as weather, flight planning, snack bar, inflight kitchen, men's room, coke machine and dispatch. There's nothing pains me more than to be stumbling around trying to figure out where things are and have another confused pilot tromp on my foot with his heavy flying boot.



Another thing, I'd have me a guard at the door. All the hitchhikers, the curious, the kids, dogs, weather worriers, alert people, nervous wives, impatient girl friends, peddlers and honor guard troops would be kept out. It just chills my soul to wait with a clearance in my hand until some woman gets all the information on the Inbound, Outbound, Transient and Base Aircraft boards.

Also, I'd have a baggage room. Not having seven foot arms, I find it difficult to nudge against a pile of B-4 bags, garment bags, tool boxes and loot packages while trying to reach a counter and fill out a form that wants me to tell BASOPS their service is just dandy.

I'd relieve the clearance officer of all those snack bar duties so he'd be available for signing clearances and answering questions like: How do you get transportation? How far is it to town? Why won't transient maintenance have anyone on duty before 0800? Does every transient have to shinny down the side of his T-Bird like I just had to?

I'd scream and holler until the base provided super service in the way of a handy-dandy maintenance kit so aircraft wouldn't have to go AOCP for such things as: VHF radios, UHF radios, Dzus fasteners, an altimeter, O ring seals, clamps and cotter keys.

I'd establish a rule that vehicle drivers assigned to Ops would not be used to run Airman Brown to the laundry, his buddy home for chow, or go to the motor pool for a new trip ticket with a pattern full of transient aircraft. Then too, I'd require that the drivers not be "around someplace" or "back in a few minutes", but exactly where I could find them.

And I'd have a separate room, with no entrance to BASOPS itself, for manifesting passengers. One of the most insurmountable tasks a pilot can be confronted with is to try to file out with 40 apprehensive, baggage-dragging passengers milling around looking for the insurance machine, trying to sneak in a personal weather briefing, asking stupid questions of each other and getting stupid answers.

I would not attempt to demonstrate my ingenuity by cleverly stashing Form 175s, Form 21s, NOTAMS, Let Down books, charts, maps, SID books and the like in unmarked cubby holes. In fact, I wouldn't even hide the pencil sharpener behind a door someplace.

I'd have the snack bar open 24 hours a day, seven days a week. I'd insist that it be clean at all times, not "closed for cleaning" for six two-hour periods out of every 24. I would refuse to let it become a juke-box equipped, teenage hangout or an unofficial club for crew chiefs and secretaries. Only digestible foods would be served and a priority line would be set up for aircrew members.

I'd expand the janitorial service to include cleaning the usually black, plastic faces on the E 6-B's chained to counter tops. The string on the wall map would be changed at least annually.

I'd set up a sort of penny arcade

and handle such things as pencil stubs, squirts of lighter fluid, aspirin and cough drops.

A crew room would be a *must*. Maybe then some of those who are always waiting on weather, or maintenance, or a phone call, or cargo, or each other would do it someplace besides right in front of the BASOPS counter.

Then, when I got all this done, I'd start a BASOPS Officer's Union and lobby for standardization. From having blundered my way around BASOPS for years, I'm convinced that this facility, more than any other, has evolved without the slightest planning. No two are alike, and rarely have I found a good one. A flight planning room at one may be well arranged, spacious, well lighted and well equipped. At the next base it may be a converted closet equipped with an outdated wall map and a kitchen stool. Whatever I have found reflects the ingenuity, the ignorance, the ability and the shortcomings of whoever happened to be holding down the BASOPS Officer's slot at the time of last remodeling.

One more item. It was 105° when I landed here today. I'd find a better use for the electric water cooler than as a support for an "out of order" sign. ★

WINGTIP VORTICES

Adapted from an FAA Flight Standards Service Release

Most pilots have at least a passing acquaintance with the rock and roll in which an airplane engages when operated in air very recently occupied by another moving aircraft. In a well-executed 360- or 720-degree turn, it is common to encounter turbulence created by your own aircraft. Sometimes it is a slight ripple. At other times it may manifest itself quite vigorously and result in a need for considerable control deflection by the pilot.

In the past, the term "prop wash" was commonly applied to this situation. Now we know that although the propellor is responsible for much of this roughness, a greater portion of the turbulence is generated by passage of air over and around the wingtips, resulting in a highly disturbed condition identified as a vortex at each tip.

It is known that the severity of the gusts encountered is directly proportional to the loading of the wing and inversely proportional to the speed and wing span. Thus, a heavy jet transport, for example, leaves the most severe turbulence behind it while flying at slow operational speeds—immediately after takeoff or just before landing. It is possible for the motion of this twisting air to be severe enough that an aircraft entering its path will have insufficient control to overcome its effects. Further, it is possible for the loads which the turbulence will impose to be above those for which the aircraft was designed. Therefore, an airplane may be thrown into an attitude from which recovery cannot be made, if insufficient altitude is available, or it may suffer structural damage which will make control impossible.

Since a slow flying aircraft leaves the most violent wake, the area around a runway is the most likely place to encounter this turbulence at its greatest severity. The hazard is increased by the necessity for staying within rather narrow confines when departing or arriving at an airport and a particular runway. A following or crossing aircraft which is landing or taking off is flying at low altitude and slow airspeed, and may be inadvertently subjected to these dangerous forces.

There is only one solution to the problem: KEEP YOUR DISTANCE. Horizontal and vertical air movement will aid the dissipation of vortex-generated turbulence. On a rough, windy day it will disappear more rapidly than on a smooth, calm day. Fly, if possible, on the upwind side of the track of any aircraft ahead of you. Recent investigation into the problem of vortex turbulence generated by helicopters reveals that a similar condition to that of fixed-wing aircraft exists. The higher the "disc loading" of the helicopter—a term analogous to "wing loading" on fixed-wing aircraft—the more severe the forces in its vortices. Stay above the flight path of a helicopter to avoid its turbulence. When you are "cleared for takeoff" by a control tower, and suspect that wake turbulence exists, you have the prerogative to request additional delay. This request should be made prior to taxiing into position on the runway.

You cannot see this phenomenon which has been described as an *invisible, horizontal* tornado, but it is there! ★

missilanea

Fourteen one-time damage reports (missile incidents) and six accidents occurred in the GAM-72 (Quail) program between January 1961 and March 1962.

Four of the six accidents all occurred when the missile could not be retracted and was therefore intentionally jettisoned for the sake of aircraft safety. The GAM-72 launch operation, or exercise operation without launch, is a sequence of automated events begun by operator control. The sequential events, i.e., track extension, missile and carriage extension, engine start, engine shutdown, missile and carriage retraction, are controlled by a series of limit switches and relays, normal and time delay.

Primary cause factors of the six accidents, and actions taken, follow:

Primary Cause: Shorted wire bundle.

Action Taken: Lengthen and reroute wire bundle to prevent continuous flexing.

☆ ☆ ☆

Primary Cause: Defective wingfold relay.

Action Taken: After study, no further action taken because this was found to be a random failure. Both OCAMA and the contractor consider the relay highly reliable. Used in several places in the system, it normally has a low failure rate.

☆ ☆ ☆

Primary Cause: Defective limit switch.

Action Taken: Modification of limit switches by ECP MDA GAM-72A-126 to replace limit switches if travel tolerance is not met.

☆ ☆ ☆

Primary Cause: Design deficiency of electrical connectors (three separate accidents).

Actions Taken: Modification of launch gear electrical connector by ECP MDA-GAM-72-82.

Instructions for installing launch gear electrical connector issued as TO-21GAM72A-503B.

Modification of umbilical launch gear connector quick disconnect by ECP MDA GAM-72-114.

Aircrew checklist modified to provide check or fire detection light immediately before missile extension to insure electrical continuity (see TO-1B-52 (H, G, and E) (CL)-1-3.)

Modification of camshaft breakaway connector by ECP MDA GAM-72-118.

Revision of Launch Gear periodic inspection cards 99, 106, 111, and 118 to insure camshaft on breakaway connector is in detent position.

Updating all GAM-72 package loading procedures by issuance of TO-B-52E-13 and (CL)-13-1.

Request via SAC message DO/DM 193363 that commanders and supervisors maintain close surveillance of GAM-72 maintenance activities, insuring that highest standards are maintained.

☆ ☆ ☆

Six of the 14 incidents reported during this period showed no trend or causal relationships. One was attributed to operator error; two were missiles dented by objects in flight; three were caused by materiel failure.

The MHU-7M has experienced six (43 per cent) of the total incidents. It is a special weapons armament trailer which, with an adapter, is used for loading GAM-72 packages. There have been repeated failures of the cylinder lift rods since its procurement. It is used primarily for special weapons loadings and when a mishap occurs with a special weapon, it is reported as a nuclear incident. Therefore, AFINS and AFSWC have been aware, concerned, and active in taking a course of action to prevent nuclear incidents. The following actions have been taken:

Hydraulic relief valve kit (TCTO 11N-H5015-502) has been distributed to all GAM-72 equipped squadrons. Installation of kit will prevent damage to cylinder rods if lock pawl should inadvertently engage.

Interim changes 1-2 to TO 11N-H5015-2 and 1-6 to TO 11N-H5015A-2 have been distributed. These provide instructions for setting the pawl actuating cylinder linkage to insure correct adjustment and to prevent inadvertent engagement of pawl.

Interim changes also provide for monthly inspection of all flexible hose on the MHU-7M trailer.

☆ ☆ ☆

Failures and resulting mishaps will decrease as reliability and maintenance experience increase. Already, the first three months of 1962 have shown a marked decrease in EURs submitted, even though the number of squadrons has increased. The mishap exposure has also been decreased by Headquarters SAC having changed missile exercise requirements from two per aircrew per quarter, to two per aircraft per year. ★

• • •

GAR-3A After downloading an F-106, the loading crew placed the missile back in its case. During lowering into the case the GAR was improperly positioned so that the nose cover struck the bottom half of the casket displacing the cover and breaking the mach buster. Inspection revealed a broken stabilizer.

CAUSE: Careless handling and uncoordinated motions of the crew.

• • •

GAR-2A After the missile was downloaded from an F-102 one vertical stabilizer was found damaged.

CAUSE: Personnel error. The GAR had previously been unseated from the indexing point for minor maintenance of the aircraft. The launchers were retracted without the missile being properly relocked to the rail. ★

Lt Col Keith Conley Directorate Missile Safety, DIG Safety

On 1 December 1961, a ski equipped C-130D from the 64th Troop Carrier Wing was en route from Dyess AFB, Texas, to Sondrestrom AB, Greenland. Upon arrival at Sewart AFB, Tennessee, a scheduled refueling stop, the landing gear was lowered and the controls positioned to raise the skis for a wheel landing. The left main ski would not retract, although the gear was cycled numerous times. The air turbine motor was then turned on to retract the skis by means of the emergency hydraulic line. The ATM oversped and tripped off the line rendering the emergency system useless. Technical representatives and ski qualified pilots gathered in the tower below, and, after much discussion, it was agreed the best course of action left was to land skis down on a foamed runway. Staff Sergeant Donald H. Greetan, a hydraulic specialist and passenger en route to Greenland, requested permission to try an idea. Sergeant Greetan removed a hose from the nose strut nitrogen bottle and used numerous odd fittings to interconnect the utility hydraulic system with the emergency hydraulic system by routing the utility pressure through the emergency lines. This permitted the skis to be raised and a successful landing to be made.

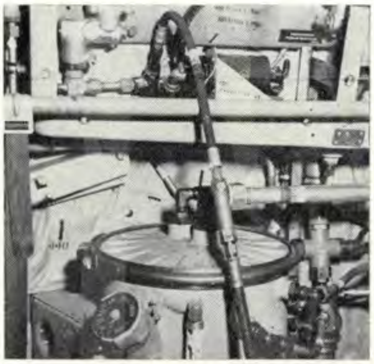
Through Sergeant Greetan's extensive background in hydraulics and knowledge of the C-130 systems, he devised and carried out a plan which averted certain damage to the aircraft and possible injury to 20 passengers and the crew.

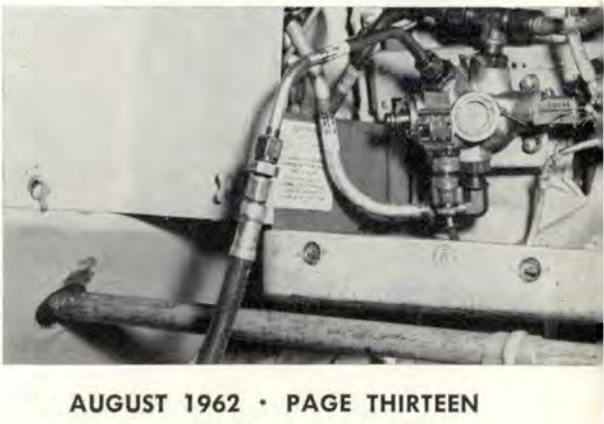
WELL DONE

STAFF SERGEANT

Donald H. Greetan

64th Consolidated Aircraft Maintenance Squadron
Dyess Air Force Base, Texas





CALL THE SHOTS

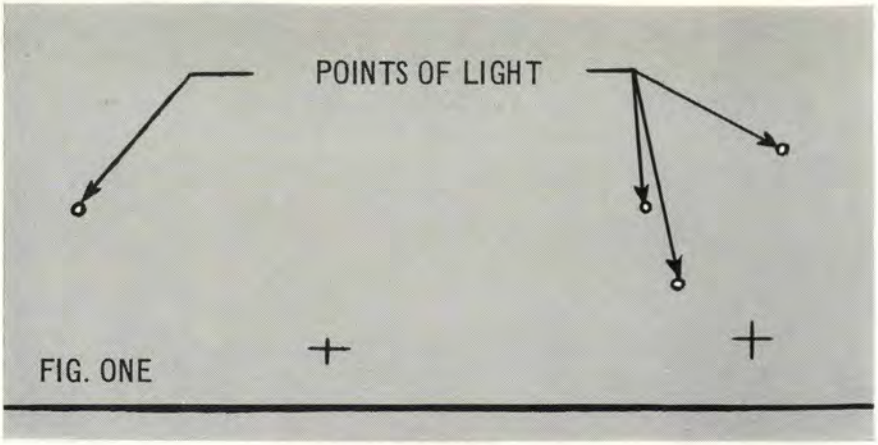


FIG. ONE

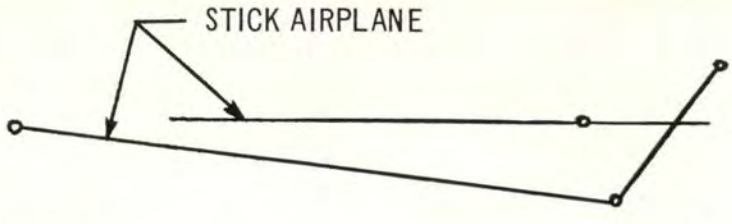
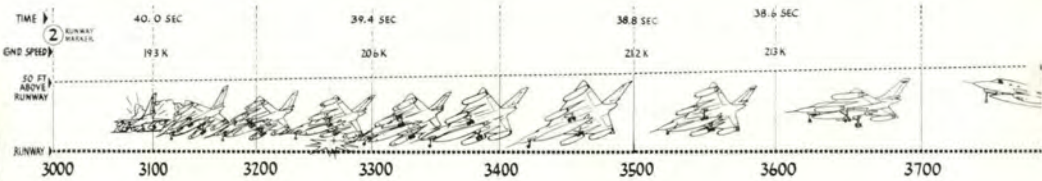


FIG. TWO



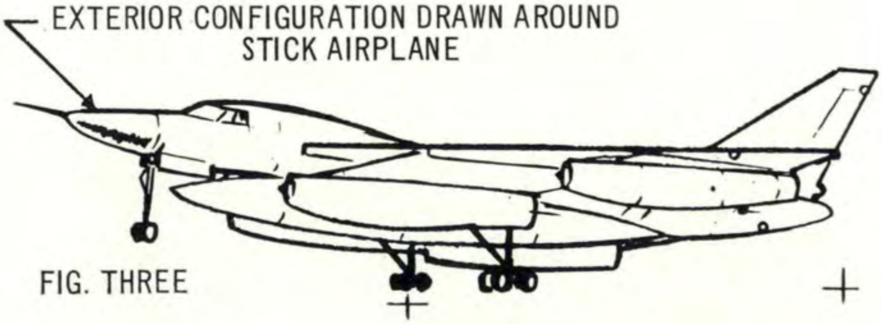


FIG. THREE

Safety men are always on the lookout for another tool that will help them prevent accidents and save lives. The one described here may not be practical for application at all Air Force bases but in those cases where it can be used, it may provide the only witness to an accident.

This system recently provided a remarkable pictorial display of the crash of a B-58 on takeoff in which the three crewmen were killed.

Disintegration of the structure followed by intense fire, precluded investigators from finding the exact cause. There were no transmissions from the crew that could provide a clue as to what happened. Although there were maintenance discrepancies, none was considered to have contributed to the accident. There was, however, a means of tracing the roll and flight path of the doomed aircraft which provided the investigators with a clue as to what happened.

This was a complete photo coverage of the movements of the bomber as it rolled, took off and climbed a short distance, settled back toward

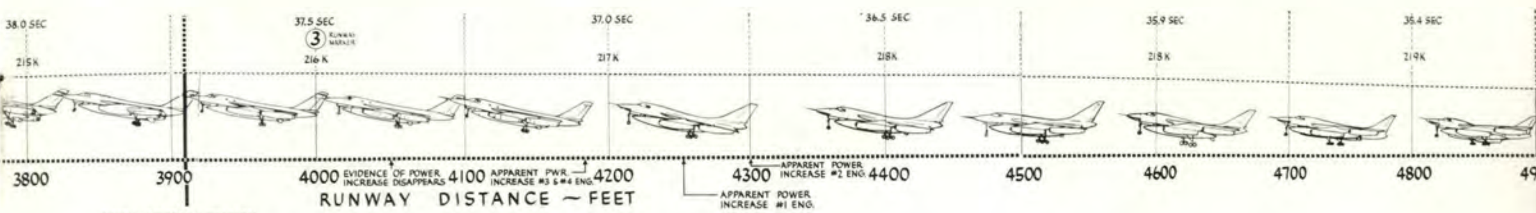


Fig. Four

the ground, climbed slightly, then rolled to the right and crashed. This coverage was by movie cameras mounted in strategic locations to record aircraft movements on the runway. From the film it was possible to reconstruct the attempted takeoff and subsequent crash.

Although it was dark when the B-58 started rolling toward destruction, the photographs showed nose landing gear, navigation, wingtip and anti-collision lights and afterburner glow. From these specks of light on the dark film, Convair flight test personnel were able to identify the lights and from them draw stick airplane sketches. These were then used as the skeleton around which the outline of the airplane could be plotted and drawn. Here is how it was done:

By using vellums in registration with the photographs, illustrators plotted the light locations. (Figure one.) Then lines were drawn between the lights interconnecting them in their logical sequences. For example, a line drawn between the navigation light on the upper trailing edge of the tail section and the anti-collision light on the lower portion of the trailing edge tail section established the tail section of the aircraft. Another line connecting the navigation light on the lower fuselage tail section and the nose landing gear lights established fuselage attitude. Lines connecting the afterburners, when visible, further established attitude. And so on.

The attitudes were cross-checked with photographs made with the opposite sequence camera. They were further checked by using a model of the B-58, plus Polaroid photos of the model in some of its attitudes to prove out plots.

After the stick airplanes were drawn (figure two), the exterior configurations were drawn around the lines and light plots. (Figure three.) Diazo chrome foils were then processed from the sketches and mounted in position, as indicated in the sequence photos, on a scaled drawing of the runway.

The final artwork was reduced photographically to one-half size, integrated with performance data prepared by accident board members, and printed as shown in Figure four.

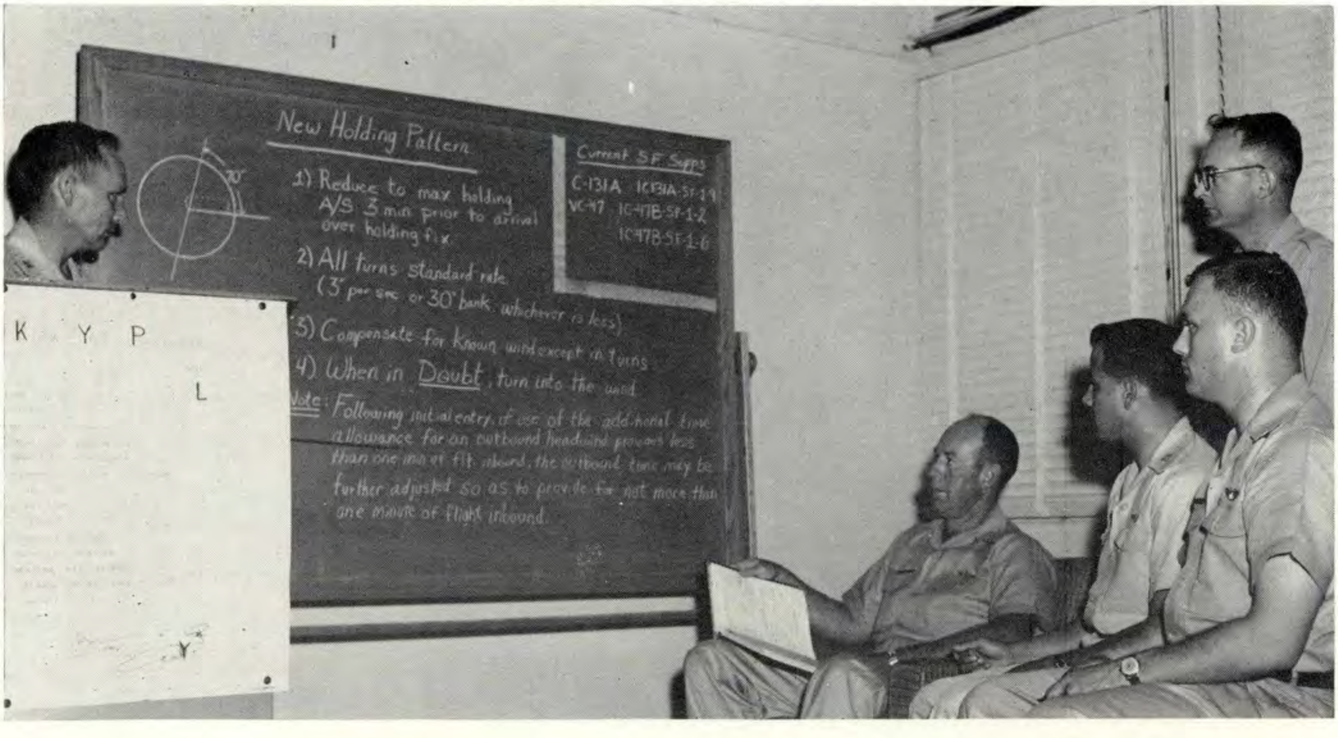
This technique alone did not solve the investigation, but it did assist the Board in its search for the cause factor—ultimately determined to be malfunction or failure of the flight control system. ★

Awards for outstanding flying safety decorate a wall in the 4434th passenger service lounge. Lt. Col. William R. Fritz, squadron commander, and Capt. Robert E. Quick, flying safety officer, prepare to add a new one. Proud of their emblem, airmen (below) make sure it's properly located on tail of squadron aircraft.

The Winning Side

Capt Gerard E. Pritchard, 4434 Air Transport Sq., Randolph AFB, Texas

Continual training keeps aircrews sharp. Instructor, below, briefs pilots on holding pattern.



A UNIQUE SQUADRON whose aircraft have flown more than seven million air miles in 17 years without a single aircraft flying accident observed an anniversary at Randolph last March 14. For the 4434th Air Transport Squadron it was just another day of Special Air Mission flying.

What accounts for this unexcelled safety record? "Basically it's standardization coupled with constant training," says Lt. Col. William R. Fritz, commander. "Our approach to flying is essentially little different from that of most Air Force units. Perhaps we have refined some procedures to fit our needs in light of the DVs (distinguished visitors) we carry. To illustrate: A rough application of brakes during ground operation or abrupt changes in RPM in flight can keep a prospective aircraft commander in a training status for a long time."

Here are some more safety-keyed squadron policies:

• Crews are subjected to many flight and written examinations. An operations manual defines related duties and responsibilities of crew positions and augments the flight handbooks. No-notice or spot checks are given periodically by the squadron's higher headquarters, the 4430th Air Transport Group. Route checks evaluate all members of a crew. No detail is considered insignificant; the preparation of a meal by the flight steward, for example, can be all-important.

• Ground school is conducted for crews when they are not flying missions. Included in the ground school is a periodic visit to the air route traffic control center at San Antonio. This has proved to be extremely effective because of the obvious benefits gained from a first-hand knowledge of ARTCC operation. Monthly study guides provided by the 4430th Group are completed and are followed by written examinations. The study guides consist of 50 to 150 open-book type questions covering regulations, manuals, aircraft systems, and FAA publications to name but a few. The guides have materially reduced classroom training, have isolated study areas and have generally provided a constant level of knowledge.

Sound like a deterrent to motivation? "Actually it has an opposite effect," says Major George E. King, Jr., operations officer for the 4434th. "It stimulates the development of a professional attitude towards flying, notwithstanding the challenge it presents to the individuals involved in a team effort."

• A sense of pride, esprit de corps and teamwork are important parts of the SAM squadron. Members are acutely aware of the importance of their mission. High in-commission rates, on-time departures and arrivals and a general attitude of "every passenger a VIP" are second nature items. The Air Force Outstanding Unit Award, presented in 1959, is carried proudly on the tail surfaces of all the SAM aircraft.

• Extensive preflight planning goes into every mission. A thorough and complete flight plan log is prepared and followed on each leg of a flight. Nothing is left to chance. As the chocks go in place at every stop on a flight the crew chief dip sticks the fuel tanks. Even in the three-point ground attitude it is better than trusting fuel gages. A reasonably accurate fuel consumption rate can be determined.

• Each flight is briefed by the squadron commander followed with a review by the group commander. Since the crews are authorized to land at any airfield, civil or military, every available source of data must be studied and checked. Civil air regulations, FLIP, Airman's Guide, en route charts and approach plates are a source of information and guidance. Flight Handbook performance charts are studied to insure a good margin of safety for all ground and flight conditions. Supervisory personnel constantly stress crew coordination, detailed briefings and compliance with established operating procedures. Cockpit procedures are a demonstration of well-trained efficiency; each phrase read from a checklist must bring a proper response. No moves made overquickly, no errors permitted.

"A constant state of training provides us with a fair amount of flexibility," says Captain Harry Niendorf, chief pilot for the squadron. While most commitments provide ample time for preparation, the nature of the mission occasionally brings an ill-timed telephone call requiring that a flight be airborne within a very short time. Training then really pays off. One such mission occurred on a weekend. A missile gone astray on the New Mexico desert caused some damage to a ranch house in that area. The Army commander at San Antonio decided to get a first hand account of the accident. The SAM crew was airborne within slightly over one hour of the first telephone call; a relatively short time considering that most crewmembers live some distance from Randolph.

Colonel Fritz comments that his maintenance and supply sections do a superb job in keeping the unit's aircraft in tip-top shape. Since the squadron's formation at Brooks Air Force Base in 1945, it has been a tenant unit at two bases and has been assigned to three major air commands, the latest of which is TAC. "Without the splendid support of the host bases our job would be most difficult," Fritz stated.

A story is told in the squadron of a new aircraft commander on one of his first missions. Weather en route home "stinkin." The General and his party arrives. The AC proceeds to brief on rapidly deteriorating weather conditions en route while secretly hoping that the "old man" will react congenially to the now-firm decision that the flight RON. He did. With the wink of a seasoned eye, the General said, "Son, the war is over."

Indeed it is. The war for flight safety, however, is never over, but for 17 years the 4434th has been on the winning side. ★

Maintenance technicians work on aircraft that was on the assembly line the year the airman in center was born. Newer aircraft are gradually replacing C-47s.

LET'S BELT THE AIR FORCE

Fred E. Budinger, Safety Staff Officer,
Directorate of Ground Safety

IT WAS ON FRIDAY, payday, that the airman picked up the seat belts at the base service station. The straps were red, matching the upholstery of his convertible, and the chrome buckles glinted in the sun. A buddy went to the hobby shop with him and helped with the installation. It wasn't much of a job. There was a fellow at the hobby shop who knew just how they should be put in. He explained the procedure, gave them the tools and in minutes the pair of red belts was in place, securely anchored to the floor of the car.

Nine days later, it was early Sunday morning and his buddy wasn't with him, the airman gave the left front seatbelt a real workout. He was on his way back to the base, sleepy, ran off the edge. The shoulder was soft and the red convertible left the highway, nearly upset going through the ditch, then smashed into a tree. Contusions and abrasions—that's what the report said. A tender midsection, a cut on the left arm, bruises on both arms and a bump on the forehead. Insurance would take care of the damage to the car. The seat belt saved the driver.

This airman is one of 60 in Air Defense Command who are alive today only because they were wearing seat belts when an accident happened. These men need no persuasion; they have been sold on the value of seat belt protection in the most convincing way possible. Our goal here is to sell the rest of you.

Last July this magazine carried an excellent article on automobile safety belts entitled "Don't Sit On Your Life Insurance." It was a timely message then. It is no less timely now.

Since that article was published almost 400 Air Force personnel have lost their lives in private vehicle accidents. I know, because a copy of every casualty message crosses my desk. After all the years I've spent in the safety business, I still get a squeamish feeling just reading some of these messages. I keep asking myself—"Why do they keep happening? Do our people have so little regard for human life?"

I've just finished a report of the motor vehicle statistics for March—24 Air Force fatalities in private motor vehicles. Eight of these reports clearly stated that the airman was thrown from the vehicle, and at least six other accidents involved such minor vehicle damage that the use of a seat belt would certainly have reduced the severity of the injuries. Don't our people realize that a seat belt costs less than one day in the hospital?

We have been talking about seat belts for a long time now, and we intend to keep talking. When it comes to safety, talk is not cheap—

it is vital. Ultimately, the message gets through to a few people, and when it results in a heightened awareness, a new consciousness of one's own responsibility — then progress results. We have made some progress, but there is no substitute for a perfect record in the safety field. Our goal is a perfect record. Nothing short of that equates in any way with the value we place on the human being.

More than 15 federal agencies now have seat belts installed in all their passenger carrying vehicles. And they insist that they be used. At a recent meeting of the USAF Traffic Safety Committee it was unanimously recommended that seat belts be installed in all Air Force vehicles. (By the time this article is published the implementing directive may already be in effect.)

If the need for seat belts exists in government vehicles, certainly the requirement is no less in private autos. While we in the Air Force cannot *direct* airmen to install belts (except in those states where their use is now mandatory) we should, no, we *must* exert every effort to convince them of the wisdom of so doing.

The 1925-1 Air Force Communications Service Squadron at George AFB has just completed a drive which resulted in 100 per cent effectiveness. Every man in the organization now has seat belts in his car. The cost of the belts was underwritten for some of the lower grade airmen by the NCOs. These airmen then reimburse their underwriters by paying as little as $1.00 per payday. This is an excellent example of cooperative spirit and determination to accomplish a purpose.

One point to constantly keep in mind about seat belts is that these belts represent a form of life insurance, but, just like some policies, they must be carefully appraised. There are a number of belts on the market today which offer little, if any, protection in the event of a crash. The belt you use in your own car should be expected to meet the same rigid specifications as those installed in a government vehicle. Look for the seal of approval of the American Seat Belt Council. This is your assurance of a quality belt.

Then be sure the belts are properly anchored to the vehicle. For, improperly mounted, they can be completely ineffective.

Now, with the belts in place and properly mounted, there still remains the job of educating ourselves to USE them *at all times the vehicle is in operation.* DON'T SIT ON YOUR LIFE INSURANCE. ★

Results of an accident in which an automobile traveling 65 mph hit a tree. Seat belt (hanging downward in left center) kept driver in the car and he received only minor injuries. (California Highway Patrol Photo.)

USE OF THE BIRD CATCHER

Col Carmel M. Shook, D/CS Materiel, AFSC, Kirtland AFB, N.M.

The Air Force has gone to great expense to provide Bird Catchers on its bases to catch our small birds, hereafter referred to as aircraft. Air Force Regulation 55-42 spells out the procedures for use of the jet barrier on Air Force and joint use air bases. At most USAF bases the jet barrier is left in the raised position for all takeoffs and landings for jet aircraft for which the barrier was designed. For example, on a TAC or an ADC base the pilot knows the barrier is up unless notified otherwise by the tower or operations. This procedure cuts down chatter by the pilot and tower personnel. In addition, the frequency of operation of the barrier is less and barrier reliability is increased.

On joint use bases, where both civil and Air Force aircraft are operating with FAA operating the tower, the pilot is responsible for calling for the barrier before takeoff and before landing. Let's analyze this procedure.

First, there is the radio chatter requesting the barrier, then a delay while the barrier is being raised and finally the tower's reply—"Barrier indicates up and locked," or a variety of other answers, depending on whether the barrier is functioning properly.

The greatest problem on joint use bases is the failure of the pilot to request the barrier as required by AFR 55-42. With an alert tower operator and perfect operating jet barriers, the pilot who has failed to request the barrier and aborts his takeoff has a good chance of having the barrier up for the impending engagement. However, we cannot always depend on all of these variables being on the side of the pilot. Therefore, we must emphasize the importance of the pilot requesting the barrier prior to takeoff and landing.

Kirtland Air Force Base serves both military and civil aircraft, with approximately 80 per cent of the landings and takeoffs made by jets. Approximately 95 pilots out of 100 arriving at Kirtland and 70 pilots out of 100 departing from Kirtland fail to request the jet barrier. We ask ourselves: "To what can we attribute this procedural failure?" First, 35 per cent of the aircraft are transient. Generally, the pilots are from bases where the jet barriers are automatically raised for them. Second, the arrival or departure from a strange field keeps the pilot's mind buzzing with many thoughts other than the jet barrier operation. Then there is the third and all inclusive reason, just plain negligence on the part of the pilot. Which reason doesn't make any difference after the aircraft has rolled off into the boondocks and the Air Force has lost a valuable aircraft and possibly an aircrew.

There are many other air bases throughout the United States that experience similar problems on jet barrier operations, but with the large number of transient aircraft passing through Kirtland, we feel that our problem is unique in that most joint use air bases are restricted to 'Official Use Only' and the number of transient aircraft is small in comparison with ours. For an F-100 at Kirtland, elevation 5300 feet, our 12,780 foot runway is equal to only 8400 feet at sea level.

So please add to the last item on your takeoff and landing checklist, "Barrier, Please." ★

BLOW

HARD

There are approximately 6000 military aircraft based in a "target" area along our eastern and southern seaboards. Periodically, usually during the period June through October, this area is subjected to the 74 mph plus winds of hurricanes. The best way of preventing hurricane damage to these aircraft is to get them out of the way—hurricane evacuation.

Here's how it's done: The Air Rescue Service has responsibility for the Joint Military Aircraft Hurricane Evacuation Plan (JMAHEP) and operates under guidance provided by Air Force joint service regulation 55-4. This reg requires that evacuating commanders maintain a detailed hurricane evac plan for all assigned, attached and transiting aircraft. This plan is to be kept current at all times and coordinated with all tenant units.

Changes affecting refuge requirements are reported without delay. The refuge base commanders, on request from ARS, furnish detailed information concerning facilities that are available at their bases to support evacuation aircraft. This information is entered on DD Form 1055. These completed forms are forwarded to ARS and kept current as changes occur.

ARS can, after receiving the above information, make the preselected refuge assignments based on evacuating commander's needs, and the refuge base commander's capabilities.

However, as in most cases, there is a hitch in the system. What happens if the evacuating base gets ready to leap off and finds their preselected refuge is socked in with weather? The answer is not so simple. This constitutes the major problem in the plan and points out the need for extensive communications capability. First step in finding the correct answer to this multi-million dollar question is a phone call to Air Rescue Service's Command Post at Orlando AFB, Florida, from the evacuating commander, requesting an alternate refuge base. Upon receipt of this call, the people in the Command Post immediately set about finding a suitable alternate. To do this they must first consider aircraft type and number, range, runway length required and other factors. All these details are kept constantly up to date and in easy reach. The Command Post then runs a fast check from the files of refuge information and selects a base that meets the evacuating base criteria. They must insure that the selected base is not already being used to full capacity and/or is not assigned to another base that will probably evacuate. SRO—Standing Room Only—conditions could cause much embarrassment.

They must check weather for present and forecast weather conditions at the proposed refuge base. Last but not least, they must contact the refuge base and obtain approval to land evacuating aircraft. All of this must be accomplished as swiftly as possible for the evacuating base commander is still on the phone chewing finger nails awaiting his alternate assignment. This joint coordination to select a new refuge base may be repeated many times during a single hurricane. During Hurricane Donna in September 1960, over 3000 aircraft were evacuated. Many of these were directed to alternate refuge bases due to inland weather and mission requirements. The guys in the Command Post don't get much sleep on nights like that.

On special request Air Rescue Service will also select and designate refuge airports in the Continental U. S.

John L. Vandergrift, Deputy Director of Information, Air Rescue Service (MATS) Orlando AFB, Florida

for aircraft from overseas locations desiring to evacuate to the U. S. in the event of hurricane danger, or for continental U. S. bases located outside the normal hurricane danger zone.

Theoretically all this pre-planning is the answer. But sometimes there are hitches. On one occasion a refuge base commander closed his base to evacuating aircraft after the birds were on their way. A quick phone call to the general officer on duty at the USAF Command Post reversed this decision in a big fat hurry and all evacuating aircraft were permitted to land on schedule.

Another time a commander stated, in no uncertain terms, that he intended to hangar his aircraft in preference to evacuation. Subsequently he had his engineers evaluate the security of the hangars as the storm's fury mounted. Their concensus that the hangars would probably tumble out of town in a hurry once the big wind hit caused a change of heart here and a rather frantic call to ARS by this same commander. Last minute movement of over 200 short range aircraft resulted.

If your base is in or near the "target" area, a word to the wise: have your plan, keep it up to date, and give ARS a call if you need help. Please make this call in time. ★

WHAT'S NEW?

All Air Force personnel are encouraged to submit items for use in this column. The idea is to share items units are using with other Air Force units. Submission should be made through unit safety officers.

The machine above, which looks like it might be used to measure earthquake intensity or, perhaps, blood pressure, is the brainchild of Lt. Donald Parker, Laughlin AFB weather forecaster. Actually it's a crosswind component meter believed to be the only one of its kind in the Air Force.

Using Lt. Parker's idea, technicians of the 4080th Armament and Electronic Maintenance Squadron built a prototype in their spare time. The device is inexpensive and simple to construct.

The meter is tied into the standard electric wind direction and speed indicators. It gives pilots fast, accurate information, and the crosswind component of gusts can be determined immediately to an accuracy of one knot.

On completion of the trial period a complete report on the meter will be turned over to Air Weather Service and other interested agencies.

Capt. Donald R. James, Director of Safety
4080 Strategic Wing, Laughlin AFB, Tex.

For want of a better name we will call the cards illustrated below Memory Joggers. They were devised in the Flying Safety Office at Chanute AFB. The cards are reproduced on heavy paper, then cut out and assembled into a deck. Each one covers one emergency procedure. One side merely identifies the type of emergency; the other side lists the steps to be followed in that emergency. Pilots can slip a deck into their pockets and do a little brushing up any time they have a few free moments.

Another item that brings Chanute pilots a little closer to their FSO is homemade birthday cards. Pilots receive them and stop by the Safety shop with thanks for remembering their birthdays. One more way of getting aircrews a little closer to the Safety officer.

Maj. Milton Stein, Flying Safety Officer
Chanute AFB, Ill.

. . . a status report

ON 8 MARCH 1961 the President requested the Administrator of the Federal Aviation Agency to "conduct a scientific, engineering review of our aviation facilities and related research and development and to prepare a practicable long-range plan to insure efficient and safe control of all air traffic within the United States." A task force was appointed to conduct this review and came up with a report known as Project Beacon. This report was completed in October, 1961, and submitted to the President on 1 November, 1961. Also in November, the Federal Aviation Agency's Air Traffic Service prepared an analysis of Project Beacon.

First, let's review major Project Beacon recommendations in the area of air traffic control; next, a look at what has and is being done.

1. Control should be on ground available position information, independent of the pilot's navigational information.

2. On high density airways and in congested terminal areas, controlled and uncontrolled traffic should be segregated and speed limits instituted for VFR traffic.

3. Positive control of all traffic above 24,000 MSL, above 14,500 MSL in non-mountainous areas and above 8000 MSL on certain high use airways.

4. Establish Controlled Visual Rules (CVR) for non-instrument rated pilots to permit VFR operation in positive control areas. Separation service would be provided but attitude would be maintained by visual reference to the ground.

5. Below 8000 MSL on certain high-use airways a speed limit should be established for all traffic.

6. Altitude reporting beacon transponders should be required of all aircraft above 12,500 pounds gross weight.

7. The combined SAGE/FAA radar network should be employed for en route control and, along with flight plans, provide the basic control information.

8. In congested terminal areas aircraft should be segregated by performance and special arrival and departure ramps designated.

9. All aircraft landing at controlled airports within designated terminal areas should be required to contact approach control at a specified distance from the airport.

10. Altitude information should be obtained from airborne altitude reporting beacon transponders. When such beacons become available they should be required in all aircraft landing at controlled airports within designated congested terminal areas.

11. Special corridors and tunnels should be provided for unequipped VFR aircraft landing at uncontrolled airports or transiting the terminal area.

12. With complete position information available on the ground, pilot reports should be reduced drastically and controller and pilot load and frequency use held to reasonable levels.

13. General purpose computers should be employed to process flight plans, issue clearances, make conflict probes, generate display information, establish landing sequences and perform other tasks of assistance to the control function.

14. Special express routes should be established in terminal areas to accommodate increased helicopter traffic.

As previously mentioned, the FAA's Air Traffic service prepared an analysis of Project Beacon. ATS also presented a plan to implement the major recommendations of the Beacon Task Force which are applicable to ATS. Work is underway on all the items. Progress made in some of the most significant programs is reported below.

• *AREA POSITIVE CONTROL*

By June 1963 the goal is to have the continental U. S. blanketed with positive control from 24,000 feet up to and including flight level 600. The eventual goal is to achieve positive control at or above 14,500 feet with appropriate adjustments over mountainous terrain. A slippage in the new center building program and/or delivery of display and beacon decoding equipment will result in slippage in the implementation of area positive control in a particular area. Positive control above 24,000 feet has now been realized in a 340,000 square mile airspace in the Chicago, Ill.-Buffalo, N.Y. area. Expansion is planned on a center by center basis as each center attains the capability.

When this program is completed the only areas not covered will be a small section over northern Maine and the so-called Northern Tier. The first of these areas will eventually be covered by long range radar and the second through use of SAGE Centers.

• *TERMINAL AREA POSITIVE SEPARATION*

The initial step will be in one or more major terminals with a target date of November, this year. A combination of the principles of separation and segregation will be used. CVR experience will be gained in terminal areas before the introduction of this control technique in the en route environment.

It is anticipated that terminal CVR service will cover a radius of approximately 15 miles and from 1200 feet to 5000 feet. In the control zone itself, usually a five-mile radius of the airport, the lower limit will extend to the surface. In addition to separation between IFR and VFR traffic, the VFR traffic will be vectored into the final approach course in proper sequence, thus eliminating the traffic pattern.

• USE OF SAGE FACILITIES

Use of Minot, Great Falls, and Grand Forks SAGE Direction Centers is being considered for the Northern Tier area. No adequate long-range FAA radars exist or are programmed and the volume of traffic is sufficiently light to make joint use of SAGE by FAA and ADC appear practical, at least for an interim period. An FAA/DOD Task Force is working out plans for this phase of Beacon.

• CENTER BOUNDARY RECONFIGURATION

The purpose here is to define the most suitable en route controller-pilot environment for the safe and efficient flow of traffic. Target date for completion of this program has been set for July, 1964. Reconfiguration of present center boundaries is involved, and elimination of the centers at St. Louis, Phoenix, El Paso and Detroit. Action had been taken to eventually eliminate small center areas such as Pittsburgh, Norfolk, Great Falls and Spokane.

• SPEED LIMITS AND SPEED-VISIBILITY RELATIONSHIPS

The Beacon Report made recommendations as to increased visibility limitations for uncontrolled VFR operations and, in addition, speed restrictions in the "VFR only" airspace and in the lowest strata of the designated positive separation airways. As a prelude to instituting these Beacon recommendations, a study has been requested that is to include such items as visual acuity, conspicuity, physiological factors, mathematical probabilities and any economic factors bearing on speed restrictions. This study is slated for conclusion in January.

• SUMMARY

Briefly, the above outlines the highlights of the Project Beacon Report and some of the major areas in which action is underway. In the November report, Air Traffic Service indicated the belief that the Project Beacon plan can be implemented in the five-year time span allotted. To achieve this, the first step is development of the basic system requirements. Acquisition of necessary hardware is, it is explained, geared to availability of funds. Some of the recommendations have already become reality, others are underway. Changes in Air Traffic Control techniques and procedures can be anticipated as Beacon plans are implemented. Additional progress reports can be expected. ★

BY GEORGE!
. . . that was a close one!

Say Again All After. Pilot's statement —"During the second half of a double Immelman at approximately the vertical position, airspeed about 150-200 knots, the pilot in the rear seat (T-33) attempted to take control of the aircraft. I told him to get off the controls and overpowered him. He got off the controls. I continued the maneuver. The pilot (rear seat) then blew the canopy and ejected with *no comment.* Altitude was approximately 8000 feet. I completed the maneuver, circled him and then landed uneventfully."

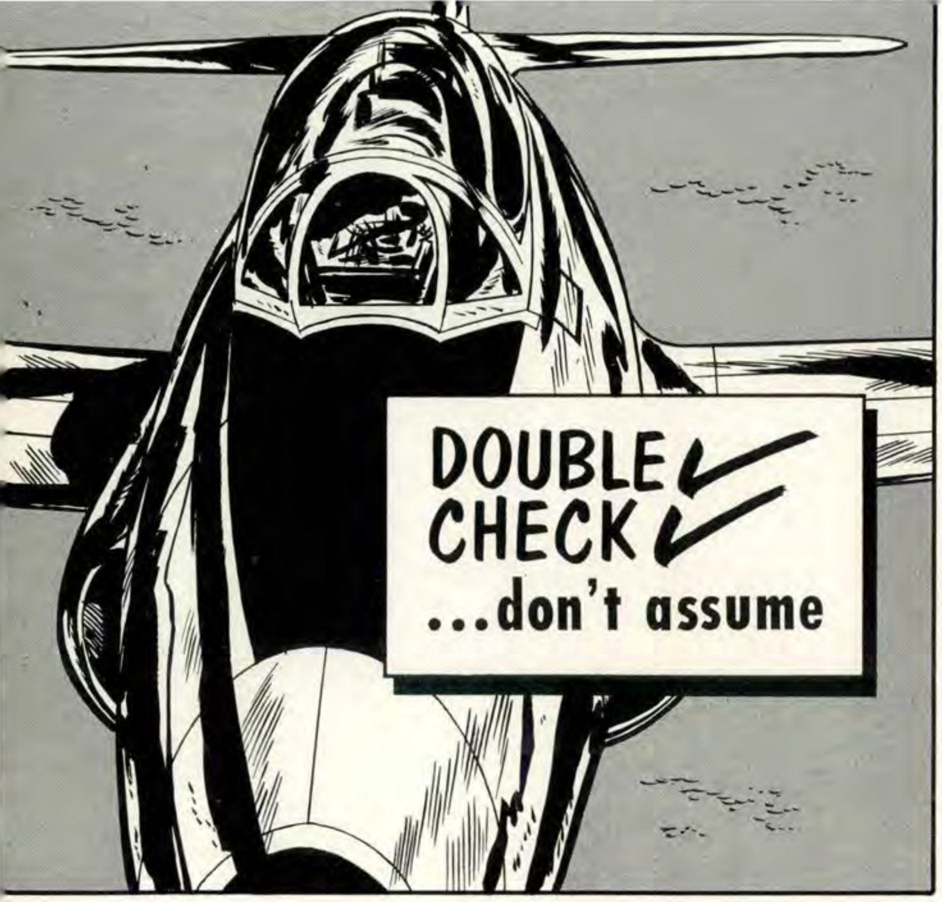
Copilot's statement—"I believe I blacked out during the double Immelman as the aircraft approached a vertical position prior to the first roll. I believe I started to recover as the aircraft was in a vertical attitude prior to the second roll. As my vision started to return, I realized that the airspeed was low and we were in what I felt at the instant was an unusual attitude. I thought that I was flying with a student and attempted to neutralize the controls for recovery. Shortly after taking control, I thought I heard the Captain say 'eject.' " Sayonara, good buddy.

U-3B Flameout. The pilot switched to auxiliary tanks when told he would have to hold 45 minutes. Weather was a 500-foot ceiling with one mile vision in fog. Approach control vectored the pilot for GCA pickup and as a descent into the overcast was started, the No. 1 engine surged. RPM was maintained with the prop control for about 30 seconds when No. 1 gave a gasp and quit. It was feathered just before No. 2 sputtered and quit. The copilot then recognized *fuel starvation,* changed tanks and No. 2 came back to life. The No. 1 engine could not be restarted in flight. A successful landing was made.

A thorough check of the aircraft revealed no discrepancies. A thorough check of the pilot revealed that (1) he ran the engines out of fuel, (2) he failed to follow starting procedures (No. 1 engine) like not energizing the starter.

Talk to Me. When passing through 17,000 feet, the copilot loosened his oxygen mask (MS 22001 with Hardman Kit) one notch because it was uncomfortable. At 23,000 feet (cabin altitude 16,000) he felt a slight tingling of his toes and fingers. Also there was a slight dimming of vision. He switched the oxygen regulator to 100 per cent and let it stay there the rest of the flight. Then he rechecked oxygen connections and panel blinker—everything was as it should be. At 35,000 feet (cabin altitude 25,000) the front seat pilot noticed that the copilot did not respond to questions asked him. He turned around to attract the copilot's attention and his head was slumped forward on his chest. An all out descent was made and when passing through 15,000 feet, the copilot came to and started a normal conversation. He was unaware of having been unconscious. On the ground the copilot's mask was found to have a rotting facelet seal and a sluggish exhalation valve. The copilot hadn't noticed these in previous flights as he normally flew an F-102 which has a higher pressure differential than the T-33. All the factors combined almost reached up and bit, didn't they? ★

Rex Riley



Col Christopher Bressan, 3720 Basic Military School, Lackland AFB, Texas

I used to think that anyone reading 17,000 feet instead of 27,000 in a T-Bird had his head up and locked. Well, I've got one which causes me to throw the key away. I'm writing about it because it can happen—no matter how many years of flying you may have or the vast experience you may possess. There is an inopportune time for anything and everything to happen, but generally the human element is the cause.

I read 270 knots in a climb when the airspeed indicated 170 knots. That little window can become a fixation. Let's say that the big needle in the airspeed indicator is primary until the 10 to 90 dial is established, and then that is primary for any operation not of an abrupt change. But the big needle must get established first. At any rate, the story won't be long. I'll get to the point.

Weather was moving in, but we had enough time to go on top, eventually penetrate, get off a GCA, ILS, etc., and complete an instrument check. I had a good, experienced, quiet talking check pilot—one who instills confidence. The poor guy cracked his head on the line taxi rear door and cut his eyebrow and nose as we debarked at the aircraft. I cut my finger during preflight. We cranked up, still hurrying, and before I knew it—and before my checklist was completed—we were lined up. I was taking the clearance, VFR on top, Rockspring departure, contact departure control, etc.

I hadn't yet checked all my radios; my hood was up but not hooked on the front panel, and I had no holder for the letdown book.

"You've got it," crackled the interphone. At this point I was about three minutes behind in preparation and trying to catch up, but hell, with my experience it should have been easy. First mistake! Even in a simple cross-country flight you've got it planned in detail and know your next move. On an instrument check it should be more detailed.

Well, I had it, and the airspeed indicated 170 knots without a doubt and we were climbing, but for all intents and purposes all I saw was 70 and it meant 270 knots to me. You see, before we transferred over to another control locally for instrument checks, we took over under hood at 100 per cent. Still no excuse. At that moment I was contacting departure control, getting a change in instructions, rechecking the radio compass, dropping my letdown book and, very honestly, not getting down to business.

I had *assumed* 270K established in that interim period. That was the second mistake. *You do not assume when flying.* It is or it isn't. At about 6000 feet, after another check with departure control, a dignified voice inquired, "What is the Tech Order speed for climb, sir?" It should have said, "What the hell are you doing at 170 knots?" It was at this time that the handling of the T-Bird quite obviously didn't feel right, although (unconsciously) it hadn't from the time I'd taken over.

Well, it was a good lesson for me. I continued the flight very much chagrined at my stupidity and finished a fair rather than a good check. It may also serve as a lesson for check pilots. It is not advisable to rush—ever! Of course, I could have said, "Whoa! I'm not ready!" Maybe it's pride, but it's not sense. I believe it advisable to provide the individual being checked with a general idea on what the pattern will be, particularly on the initial leg. When you're at altitude, you generally know what follows.

Under the hood, handling clearances, experiencing turbulence, trying to catch up and do everything according to Hoyle keeps you busier than you normally are even under more trying conditions when you have two pilots. Regardless, the key is to be established before starting and then you can handle it all.

In the long and short of things, it was totally my mistake caused by a reaction to habit, concentration on too many things at one time and not sufficiently on the proper thing, and an abrupt transition under hood. It probably will never happen to anyone else and, with embarrassment, I'll probably remain infamous in local circles where fingers may point and whispers say, "That Colonel climbed at 170 knots!"

"So?"

"But it was a T-Bird, and he thought it was 270 knots!"

"Oh!" ★

THIS IS S·C·A·T·T·E·R·E·D ?

Maj Wilson V. Palmore
Hq AWS, Scott AFB, Ill

YES SIR, that's the picture. The last half of your flight should have scattered thunderstorms, bases 500 feet, tops 45,000 feet. There will be severe turbulence in the thunderstorms and hail in the vicinity. The storms will be moving northeasterly at 15 knots. SELS has an advisory covering this area from 2100-0200Z. Two hours after your arrival the thunderstorms should increase in coverage to numerous with possible tornadoes in the area.

"What a nice way to end a weather briefing—did you dream that up yourself or did someone help you?" You might feel this way when you receive a typical thunderstorm briefing this summer.

No, the forecaster doesn't make up these briefings by himself. His few words are the end result of a great deal of effort that goes into observing, analyzing and forecasting. You might call him a middleman. But he does more than pass it on to you. He must revise, refine, update all that he receives to provide you a forecast tailored to your needs.

Now we come to the point of this article. If you don't fully understand the forecast, of what value is it to you? Go back to the first paragraph. You read it? Do you understand it? Let's find out by reviewing some of the phrases and words used in the briefing.

"Last half of your route"—seems clear enough; divide your route in half, and the last half is where you will have thunderstorms. Lengthwise yes, but how about "widthwise"? The forecaster is required to brief on weather within 100 miles of your route. The 175 entry will be for 25 miles on either side of your route. So it is possible that you might receive a thunderstorm briefing and yet not encounter any. (May this be your good fortune the rest of your flying career.)

"Scattered thunderstorms." This is one of three terms used to describe coverage of thunderstorms. The other two are "few" and "numerous." Definitions: "few," less than 15 per cent of a given area covered with thunderstorms; "scattered," 15 per cent-45 per cent coverage; "numerous," greater than 45 per cent coverage. Forecasts of specific locations of individual thunderstorms cannot be made. At best we can only peg a large area or a definite line. Forecasters cannot guarantee that you could circumnavigate thunderstorms. We do, and can pass on by PFSV, location of thunderstorms painted by CPS-9 radar.

"Bases 500 feet." This is height above the ground. However, heavy rain will normally obscure the base of the cloud.

"Tops 45,000 feet." This height is MSL. Thunderstorms build rapidly and the tops vary considerably with time of day, geographical location and the particular weather situation. Conditions being right, tops could explode to above 65,000 feet. Unless recent radar or pilot reports are available, don't commit yourself to an *on top* clearance unless you have a high flying bird.

"Severe turbulence." Turbulence and icing intensity will be reported and forecast as light, moderate, severe or extreme. The meaning of each requires a rather long-winded, long-haired dissertation. If the editor permits, we'll follow up in one or two months with a separate article. *(Permits? The editor insists.)*

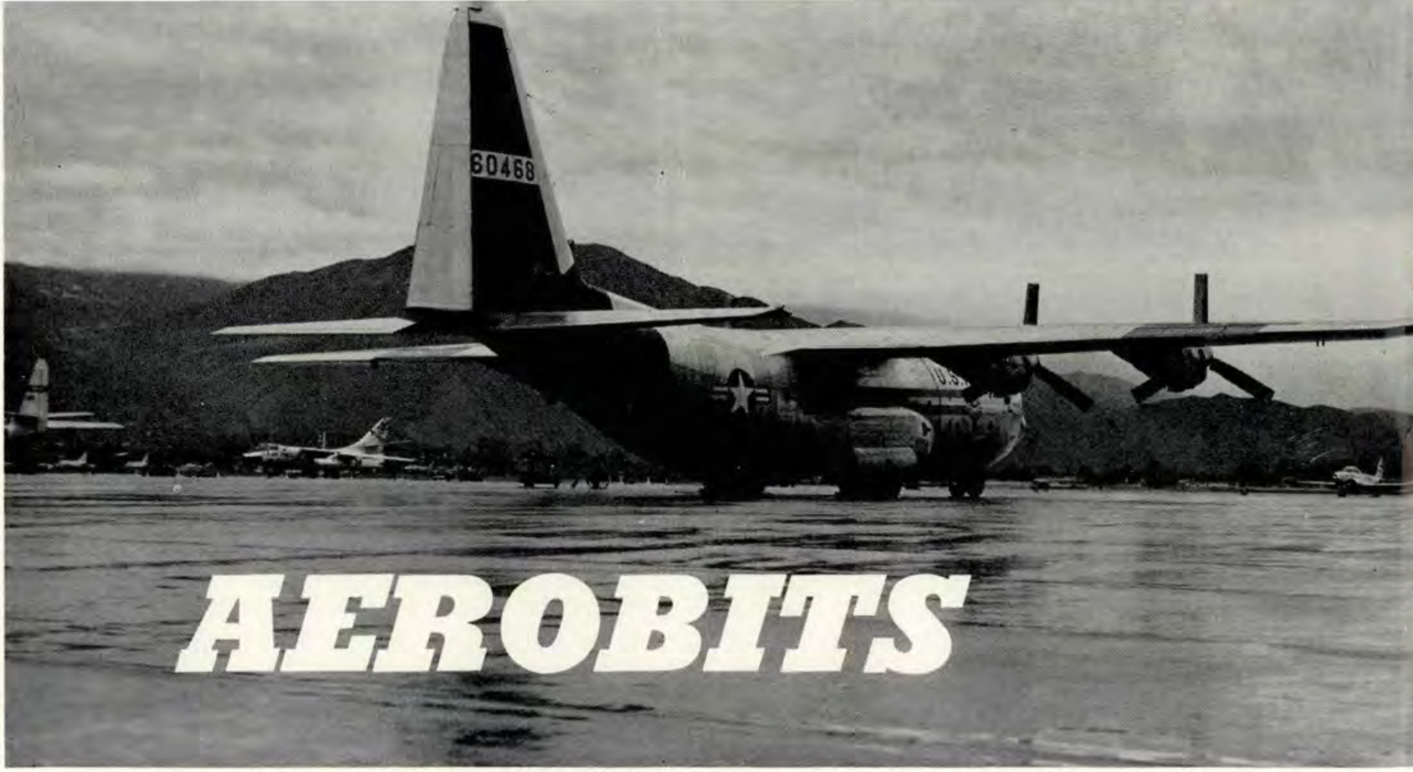
"Hail." Ice, solid water, "hard stuff." You know—like rocks—variable in size to please, from peas to baseballs.

"In the vicinity." This means near thunderstorms. Hail can be actually thrown out of clouds or fall from overhanging clouds. Stay clear. How far? Review the article, "Radar Hail and Storm Avoidance," May issue, AEROSPACE SAFETY.

"SELS." Pronounced as "sells," abbreviation for the U. S. Weather Bureau Severe Local Storms Unit at Kansas City. This is the combined Air Weather Service and Weather Bureau storm unit. Prior to March 1961, it was the Air Weather Service Severe Weather Warning Center. The present unit has the responsibility for providing severe weather outlooks, advisories and amendments associated with thunderstorm and tornado activity for commercial aviation and military use. These are transmitted over weather teletype networks as priority messages. Messages are also transmitted in chart form on some facsimile maps. These advisories assist the forecaster in tornado, severe weather, and general thunderstorm forecasting. The difference between severe and general thunderstorms is that severe thunderstorms meet one or more of the following criteria:

- Surface winds 50K or higher
- Hail three-fourths inch diameter or larger
- Severe or extreme turbulence near the ground
- Extreme turbulence aloft
- "Tornadoes"—'nuff said.

So, if the forecaster (in the station or over PFSV) uses some newfangled words for you oldtimers (open cockpit primary trainers) or some old-fangled words for you newcomers (jet primary trainers), ask him to slow down and clarify. You are the one who must test the forecast. ★



AEROBITS

• IT PAYS TO READ THE MANUAL. The C-130 aircraft was taxied to the runup area adjacent to the active runway for pre-takeoff checklists prior to departure on a routine mission. All was going well until the right wing suddenly lifted, causing the No. 1 propeller to contact the ramp. When the sparks quit flying, it was found that all blades of the prop were damaged, the gear reduction housing of No. 1 engine cracked, and No. 1 cowling damaged. Further investigation revealed holes in the left aileron and left pylon tank. What happened here to cause this expensive accident?

During engine runup the surface winds were 280 degrees at 23 knots, gusting to 32 knots. The aircraft was positioned for runup on a heading of 219 degrees. If you now recognize the cause of this accident you are familiar with your Dash One. If not, you may also have experienced a similar type accident. The aircraft was positioned 61 degrees to the left of the prevailing wind direction. The Dash One contains a CAUTION note requiring that the aircraft be headed within 45 degrees of wind direction when the wind velocity is in excess of 10 knots. By substituting the No. 4 engine for the No. 1 engine, this article could serve as a brief for a previous major accident.

Gents, it pays to read, understand and follow the instructions contained in your Flight Manual, especially those CAUTION and WARNING notes.

Lt Col Gordon D. McBain, Jr.
Transport Br., D/FS

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• BACK IN FEBRUARY OF 1961 Aerospace Safety ran a story about a T-33 that disintegrated in flight ("Wreckage in Rattlesnake Gulch"). The condition of the wreckage was such that it was extremely difficult to isolate the cause. Finally, however, tedious investigation led to the culprit: the upper engine access doors which had not been fastened prior to flight.

Recently a T-33 crashed on takeoff and the pilots lost their lives. What happened? Unlocked access doors again? No, but something similar.

Taking off on a long, hard surfaced runway, the aircraft was hardly airborne when it suddenly yawed to the left and settled back to the ground on the dirt, left of the runway. It bounced several times, slewed around 90 degrees and burst into flames as it stopped. During this time the canopy had been punched off and flames engulfed the cockpit. Both pilots died later at a hospital.

As they approached the problem of determining the cause of the accident (the pilots were unable, because of their condition, to shed any light), the investigators had to probe every possible reason for engine and/or control failure that would lead to both a heading deviation and power loss resulting in the aircraft returning to the ground. It was possible to eliminate most of the items that would ordinarily be suspect.

The engine was removed and tested and found to develop full power. The flaps were still down eliminating the possibility of split flaps. Fuel samples were checked out in a laboratory and found to be okay. A dozen other possibilities were eliminated. There was no evidence of an internal explosion and all damage was due to ground impact and fire.

By this time only one acceptable solution was supported by the facts of the investigation. The front half of the left tiptank fairing came loose from its normal position and lodged momentarily against the leading edge of the wing. This instantaneously caused 3820-foot pounds of moment causing the aircraft to yaw violently to the left.

Eventually it was possible to establish a sequence which is considered to be very close to the actual events and the order in which they occurred. Upon becoming

C-130 T-33 F-102 T-37 H-21

airborne nearly halfway down the runway, the pilot raised the gear. Almost simultaneously the fairing blew to its position across the leading edge of the left outboard wing section. As he applied corrective aileron and rudder the pilot pulled off power because he was very close to the ground with 7000 feet of runway left. During the time it took the pilot to react to the yaw the aircraft heading changed about 10 degrees to the left. A second or two later the fairing dropped off and the pilot regained control but his airspeed, RPM and altitude were too low for an attempt to go around.

The aircraft struck the ground left of the runway in level attitude as shown by tip and fuselage impact points. The canopy was blown and came to rest 200 feet behind the aircraft, which hit the ground hard a second time before it finally stopped. Apparently the left tiptank ruptured and caught fire at the last impact and left a stream of fire along the ground. It separated and continued straight ahead. Eighty feet before the aircraft stopped the right tip ruptured and then drenched the cockpit area with flaming JP-4 when the aircraft came to a sudden stop.

The investigators carefully examined the left tiptank and the fairing that lodged on the wing. There was no damage to the nine air locks, leading to the conclusion that the fairing had been removed and not refastened. Contrast this with the air locks on the rear fairing, which was partially ripped off on impact. Those locks remained fastened and were torn from the fairing. It could not be determined who failed to secure the fairing. Obviously it was not caught in the walkaround preflight, although the checklist calls for checking all doors and fasteners.

As for the fire resulting from the ruptured tiptanks, investigators found the bomb release master switch in the OFF position and the auto drop switches off in both cockpits. If the auto drop system had been alerted the right tiptank may have separated from the aircraft when the left tank ripped off. It was fuel from the ruptured right tank that drenched the cockpit area. (See T-Bird Tips, Aerospace Safety, May 1962.) **RWH**

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• **EFFECTIVE SUPPORT?** Every now and then for some unknown reason, it has been necessary to remind Air Force personnel that almost every action they take is, or should be, in support of the pilot performing the tactical mission. With missiles occupying a considerable amount of our effort these days, we cannot make that statement as unequivocably as before but you would think that on a base with tactical fighter aircraft, everyone would be pretty well mission oriented. Here is a story that shows how frustrating it can be when that strong support arm, so necessary to a fighter pilot, is weighed in the balance and found wanting.

Normal flying was in progress at a tactical fighter base in the Far East. The first hint that events were destined to be other than routine occurred at 1330 hours when RAPCON reported storm buildups eight miles south of the base. At 1350 the assistant operations officer received a severe weather warning on the squadron teletype. Also at 1350 the Senior Mobile Controller reported to base weather that cumulus clouds were building up over the mountains, eight miles south of the base. This warning was repeated to base weather at 1400. At 1412 an officer reported a wall of rain 10 miles south of the air base and information relative to an amended severe weather warning was, for the first time, disseminated to mobile and the Wing Operations Center. At 1418, WOC again received the weather warning which indicated the base would go to 1000 overcast and one mile in thunderstorms, rain showers, severe turbulence and hail. At 1421, 51 minutes after the first bad weather information was given to Base Weather by RAPCON, and 31 minutes after receipt of a severe weather warning message on the teletype, an F-102 pilot declared an emergency and was given the following weather at home base: 1800 scattered, 3000 feet overcast and four-mile visibility; no warning of probable

AEROBITS | *CONTINUED*

change in conditions was given. As a result, the F-102 pilot lowered his landing gear using the emergency system (secondary hydraulic failure) and was thereby committed to land at home base or a nearby unsuitable airfield with 6000 feet of runway, and no barrier. The first opportunity to avert this accident slipped away because of the failure of supervisors to be aware of a rapidly deteriorating situation.

The first GCA was unsuccessful due to zero visibility in rain. The pilot attempted a second GCA but it too was unsuccessful due to lack of azimuth information from GCA. Power failure had put the TACAN station off the air prior to the first GCA. The pilot requested weather at the unsuitable alternate but in spite of multiple requests and declarations of low fuel, he received no weather information for 13 minutes. Another possible SAVE was lost because weather at the alternate during this time period deteriorated from four-mile visibility to almost zero at the time of the crash. The pilot by now was operating under severe stress because of his low fuel state, inability to receive assistance and preoccupation with the thought of pending ejection. Deciding finally to go to the unsuitable alternate (fuel 1200 pounds), he was initially unable to contact GCA. Contact was made and the pilot was told there would be a 30-minute delay (fuel 800 pounds). A civilian DC-3 was on final approach and refused to break out of the pattern. Control was established but by then the pilot was too close to the field and too low on fuel to complete a GCA run. He stated he was going to eject then saw the field and made an extremely tight low visibility approach. Visibility ahead was zero in rain, contact was maintained out of the side panels of the front windshield. The pilot landed 2000 to 3000 feet long on a wet 6000-foot runway and, with drag chute blossomed, ran off the end and across a perimeter road, shearing the left main landing gear and nose gear. During this same time period, an F-100 pilot missed several approaches, bailed out and drowned before he could be picked up.

It seems rather tragic that the loss of lives and multimillion dollar aircraft are periodically necessary to keep the required emphasis on the mission. This is not solely the commander's job. He is responsible for it but it takes every man in every office or workshop on the base to make effective support a reality. How does your base stack up?

Lt Col Frederick C. Blesse,
Defense Br., Fighter Div.

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• **A T-37** scheduled for an instrument training mission with an instructor pilot and student pilot was observed flying low to the ground in the vicinity of a canyon. Two fishermen sighted the aircraft flying approximately 100 feet below the rim of the canyon following the river. On the second low level pass it appeared to witnesses that the pilots of the T-37 were attempting to fly underneath a bridge spanning a 200-foot gorge. The left wing of the aircraft hit steel telephone cables that were strung across the canyon. The aircraft traveled approximately 2000 feet and crashed killing both pilots.

This is a classic example of what can result from poor judgment and violation of flying regulations.

Lt Col Wm. A. Wennergren,
Tactical Br., Fighter Div.

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• **AN H-21** aircraft was dispatched on a routine balloon tracking and package recovery mission. Upon arrival in the predicted impact area, the H-21 circled the parachute-package awaiting its ground impact. As the package neared the ground, the trailing antenna made contact with several large electrical transmission lines, shorted to the ground and instantaneously ignited some grass and shrubs.

The pilot landed the H-21 and dispatched two airmen to fight the fire. A 10- to 15-knot surface wind caused rapid spreading and skipping of the conflagration and it rapidly approached the package. After obtaining permission from his commander, who was airborne controller for the mission, the pilot took off and hovered downwind of the fire in an attempt to prevent its spreading.

After approximately one minute, smoke severely restricted the pilot's outside visibility, so he elected to back away from the fire. As this maneuver was started the helicopter began to tilt to the right, the right gear made contact with the ground, and the aircraft turned over on its side. The pilot evacuated the aircraft uninjured but the H-21 was destroyed by fire. Primary cause was operator error in that the pilot displayed poor judgment in attempting to combat a ground fire without adequate knowledge of hazards, techniques and procedures.

Contributing causes:

a. Supervisory error in that a relatively inexperienced pilot was authorized to engage in combating a ground fire from a helicopter without having received proper training in firefighting techniques.

b. Restriction of visibility and possible pilot disorientation in that smoke and rotor-wash debris in the immediate hover area restricted pilot's outside visibility.

c. Pilot's failure to recognize the requirement to compensate for possible loss of lift caused by the fire in combination with high ambient temperature. ★

Lt Col James F. Fowler, Transport Br., D/FS

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1st Set of Flying Rules—Circa 1920—Air Force (Signal Corps) Regulations

"In taking off, look at the ground and the air."

12,000 INCHES OFF!

SUBJECT: ERRONEOUS ALTIMETER SETTING. THIS MESSAGE IN 4 PARTS. PART I. A RECENT INCIDENT INVOLVING A JET AIRCRAFT AND AN ERRONEOUS ALTIMETER SETTING IS WORTHY OF THE ATTENTION OF ALL AIRCREWS. THE JET WAS CLEARED FOR DESCENT TO 23,000 FEET AND GIVEN AN ALTIMETER SETTING OF 2921. THE ALTIMETER SETTING WAS GARBLED AND FURTHER CONTACT WITH THAT CONTROLLER WAS LOST. THE PILOT CONTACTED APPROACH CONTROL AT DESTINATION, WAS GIVEN FURTHER CLEARANCE, THE WEATHER AND AN ALTIMETER SETTING OF 3027. ALTIMETER WAS READ BACK AS 3027 AND WAS NOT CORRECTED. SUBSEQUENTLY, ANOTHER AIRCRAFT WAS GIVEN THE CORRECT ALTIMETER SETTING OF 2928. THIS TRANSMISSION RESULTED IN THREE OF THE JET CREWMEMBERS NOTING THE CHANGE FROM "POINT 27" TO "POINT 28" <u>BUT NOT THE DIFFERENCE BETWEEN 30 AND 29 INCHES.</u> DURING DESCENT TO TRAFFIC ALTITUDE ONE CREWMEMBER NOTED THE LOW READING ON THE RADIO ALTIMETER BUT ASSUMED THE INSTRUMENT TO BE IN ERROR. HE LATER CALLED THE PILOT'S ATTENTION TO THE LOW INDICATION WHEN THE AIRCRAFT WAS 200-300 FEET ABOVE THE GROUND. SIMULTANEOUSLY SEEING TREES THROUGH BREAKS IN THE CLOUDS, THE PILOT INITIATED CLIMB, OBTAINED THE CORRECT ALTIMETER SETTING AND COMPLETED HIS FLIGHT WITHOUT FURTHER INCIDENT. PART II. INVESTIGATION REVEALED THAT THE CONTROLLER ERRED, HOWEVER, HIS ERROR IS UNEXPLAINED EXCEPT FOR THE <u>POSSIBILITY OF "HUMAN" ERROR IN WHICH A PERSON IS CAPABLE OF THINKING ONE THING AND SAYING ANOTHER.</u> THE CONTROLLER CONCERNED HAD ISSUED THE CORRECT ALTIMETER SETTING TO OTHER AIRCRAFT BOTH BEFORE AND AFTER THE ERRONEOUS TRANSMISSION IN THIS INCIDENT. THE INVESTIGATION ALSO REVEALED: (A) THE CREW OF THE AIRCRAFT HAD BEEN BRIEFED THAT THEIR DESTINATION WAS IN A LOW PRESSURE AREA WITH FORECAST ALTIMETER SETTING OF 2945. (B) THE CORRECT ALTIMETER SETTING, GIVEN TO ANOTHER AIRCRAFT, WAS INTERCEPTED BY THREE MEMBERS OF THE JET CREW WITHOUT NOTING THE ONE INCH DIFFERENCE. (C) THE RADIO ALTIMETER READING WAS ASSUMED TO BE IN ERROR UNTIL THE AIRCRAFT WAS DANGEROUSLY LOW. PART III. AUTHORITIES CONCERNED HAVE TAKEN APPROPRIATE DISCIPLINARY ACTION WITH RESPECT TO THE CONTROLLER CONCERNED. THEY ARE ALSO CONTEMPLATING EQUIPMENT CHANGES AS WELL AS AN EDUCATIONAL SAFETY ARTICLE BASED ON THIS INCIDENT. THE LATTER WOULD BE DESIGNED TO GRAPHICALLY BRING HOME TO CONTROLLERS THE IMPORTANCE OF ISSUING CORRECT ALTIMETER SETTINGS. PART IV. TO FURTHER GUARD AGAINST ERRORS OF THIS TYPE, IT IS DESIRED THAT: (A) THIS INCIDENT BE BROUGHT TO THE ATTENTION OF ALL AIRCREWS AS SOON AS POSSIBLE. (B) AIRCREWS BE ENCOURAGED TO ENTER FORECAST ALTIMETER SETTINGS ON THEIR FLIGHT LOG AND THEN COMPARE THE ACTUAL SETTING GIVEN WITH THE FORECAST. VERIFICATION OF THE ACTUAL SETTING GIVEN SHOULD BE REQUESTED IF THE FORECAST AND ACTUAL SETTINGS ARE MORE THAN 2/10 INCHES APART. (C) PILOTS BE ENCOURAGED TO CHECK DESTINATION WEATHER, INCLUDING ALTIMETER SETTING, PRIOR TO ENTERING THE TERMINAL AREA. ADEQUATE PILOT-TO-FORECASTER FACILITIES AND/OR FAA FLIGHT SERVICE STATIONS ARE AVAILABLE FOR THIS PURPOSE. (C) AIRCREWS BE ENCOURAGED TO UTILIZE ALL AVAILABLE MEANS TO CROSS CHECK ON CRITICAL PHASES OF FLIGHT SUCH AS TERMINAL NAVIGATION AND ALTITUDES. IN THIS INSTANCE THE RADIO ALTIMETER WOULD HAVE GIVEN EARLY WARNING IF THE CREW HAD NOT IGNORED IT. ★

PERSONNEL

ERROR

PREVENTION

*U S. GOVERNMENT PRINTING OFFICE 611220