TAC ATTACK

JULY 1968

INDICATOR OF EFFICIENCY
...page 4

for efficient tactical air power

TAC ATTACK

JULY 1968

VOL. 8 NO. 7

TACTICAL AIR COMMAND

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TACRP 127-1

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Distribution F, Controlled by OSEPA - TAC Publications Bulletin No. 22, dated 3 June 1966

for the working types

My departing message is directed primarily at TAC's working element...the stick-and-rudder troops, the man with the wrench, the cook, and the clerk... because every subordinate commander in the TAC organizational structure already knows the story.

You've probably heard the statement that the Commander, TAC, considers himself the Command's Safety Officer... and it goes on to reflect policy and guidance to reduce accidents. You may be assured that General Disosway has played that specific role. You may also be assured that his interest has paid safety dividends and you are the beneficiary.

During the past three years TAC's mission has changed to the degree that it can be described in five words: "Test and train for SEA." If USAF decides to train chimpanzees to fly C-119s, TAC will get the mission... and TAC's "can do" policy would probably be, "Press on, lads, and don't tear up the equipment." Our mission isn't that tough as yet, however, I've often envied the safety problems of the other major air commands having many fewer aircraft types and missions.

Specifically, TAC has trained and deployed tactical aircrews during the last three years in aircraft ranging from World War II Gooneys, Skyraiders, and the like to highly sophisticated weapons systems such as the F-105, F-4, and F-111. Throughout this broad mission spectrum, General Disosway's policy of doing the job safely has never wavered. When he assumed command in August of 1965 our aircraft accident rate was 10.6. In spite of increasing mission demands, each ensuing year has shown a rate reduction. At this writing it is an all-time low of 7.8.

In the ground safety area prior to mid-1965, TAC bases were not aggressively promoting seat belt installation. With command support since then, about 99 percent of all private motor vehicles registered at TAC bases have installed seat belts, even though total manpower increased about 30 percent. Additionally, military injuries decreased 21 percent, private motor vehicles injuries are down 13 percent, fatalities have been reduced 26 percent, and Air Force motor vehicle accidents are 35 percent lower. Enough of accident statistics.

One last point for the fighter pilot. If all goes as planned you will be wearing custom-fitted helmets in the near future, courtesy of General Disosway. He has personally pushed this project in the same manner he has pushed for modern, reliable egress and life support improvements in every weapons system we possess.

Command support of the safety program is vital to its success, but it can't carry the entire load. Fortunately, you at the working level have carried your share of the accident-prevention program. The results have been outstanding... and it's been a pleasure to have been involved.

H. B. Smith

H. B. SMITH, Colonel, USAF

☆ an ☆ indicator ☆ of ☆ efficiency

GENERAL GABRIEL P. DISOSWAY

During 1967 our Regular, Air National Guard, and Reserve units established the lowest accident rate in TAC's history. This record is particularly gratifying to me because it indicates that my commanders have been using their authority to place command emphasis in the proper places. I have made it a matter of policy to give commanders all the responsibility and authority they need to get the job accomplished. Their acceptance of that responsibility, and their emphasis on a safe, logical approach to our hazardous mission have been reflected in our steadily improving safety record.

This graphically demonstrates that a safe flying operation is not a matter of chance . . . a case of good luck or bad luck. It is simply a matter of professional skill combined with common sense, caution and a constant awareness of what the aircraft and man can accomplish.

If an organization begins to get sloppy in its operation the first place I notice it is in their accident rate. I have always believed that a unit's safety record is, in part, a measure of its operational effectiveness. A commander who has complete command and control of his day-to-day flying operation will spot areas of weakness. This provides him with the indicator he needs for command emphasis, which in turn will preclude accidents.

One item that assists both the unit commander and my staff in before-the-fact accident prevention is the incident report. When these reports begin to reflect an increase in incidents involving an organization's mission aircraft, then they are forecasting an accident potential. On the other hand, if incidents go unreported, the mission can be jeopardized and a commander will lose valuable support and assistance of the headquarters staff.

Another tool that I have found to be of great benefit in reducing accidents is the Command Briefing of selected major accidents by my lower echelon commanders. This so-called "star talk" frequently uncovers some weakness in the system or our overall method of operation which, when promptly corrected, benefits the entire command.

Our combat crew and replacement training programs have probably offered the greatest challenge to come along in many years. With a limited number of aircraft, each one of you has been called upon to provide realistic, combat-oriented training and at the same time maximize your efforts in safe flying. This has at times posed a problem. Your student pilots have come from a variety of flying backgrounds. Yet, last year's record-low 8.1 accident rate, coupled with the sustained superior performance of your graduates in combat, proved beyond doubt that you met the challenge in an outstanding manner.

It seems appropriate here to make note of the near-perfect safety record of our tactical airlift wings last year. They flew more hours, carried more passengers and cargo, and trained more new crews than at any other time in our history. Despite this increased exposure, they finished 1967 with an 0.48 accident rate . . . four times better than 1966 and 100 percent better than their previous best year.

Our fighter units have also faced the same increased work load coupled with increased mission hazard necessitated by realistic training required of SEA-bound crews. Their significantly improved accident record is also noteworthy. Several units have flown many thousands of hours, some in excess of a year, without a major accident.

The most serious problem today facing the fighter RTUs and combat crew training wings is the ever-increasing loss-of-control accident, especially during ACM training. This one area has traditionally accounted for a considerable share of our accidents. Yet proficiency in engaging and destroying enemy aircraft is an important part of the fighter pilot's skill. Here again, with considerably more command emphasis and supervision, our losses can be stopped. We don't want to dilute our training program to a state of ineffectiveness because of accident potential. We have seen in the past that with a disciplined, well planned, and supervised program, aerial combat maneuvering can be effectively taught without accidents.

Another important topic within the command involves our life support equipment. This is an area I have personally stressed — in fact, I require regular briefings on the status of our most pressing life support problems. During the last three years we have gained considerable experience and insight into the importance of providing aircrews with comfortable, functional, and reliable equipment. Many of the changes we have requested are now in the field. Others are in the test stage. With your continued interest and emphasis, these improvements will soon materialize.

In the meantime, we must continue to stress egress and survival training so that every aircrewmember has a thorough understanding of his equipment.

We in TAC are experiencing a constant turnover in our skilled personnel, both aircrew and maintenance men. The new people we receive must be made as capable as, or, if possible, more capable than their predecessors. Keep in mind that, along with producing trained men for combat, our job is also the conservation of personnel and equipment for whatever emergencies lie before us. Accidents can only result in a lessening of the total military strength of our country.

TACTICAL AIR COMMAND

AIRCREW ACHIEVEMENT AWARD

Lt Col Robert L. Foster
Commander

LtCol James S. Miller
Navigator

LtCol Allen D. Boyd
Navigator

1Lt Fred D. Womack
Co-pilot

MSgt Oscar Neill
Flight Engineer

MSgt Chester Harper
Boom Operator

The KC-97L crew of Lieutenant Colonel Robert L. Foster, Commander of the 134 Air Refueling Group (ANG), McGhee Tyson Airport, Knoxville, Tennessee, has been selected to receive the TAC Aircrew Achievement Award.

Colonel Foster's operations section overheard a radio conversation between Air Traffic Control and a commercial airliner while monitoring local air traffic. The airliner was assisting an Air Force C-131 in severe weather with 25 passengers aboard. The C-131 had lost one engine, all electrical and battery power, and all navigational aids. While leading the Air Force crew through dense clouds to McGhee Tyson Airport visual contact was lost. Low on fuel, the airliner was forced to abandon its search.

Colonel Foster piloted his quickly assembled aircrew toward the C-131 following vectors provided by ATC. Using airborne radar intercept procedures his navigator soon positioned the aircraft side by side. The transport flew a right wing position on the tanker as directed by Aldis lamp signals and hastily printed placards held against the KC-97 canopy. During a gradual penetration the formation broke through the cloud cover and spotted a small landing strip. Colonel Foster circled the airport and requested Chattanooga Tower to alert the highway patrol to assist the C-131 passengers and crew. The C-131 made a successful emergency approach and landing.

The immediate action and professional teamwork displayed by Colonel Foster's crew in preventing a possible accident and loss of life merits their selection for the Tactical Air Command Aircrew Achievement Award.

it pays to wait

by Roger Emett

(Automatic vs Manual Separation on the Martin-Baker System)

When pulling the D-ring, grasp the left parachute riser with the left hand just above the ripcord. Then pull the ripcord hard as possible with the right hand.

Roger Emett is a technical representative to the United States Air Force. His near 25-year career in military cockpits has provided his firm, the Martin-Baker Aircraft Company, with knowledge and experience of interest to all fighter pilots. Before his RAF retirement in 1965, pilot and Squadron Leader Emett, was awarded Britain's Air Force Cross for his accomplishments in training and aerobatic flying. He is currently working with the Egress Section of the 33rd TFW, Eglin AFB, Fla.

After ejection on the Martin-Baker H5/H7 seat it takes far longer to achieve a full parachute and a much greater loss of height is involved with the manual override system than with the automatic ejection sequence. Despite this, there have been some cases in recent months where pilots have ejected above barostat altitude and used the manual override for separation and manual parachute deployment using the ripcord D-ring when it would have been wiser to have let the automatic sequence do its job for them.

A tragic accident occurred in Southeast Asia when an F-4 back seater used this manual override handle unnecessarily. The crew had experienced flight control problems at low altitude but had managed to coax the crippled aircraft up to 16,500 feet before ejecting. The aircraft commander ejected without any trouble and was uninjured in the escape. However, the rear seater's parachute did not deploy after ejection and he was killed.

The investigation revealed the parachute ripcord handle D-ring was still in the retaining clips and the parachute link line which deploys the parachute under the automatic sequence had been cut by the guillotine. The ejection seat had landed some 300 feet from where the body had struck the ground. The emergency harness release handle had been used and had operated correctly to release the harness attachments and to fire the guillotine. The seat automatics were put on test and, after free falling from altitude, these items still checked out within the prescribed tolerances. It was evident that the seat had functioned as designed. If the emergency harness release handle had not been used above barostat altitude, automatic seat separation and parachute deployment would have occurred.

In this particular case, the parachute D-ring handle was very tight in its retaining clips and it was found that a force of 70 pounds was required to pull it out of the clips to allow deployment of the parachute manually. The lower stitching securing the ripcord handle retaining plate to the parachute harness had pulled away from the parachute harness.

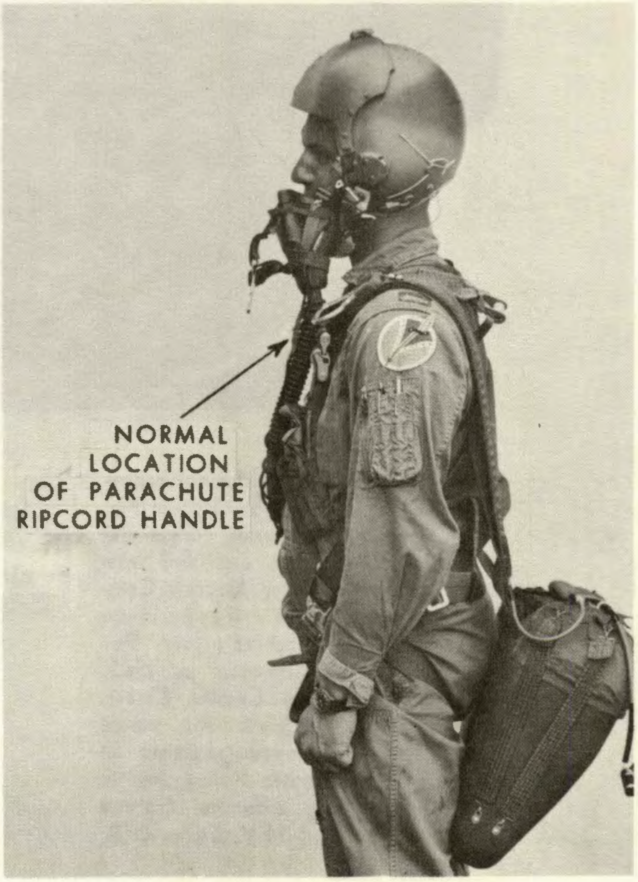
The actual sequence of events which led to this unfortunate accident may never be known for sure. However, the available evidence suggests three main possibilities:

a. The pilot ejected and became anxious about the time elapsing while free falling in the seat on the 5-foot drogue and elected to use the manual override system. Then, having separated from the seat, was unable to get the parachute deployed because of the excessive force required to free the ripcord handle D-ring from the retainer clips, or

b. After ejection and subsequent manual separation, the pilot was incapacitated or made no attempt to deploy the parachute, or

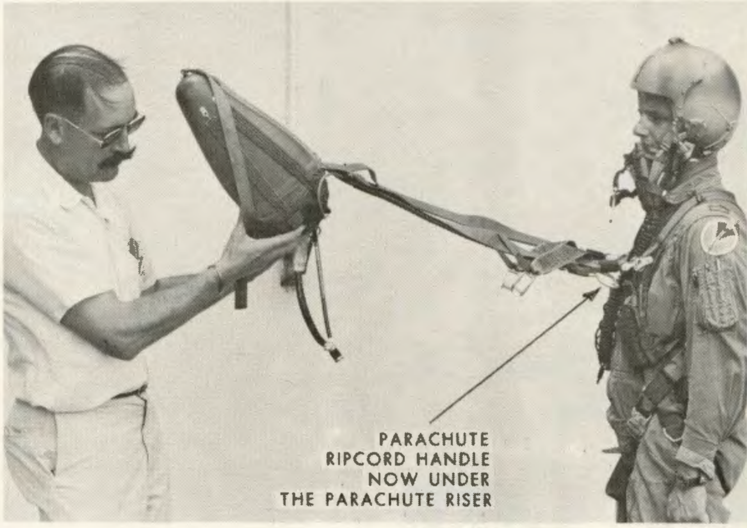
c. The emergency harness release handle was used prior to ejection... reaching for arm rest firing handles as on some other ejection seats by mistake. This has been done a few times on simulator rides even with experienced F-4 aircrews. If such a thing occurred the body would not be restrained and would "jackknife" under ejection loads. Injury or incapacitation would be inevitable if the seat pan ejection handle was then used. Seat separation would occur as soon as the drogues deployed and, perhaps explains the fact of the seat and body impacts being 300 feet apart. The ejection was at low speed and if manual separation occurred when the man and seat had a vertical trajectory on the drogues, the two impact points should not be far apart. The broken stitching on the ripcord handle retaining plate is equally consistent with ground impact forces. Normally, it will take considerably more than the 70 pound force required to free the ripcord handle and in this particular case, to break the stitching securing the retaining plate to the harness. To break the stitching without pulling the handle out of its housing suggests a force in the opposite direction to the normal pull.

Whatever the answer we must ensure that the circumstances of this accident are not repeated.



During manual deployment the D-ring must be pulled to its full extension - 3 to 4 inches.

The D-ring may not be where you think it is. The parachute pack may swing over your head and mask the D-ring with the riser.



TIME IN FREE FALL ON THE FIVE FOOT DROGUE

Few pilots have an accurate picture of the time required to free fall in the seat from ejection altitude on the five foot drogue, waiting for the automatic sequence to function at barostat altitude. Most are prepared to wait a reasonable time, but what is a reasonable time in such a situation? Remember that your pulse will have been racing immediately prior to ejection, and although the decision to eject has been made, and the worst is over, the unusual sensations of the ride and the realization that there is more to come will not be conducive to relaxation! In any emergency situation, time seems to be compressed anyway. What is actually a matter of seconds may seem like an eternity when you are heading for the ground at high speed.

How long would you be prepared to wait before being concerned?

Ideally, one should wait for the automatic sequence to function.

AUTOMATIC VERSUS MANUAL SEPARATION

Automatic seat separation and parachute deployment is rapid and positive. Manual separation and manual parachute deployment is not.

After ejection, the drogues stabilize the seat and ensure optimum alignment for automatic separation and deployment of the personal parachute. This will be accomplished in less than one second from shackle release, in something like 150 feet, and with no risk of man/seat involvement.

In comparison, manual separation and manual parachute deployment is a time consuming and height wasting affair. The occupant must pull the emergency harness release handle to release the lap belt, shoulder harness, and leg restraints. Pulling the handle will also operate the guillotine to sever the parachute withdrawal link-line. Since the occupant will still be attached to the seat by the sticker clips, it will be necessary to lean forward to get the parachute off its horseshoe support arch and push away from the seat to break out the sticker clips and clear the seat. All of this takes valuable time and altitude.

When clear of the seat, the ripcord D-ring handle must be pulled to full extension (3-4 inches) to open the parachute pack. But first you must locate the handle. If you are tumbling, and this is very likely, it may take longer than you think to locate the handle. Remember, the parachute pack will be free to swing around to the full extent of the risers and will not necessarily stay behind in relation to the body. If it swings forward, over the head for instance, the D-ring could be masked by the riser which would make it more difficult to locate and use. The thing to do is to look for it, then grasp the left parachute riser with

When manually actuated the parachute is pulled out by a small pilot chute instead of the five foot drogue.

the left hand just above the ripcord, and pull the ripcord D-ring handle as hard as possible with the right hand. This will open the pack, but instead of the five foot drogue to draw the chute out of the pack, there will only be the small pilot chute to do the job and parachute deployment will be less rapid as a result.

Obviously, there is nothing to be gained by trying to beat the automatic sequence at low level. It could prove fatal.

Another recent incident in Southeast Asia illustrates the problems associated with manual separation and parachute deployment. An F-4 pilot ejected about 14,000 feet over the sea and rode the seat down on the five foot drogue waiting for automatic separation. When separation did not occur after an appreciable time and deck equipment was becoming distinguishable on ships in the water below, he rightly decided it was time to use the manual over-ride. He separated without difficulty and then found himself in an inverted jackknife position with the parachute pack visible just above his head. He reached for the ripcord D-ring with his right hand but could not locate it initially until he looked for it and pulled it into view with his left hand. He pulled the D-ring but could not get it out of its housing at the first attempt. On the second attempt, he pulled the handle to its full extent but nothing appeared to happen until he pulled a third time and the chute opened. (No further cable extension occurred, so the parachute was probably deploying after the second pull.) Since the parachute descent subsequently took about two minutes down to the water, the parachute probably deployed in the region of 2,000 to 3,000 feet. In this particular case, it took several seconds to separate from the seat and manually deploy the parachute and a significant altitude loss was involved. The pilot showed commendable presence of mind in dealing with the situation.

The circumstances of this incident also suggest the possibility of barostat failure but as the ejection seat was not recovered, the issue cannot be resolved. Damage to the barostat or to the time release mechanism itself would prevent automatic operation at the normal altitude setting. (H5 seat 10,000 - 13,000 ft; H7 seat 11,500 - 14,500 ft.) However, there are five separate capsules comprising the aneroid in the barostat. A leak in any one of these would not negate the system, although in such an event, barostat operation would occur approximately 3,000 feet below the original altitude setting.

FAILURE OF THE AUTOMATIC SEQUENCE

Complete failure of the automatic sequence is unlikely but the possibility cannot be ignored. And since manual separation, with all its drawbacks, is the only alternative, one must know how to recognize a failure and take prompt action should it occur.

If the seat does not stabilize almost immediately after ejection, failure of the drogue gun or the drogue assembly would be indicated. The drogue gun fires 1.0 second after ejection on the H5 and 0.75 seconds after ejection on the H7 seat. If the seat does not stabilize but continues to tumble, prompt action to pull the emergency harness release handle is required for if the time release mechanism delay runs out and allows the occupant to tumble out of the seat before the guillotine is fired to sever the parachute link line, the seat would remain attached to the apex of the parachute during the descent!

Failure of the time release mechanism also requires use of the manual override system to avoid riding the seat down to ground impact on the drogues still strapped in the seat.

At night, or in a weather situation where there is no visual reference with the ground, it would be impossible to tell whether the time release mechanism has failed or not, without knowing the approximate ejection altitude and time required to descend to barostat altitude on the five-foot drogue. The Pilots Manual TO 1F4-1 gives no advice in this respect but the diagram (Fig 1) gives some idea of the time required in free fall from ejection altitude down to 10,000 feet and from 10,000 feet down to sea level, strapped in the seat, with the 5 foot drogue deployed.

It takes about two minutes from 30,000 feet and over one minute from 20,000 feet to fall to the 10,000 foot level on the 5 foot drogue. Automatic seat separation and parachute deployment occurs between 10,000 feet - 13,000 feet on the H5 seat, and between 11,500 feet - 14,500 feet on the H7 seat.

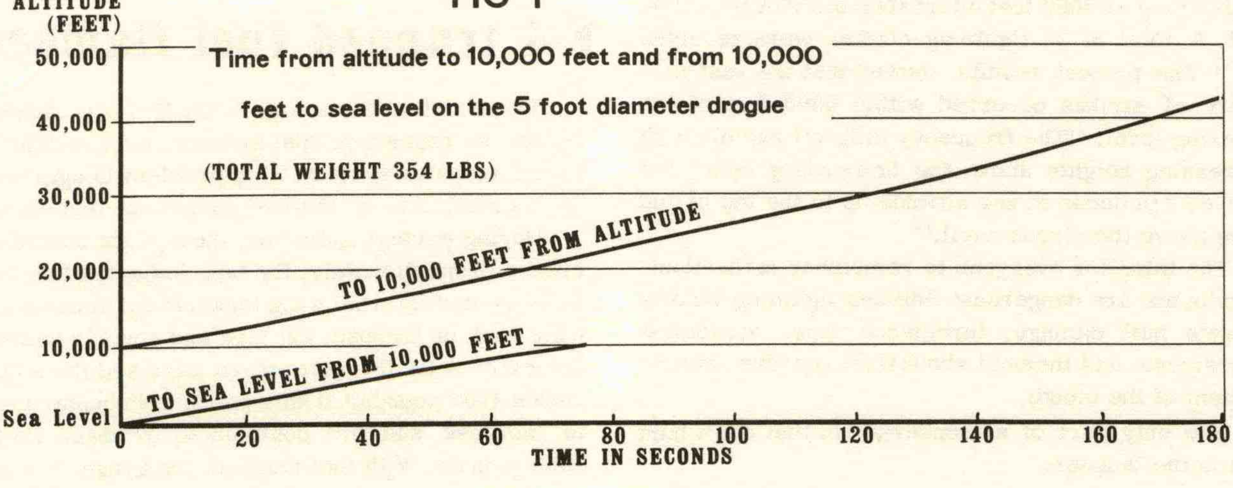
If the system failed at barostat operating height, then it would take another minute at least to fall to sea level. So in most circumstances there is usually time to spare after a high altitude ejection, depending on the local terrain.

In all ejections, one should plan to use the manual override handle only if the automatic system fails ... except for the rare occasions over mountainous terrain where the ground level approaches barostat altitude. In the latter case, it will require very prompt override action after ejection to achieve a full parachute on the manual system in less time than the automatic deployment would take ... according to ejection altitude.

The record is good: Over 340 successful ejections have been made to date on Martin-Baker ejection seats in the USAF, and a 95% success rate was achieved for 1967. Over 2000 lives have been saved on Martin-Baker seats world-wide.

The Martin-Baker system has an outstanding record of reliability. So if you have to eject above barostat altitude think positive and allow the automatic system time to function. Be prepared to wait down to the 10,000 foot level before using the manual override. It will usually prove advantageous. ➤

FIG-1



TAC TIPS

...interest items, mishaps

lightning strikes

Almost daily the Office of Safety receives messages concerning lightning strikes to Air Force aircraft. The majority of the reports seem to involve fighters which indicate that some fighter units may be pressing their luck with thunderstorms.

One incident report read, "The aircraft was departing on a standard instrument departure. At below 3000 feet in weather, the crew heard a loud bang. The Attitude Director Indicator (ADI) immediately tumbled in both cockpits. The forward looking radar, Tacan and Inertial Navigation System failed. The standby ADI was selected but it too was inoperative. The pilot went to "needle, ball, altimeter and standby compass, selected afterburner and made a somewhat exciting climb to 19,000 feet where he broke out of the clouds."

The UHF and SIF were found to be functional and after some conversation with the controlling agency the F-4 was led down to a safe landing by a flight of F-102s.

A recent Air Force study of the lightning strike problem states in part "... most lightning strikes to aircraft occur as flights near the freezing level. On the Thunderstorm Project a total of 1363 thunderstorm-cell penetrations were made by a group of aircraft flying at 5000 feet intervals from 5000 to 25,000 feet. A total of 21 lightning strikes were received ..." The project results showed that the vast majority of strikes occurred within 5000 feet of the freezing level. "The frequency falls off rapidly with increasing heights above the freezing level, but strikes can occur at any altitude up to the top of and even above the cirrus anvil."

The thing for everyone to remember is that thunderstorms are dangerous. Besides lightning strikes there's hail damage, turbulence upset, structural overstress, and thermal shock flameout (due to water content of the cloud).

The only part of a thunderstorm that can't hurt you is the thunder.

F-4 ejection

A recent low-level high speed ejection fatality in another command has pinpointed a deficiency of information concerning the ejection envelope of the Phantom's H-5A seat. The ejection took place near ground level at around 450 knots. The escape was unsuccessful because of the G-limiter in the time delay mechanism.

The G-limiter is a safety feature designed to prevent failure of the parachute canopy at high airspeeds. It delays seat-man separation and parachute deployment until the ejection G forces drop to a range of 3 to 4.5 Gs. As a result, a high speed ejection below 100 feet can quickly put you out of the safe envelope. In the 130 knot to 350 knot speed range ground level ejections are possible. Above 100 feet ejection is safe to 525 knots.

TAC's F-4 fleet should be fully equipped with the H-7 seat by February 1969. As you may know, it is not speed and G restricted.

from FLIGHT SAFETY
McDonnell Douglas Co.

F-4 trapped fuel flameouts

Trapped-fuel flameouts in the F-4 are caused by failure to reposition fuel switches or a malfunction of the transfer system. This problem is aggravated by a peculiarity of the fuel gauge tape and counter.

During normal operation, the tape and counter decrease proportionately; the tape indicates fuel in the fuselage and internal wing tanks. If, for some reason, wing fuel is trapped, the tape and counter decrease normally until the tape nears zero and the counter shows 4100 pounds. At this point, the counter begins to increase and will continue to increase 1200 to 1800 pounds. With fuel trapped, the gauge may indiwith morals, for the TAC aircrewman.

cate 5300 to 5900 pounds on the counter, and zero on the tape.

This causes considerable confusion because most F-4 pilots associate 4100 pounds as wing fuel and can erroneously assume that some of the amount shown on the counter is in the fuselage tanks, and that the tape indicator is malfunctioning.

This counter-reversal phenomenon is caused by air striking the fuel compensator when exposed as the feeder tank nears empty. The compensator is a wet gauge instrument which measures fuel temperature and density to give an accurate fuel gauge reading.

If this does happen and the cause is incorrect switching (for correct switching see Interim Safety Supplements IF-4C-ISS-85; IF-4(R)C-ISS-57; IF-4E-ISS-17), static tests by an operational unit have shown that the pilot is approximately two minutes from flameout after the counter starts increasing. By resetting transfer switches during this period, flameout most probably can be prevented. If switching is not accomplished until after engines begin to surge and stall, flameout will occur. Probability of relight is doubtful.

TCTO IF-4-796 is expected to prevent trapped fuel flameout. This modification includes an automatic gangload feature to open all fuel valves when the low level fuel light illuminates. In addition, TCTO 1F-4-814 improves illumination of the master caution light and adds a repeater caution light in the rear cockpit.

These mods will not prevent fuel starvation if internal wing transfer valves malfunction. So pilots must continue to monitor fuel to insure that usable fuel is available.

air turbulence injuries

Two recent incidents in which transport aircraft encountered air turbulence resulted in injuries to crew and passengers.

A C-119 on a transport mission with seven crew and 26 passengers flew over a mountainous area. Expecting turbulence, the copilot recommended passengers be strapped in. However, the aircraft commander withheld the order for fastening seat belts because passengers "...had been in their rather uncomfortable bucket seats for well over two hours." Severe to extreme clear-air turbulence encountered resulted in five major injuries.

A C-141 aero-evacuation flight at 33,000 feet was notified of moderate-severe turbulence enroute at 33,000 feet. Medical attendants were in the process of securing cabin and patients when turbulence was encountered. One nurse received a compression fracture of her back and two other attendants received minor injuries.

In both incidents, turbulence was expected. Pilots flying in known or suspected turbulence areas should insure that passengers and crew are safely strapped to prevent recurrence of these incidents.

Adapted from TIG Brief

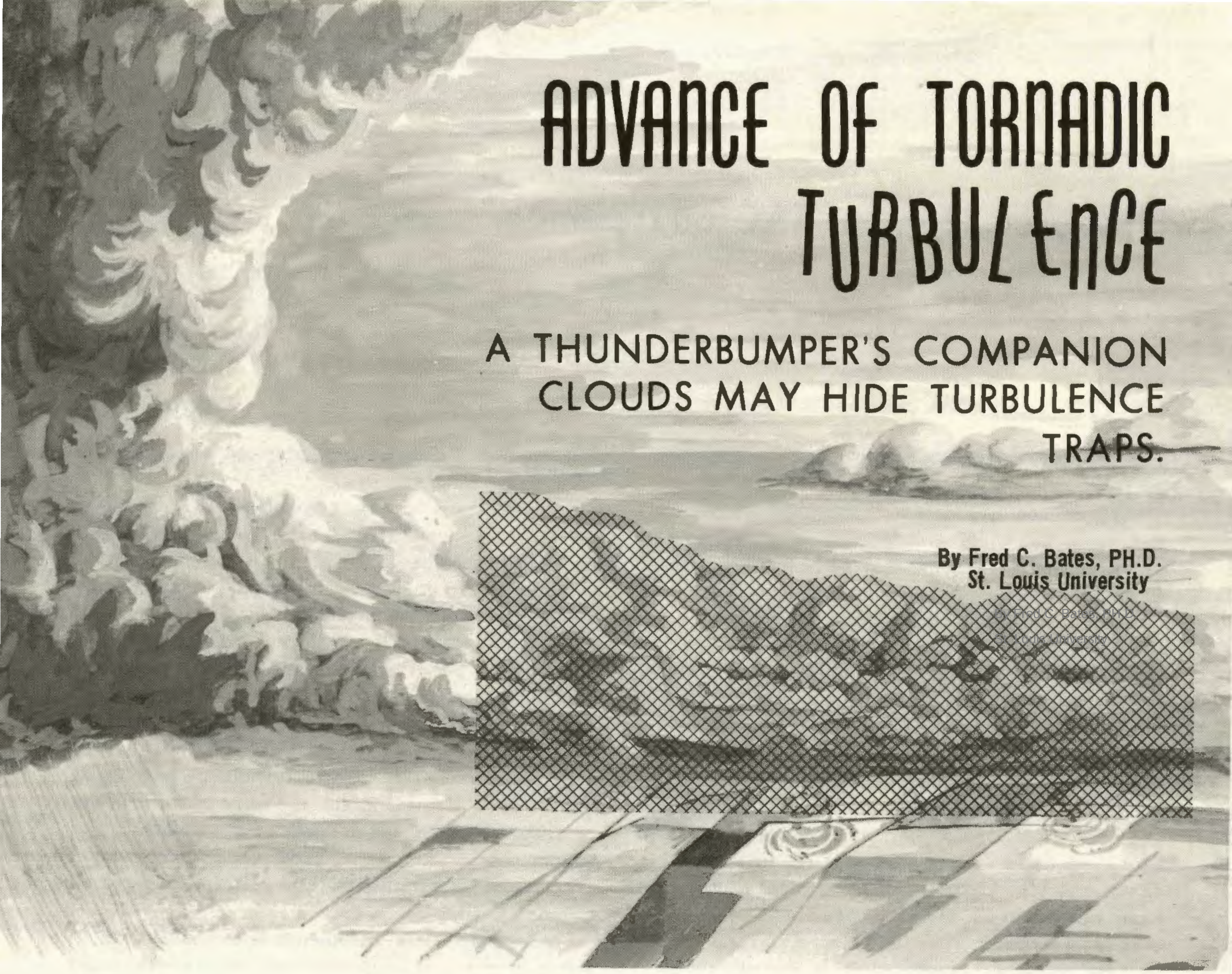
to hit or be hit ?

Most fighter pilots know that a crippled air-to-air dart can be most unpredictable. Recently an F-4E pilot began firing at 1500 feet with five degrees angle off. As he scored, two wings plus the radar reflector flew off the dart. This caused the crippled dart to roll up - as the debris fell off. The rolling moment resulted in the parts being thrown up rather than straight back. Although the pilot broke off his attack upon observing the hits he was unable to dodge the debris. Fortunately, damage to his F-4 was limited ...only required 24 manhours to repair.

The name of the game is to get the dart. Don't let it outmaneuver you. Right?? Right!!

ADVANCE OF TORNADIC TURBULENCE

A THUNDERBUMPER'S COMPANION CLOUDS MAY HIDE TURBULENCE TRAPS.



By Fred C. Bates, PH.D.
St. Louis University

Some recent observations and studies indicate that vortices, or "tubes" of tornadic or near-tornadic intensity may be encountered in and under innocent-looking lines of clouds extending from thunderstorms. Visible tornado (or waterspout) funnels may not be present to alert the unwary pilot but it appears that these vortices may exist up to 20 nautical miles from the associated thunderstorm. The areas where the "tubes" exist often are free of either precipitation or lightning, and the ambient turbulence in their vicinity is only light to moderate. Invisible vortices below the cloud bases may sometimes be evidenced by dust-whirls at the surface (or "sworls" on a water surface).

Deductions from some accidents in the vicinity of thunderstorms indicate that these "tubes" may extend to great heights within the flanking cloud lines (at least to about 18,000 feet MSL, and theoretically as high as 35,000 feet near the thunderstorm). Neither the "tubes" nor the embedding clouds appear to be reliably detectable on airborne radar, although the cloud line may be picked up by ground radar when viewed within about 30 miles if there is no intervening heavy precipitation. The cloud line may be detected on airborne radars below 8,000 feet MSL and within some 20 nautical miles. Typically the echo shows a sharp first iso-echo contour with a relatively "dry" interior. It is likely that these cloud lines give rise to the longer appendage echoes sometimes seen with tornadoes.

One important aspect of this hazard is the great distance from the associated thunderstorm at which these "tubes" may exist. Ten miles is an average value for audibility of thunder so that a thunderstorm might not be reported at the coincident ground station. Since there are no completely reliable local indications of the existence of the vortices, avoidance must be based upon a knowledge of the presence of thunderstorms with which these cloud lines and "tubes" are frequently associated, and flight procedures to avoid the cloud lines.

The meteorological conditions under which the hazard exists are similar to those for the tornado. Thunderstorms in tornado forecast areas should be suspected. It also appears that these "tubes" are much more frequent than observed and reported tornadoes, so that thunderstorms, other than those well-known to be of an "air-mass" nature, also should be suspect. A good first rule for absolute safety from this hazard is to avoid all suspected thunderstorms by at least 20 nautical miles on any line of bearing and at any altitude.

Thunderstorms in squall lines over smoother terrain are likely candidates, especially when there is appreciable wind-speed change greater than about 30 knots with altitude to about 20,000 feet. A preferred orientation of the cloud line is into the storm-related wind. To estimate this, take the storm-motion vector (as from a radar observation) and subtract the mean wind vector in the lower 20,000 feet. The resultant vector will point in the direction from the thunderstorm in which these cloud lines with related "tubes" frequently tend to form. Avoid flying in or under clouds, especially lines of clouds, in the quadrant about this vector. Under IFR conditions, "build-in" an avoidance of 20 nautical miles up to 5,000 feet above the surface, 15 miles at 15,000 and about seven miles at 25,000 feet.

Caution is especially advised on landing and take-off, descent and climbout, under or through these lines of clouds. Because of a possible convergence of the "tubes" upward in the cloud line, the hazard tends to increase with altitude in the clouds.

Effects upon aircraft encountering these "tubes" may range from a hard "bump" of several Gs upon a direct encounter with a weaker "tube," through an unusual "thump" in grazing incidence with the circulation of the "tube," and vigorous upsets in other grazing encounters, to catastrophic airframe failure in central encounters with fully developed "tubes." No aircraft has ever been built that can be expected to take the loads possible in a tornado, and survive. These fully developed "tubes," even with no tornado funnel to the surface below, are of such a nature and intensity as to preclude passing through unscathed.

Preliminary estimates of probability of encounter with these "tubes" in random flight (no avoidance skill) below 35,000 feet in the United States east of the Rocky Mountains indicate that an air transport might encounter a "tube" once every 3,000 hours (approximately). The probability of this encounter being of a major or catastrophic nature has been estimated at about one chance in eight. Thus, if no avoidance is practiced, a major or catastrophic incident may be expected in 24,000 hours of indicated operation. Skill in avoidance can increase this "waiting time" by a factor of 10 or more. Note, however, that close avoidance of a heavy thunderstorm echo to the south or southwest may produce a negative avoidance skill. The old rule of "out of echo, out of trouble" is definitely out for these phenomena.

Some further suggestions for flight safety with respect to these hazards are:

1. Under visual flight rules, do not fly below lines of clouds extending from an intense thunderstorm and often on a common base with the thunderstorm. If flight is absolutely necessary, circumnavigate or overfly with adequate clearance. Remember how far from the thunderstorm the hazard may exist and how innocent the related airspace may appear.

2. If inadvertently caught under one of these lines, watch for dust whirls (or water sworls on a water surface) and avoid overflying these. Get out from under fast.

3. Use a local ground weather-surveillance radar to best advantage in pre-flight briefing. The type of thunderstorm which often produces these "tubes" appears to have a typical echo (extensive anvil return, a scallop, sometimes an appendage coincident with a cloud line). A similar look at your airborne set before takeoff and below 8,000 feet can be helpful. Use gain settings higher than those for best delineation of thunderstorm echoes to bring up the weaker cloud echoes.

4. If no information is available for estimating the storm-relative wind vector, the most frequent orientation of the flanking cloud lines from the associated thunderstorm is from southeast through southwest to northwest.

5. Under the instrument flight rules, note carefully that the orientation of the related cloud lines may not coincide with the orientation of the thunderstorm line itself. Use the basis of estimate given to find the probable cloud line orientation. In using ground-radar vectors, be sure the set used either has the capability of detecting these cloud lines or is backed up by such a set.

6. Close avoidance on the opposite flank of the thunderstorm is not suggested. It must be remembered that there are other hazards, e.g., large hail, which must be avoided.

FLIGHT SAFETY FOUNDATION BULLETIN 68-102

USAF SAFETY AWARDS FOR 1967

Flying Safety Plaque

For meritorious achievement in Flight Safety, 1967

1. 64th Tactical Airlift Wing, Sewart AFB, Tennessee
2. 16th Tactical Fighter Squadron, Eglin AFB, Florida
3. 1st Air Commando Wing, England AFB, Louisiana

Missile Safety Plaque

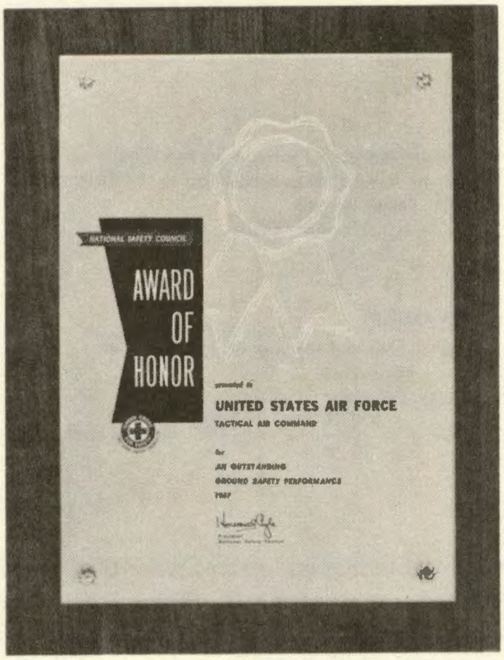
For meritorious achievement in Missile Safety, 1967

Cat I: 4453rd Combat Crew Training Wing, Davis-Monthan AFB, Arizona

Cat III: USAF Tactical Fighter Weapons Center, Nellis AFB, Nevada

National Safety Council Awards

Outstanding achievement in improvement of ground safety records.



Award Of Honor

Tactical Air Command
Ninth Air Force
Seymour Johnson AFB

Award Of Merit

Twelfth Air Force
McConnell AFB
MacDill AFB
Nellis AFB

4453 Combat Crew Training Wing, Davis Monthan AFB, Arizona

4500 Air Base Wing, Langley AFB, Virginia

TAC Drive Safe Award

FIRST QUARTER, 1968

For achieving the lowest private motor vehicle accident rate.

Cat I: 840 Air Division, Lockbourne AFB, Ohio

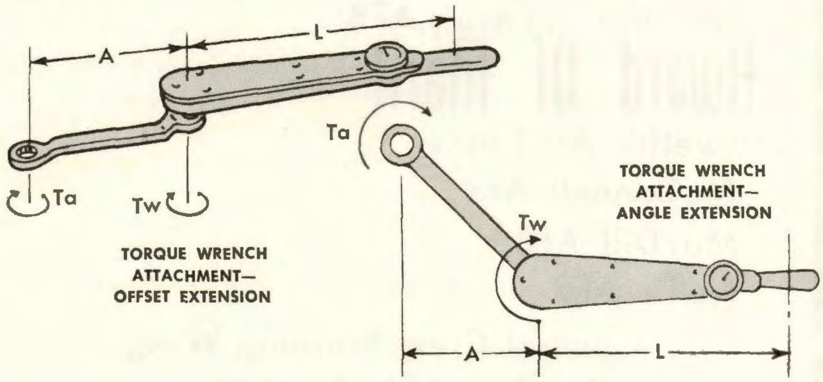
Cat II: USAF Tactical Air Warfare Center, Eglin AFB, Florida

CHOCK TALK

chock talk

...incidents and incidentals

torque talk



TORQUE WRENCH ATTACHMENT— OFFSET EXTENSION

TORQUE WRENCH ATTACHMENT— ANGLE EXTENSION

Tw = Indicated torque on the torque wrench
Ta = Actual torque applied to the fastener
L = Lever length
A = Attachment length

$$Tw = \frac{Ta \times L}{L + A}$$

EXAMPLE
Ta = Desired torque = 300 inch-lb
L = 10 inches
A = 4 inches

$$Tw = \frac{300 \times 10}{10 + 4} = \frac{3000}{14} = 214 \text{ inch-lb}$$

As the overall strength of a chain is no greater than its weakest link, the reliability of an aircraft is no better than its ability to withstand stresses and strains within its designed limits. Each threaded fastener used throughout the aircraft was specifically selected to fulfill a precalculated clamping or retaining requirement. As the link in the chain, each fastener when properly installed will contribute its small bit to the total reliability of the assembly.

In removing and replacing aircraft parts, we are often prone to install a special bolt, screw, or nut with the thought that since the manual said "tighten," we can bring it up snug and give it a tug! What the manual really said was, "adhere to standard torque limits," and this means use a precision torque wrench. Each fastener has its proper torque. Judgment and feel are poor substitutes for a torque wrench.

An experienced mechanic is familiar with two basic types of torque wrenches; he selects the proper type and proper size for the job. The indicating dial-type wrench is a convenient wrench to use because the torque is read on the dial as the force is being applied. The audible or click-type wrench is often handy to use in places where you cannot look at a dial as you perform the tightening operation. The desired torque is preset into this wrench by the mechanic before the tightening operation. When the preset torque is reached, the wrench will click and release, or "break," to give you approximately 15 to 20 degrees of free travel. Each type of torque wrench is as easy to use as any socket handle wrench.

Many torque wrench applications will require the use of attachments such as adapters and extensions to reach fasteners in places of limited accessibility, or they may be needed to position the wrench so that the dial can be read. Be careful of the offset extension. It will invalidate the reading on the dial or the preset torque and provide a false indication of actual torque on the fastener. You will need to correct the reading you observe on the dial or preset into the wrench (indicated torque) to obtain a desired torque for the fastener. The illustration above contains the formula used to compute the corrected indicated torque taking into account the effect of the extended length of the lever.

TEN TORQUE TIPS

1. DO ... use standard torque limits on threaded fasteners where special torque limits are not specified in maintenance manual procedures.
2. DON'T ... loosen a castellated nut or drilled-head bolt to obtain alignment for safetying. Tighten from the low limit to align safety hole.

3. DO ... torque all fasteners from the nut end wherever possible.
4. DON'T ... attempt to check a pretorqued nut for proper tightness. It requires 10% additional torque to start the fastener turning. Back off and start again.
5. DO ... tighten fastener to the HIGH limit if you must torque from the head end. Some torque is absorbed in turning the bolt in the hole.
6. DON'T ... fail to inspect threads for nicks, burrs, and contamination before installing.
7. DO ... compute the corrected torque wrench reading or setting that will provide the desired torque on the fastener when using an offset extension.
8. DO ... tighten new nuts and bolts to desired torque, then back off 1/2 turn and retorque. This cleans and smooths threads to provide more nearly accurate torque.
9. DON'T ... drop, file, mark, etch, or overload a torque wrench.
10. DO ... examine the accuracy of a torque wrench by periodic testing.

Northrop, TALON SERVICE NEWS

SUUpervisory error !

A weapons loading section was directed to mount an unloaded SUU-23 gun pod on an F-4, scheduled for a public static display at a cross-country airdrome. A NORs pod was selected, cleaned and painted, and mounted in accordance with TOs. Because guns are supposed to be cleared in the dearming area, and the drive assembly was not installed nor the firing leads connected, the load crew did not determine the loaded or unloaded status as directed, nor note this information on appropriate forms.

You guessed it! The aircraft commander was explaining the workings of the pod to a group of interested persons during the display. As he opened the side access door for all to see he assured them, "it was a safe and unloaded weapon." When the door opened, rounds fell from the disconnected end of the feeder assembly. The pod was immediately secured and the 20mm rounds recovered by the base EOD.

The measures indicated in the incident report are expected to prevent recurrence of supervisory error in the weapons section. Need we say more?

lightning bugs

T-39A/B lightning protection devices include diverter strips on radomes, diverter rods on aft fuel vents, and metal strips on wing tips. At some installations, maintenance men have nulified this system by unauthorized maintenance procedures.

The radome conductor is a one-half inch wide strip of aluminum foil extending from the extreme forward point, aft along the upper centerline to the fuselage. It is protected from the wind stream by the rain-erosion-resistant coating on the radome. The foil is destroyed when lightning strikes, and must be replaced to prevent the next lightning incident from possibly shattering the radome. Radome particles could be ingested causing serious engine damage.

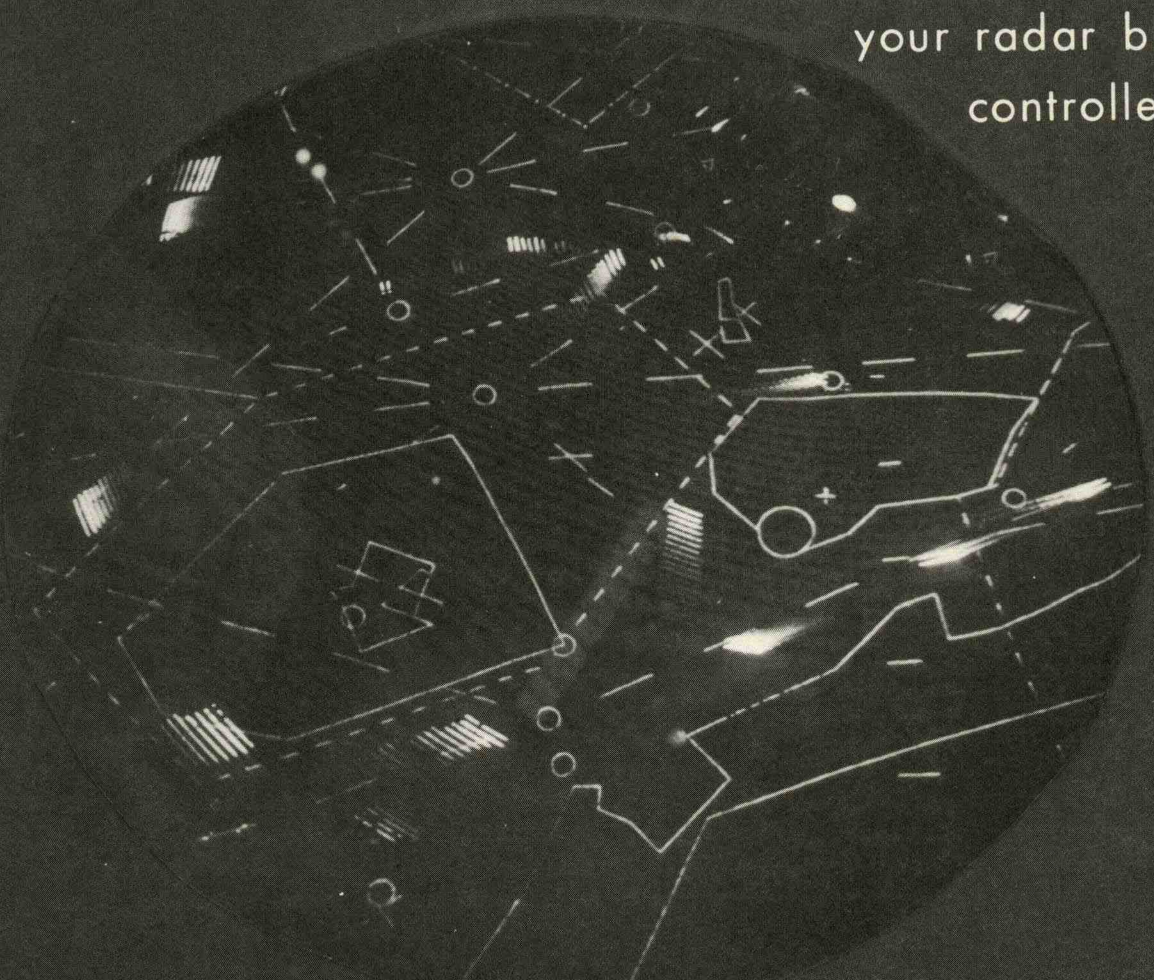
After replacing the strip, the radome must be recoated to maintain rain-erosion and wind stream protection. Also, application of oil, shoe polish, and a variety of other products, used by some units to improve the weathered appearance of the radome, can cause a static condition and, in the T-39B, the radar optics can be adversely affected. Radomes should be refinished according to TO 1T-39A-3.

The aft diverter rods are constructed of a fiberglass core, coated with an electrically conductive black paint. The coating is applied so a graduation of resistance is provided from the rod tip to the base of the retaining ferrule. This conductor coating is protected by a red epoxy coating, a gray topcoating, stripped with Dayglo, and marked with a DO NOT PAINT decal. Unfortunately, the decal deteriorates at about the same rate as the protective coatings and in some units, maintenance men have repainted with the wrong material, making the rods ineffective. Only applicable paints and Dayglo should be used for refinishing, and if the conductive black coating is exposed, the rod should be replaced. Also, if the rod is loose, but the conductive coating is intact at the retaining ferrule, apply Granger epoxy adhesive or equivalent at this connecting point and tighten the ferrule in place.

OPERATION'S SERVICE NEWS

YOUR MAN AT CENTER

... becomes a proxy crew member when he marks your radar blip on his controller's scope.



By Don Reynolds

Today's pilots could expect nothing but pandemonium in the sky if it were not for Air Traffic Control services of the Federal Aviation Administration. Airways in the United States have grown from a few low level routes to a complex network of crisscrossing corridors during a little more than a generation of pilots. The routes are fast developing into a maze of high and low level tracks which are being flown by a variety of aircraft, at fast and slow speed, heading toward many destinations. As the air traffic expanded, so did the need for positive air traffic control. Services of ATC are designed to provide this order and control. Their modernized services, geared to the FAA rule book, give every pilot assurance that he can survive in the sky. In fact, these services are very broad and can, within a shade of perfection, guarantee collision-free routing. The following article will, hopefully, satisfy pilots' curiosity about radar capabilities and those people "at the center." Who are they? What do they do? And why?

Air traffic control is founded on a mass of rules and regulations. Some flying types see this as an attempt to destroy all sense of freedom in the wild blue yonder. The adventure of random, sky-boring flights, SOP to pilots of only a generation ago, is fast becoming a thing of the past. But don't blame the rule makers. They have their reasons. A few statistics make this very clear.

At the end of WW II, there were about 25,000 aircraft being flown over the United States by air carrier, and private pilots. Federal Air Traffic Control was less than ten years old then, and its services consisted mostly of radio surveillance along low frequency airlanes and similar airdrome approach and departure assistance. Today, there are an estimated 115,000 civil aircraft in the U.S. being flown by over half a million pilots. This includes the more than 165,000 student pilots who are expanding their ranks by about ten percent annually. Add to this the tremendous growth of air carrier traffic. In 1945 a few more than 400 transports flew at about 150 miles per hour. Today, the average speed of the more than 2,000 air transports is near 500 miles per hour.

ATC has prevented airspace from becoming an Amazonian jungle of survival of the fittest, or fastest, by keeping their eyes in the sky . . . via radar.

After WW II, radar surveillance was introduced by FAA and has become the primary means of positive air traffic control. Today there are 28 Air Route Traffic Control Centers (ARTCC) across the United States and its possessions. Each center is served by one or more air route surveillance radar (ARSR) units which scan its skies.

A center also serves as a clearing house for flight plans throughout the system. A flight plan received at one center is transmitted to all other centers which will be overflown. To speed up flight plan clearance, computers are being installed at the centers to eliminate slower manual processing techniques. (All following references to the computer should be interpreted as either manual or electronic flight processing.)

The center's air traffic control area is subdivided into sectors. A sector controller team of five persons monitors an assigned area on a radar scope which shows an enlarged portion of the master ARSR. This is coordinated with flight progress strips, received at sector control from the center's electronic computer. Each strip represents a filed flight plan and indicates estimated times at given locations and planned altitude of all IFR movements that will pass through the sector.

Each sector control is equipped to receive and transmit on assigned VHF and UHF frequencies. Each is also assigned a series of IFF transponder codes.

Tied to the center network are approach and departure control systems which utilize 120 airport surveillance radar (ASR) units at major terminals. ASR differs from ARSR by displaying a lesser range and by using an increased antenna rotation rate which provides current information more frequently to the controller.

What happens at ATC when you file your IFR flight plan?

Your IFR flight request (DD Form 175) is one of more than 25,000 received by FAA every 24 hours. It is phoned or teletyped to the nearest ARTCC where it is put into the computer. (Some military and civilian airports now teleprint direct to the computer speeding up flight plan filing.) The computer, linked with 27 other centers, processes the flight plan and prints out flight progress strips to each of the sectors which will be overflown. About 30 minutes before your arrival over a sector, the controllers are expecting your arrival at an estimated time based on your filed true airspeed.

It is the controller's responsibility to direct all IFR traffic through his sector. The flight progress strips give him an opportunity to preplan. If oversaturation seems imminent, he will ask assistance from other sector controllers who can delay or divert excessive traffic before the otherwise inevitable scheduled congestion happens.

During rush hour periods, a single sector controller may direct as many as 50 or more aircraft per hour. This is IFR only and does not include the sometimes equal amount of VFR traffic through the sector. With the help of his team, the controller knows the heading, altitude, and airspeed of each IFR aircraft.

This is how the five-man team works. The flight data processor (also known as assistant manual controller) takes computer printouts from the sector teleprinter, mounts them on flight progress strips,

THE SECTOR RADAR SCOPE (OPPOSITE PAGE) PRESESENTING A SKY FULL OF FLYING AIRCRAFT MAY BE AN ABSTRACTION TO PILOTS BUT IS REALITY TO AIR TRAFFIC CONTROLLERS. "SHRIMP BOATS" MARKING IFR FLIGHTS WERE REMOVED FOR CLARITY. DIRECTION OF TRANSPONDER EQUIPPED AIRCRAFT (MULTIPLE SHORT LINE BLIPS) IS INDICATED BY FADING BLIP TAILS. DOT SHAPED VFR FLIGHTS, NAVAIDS, CONTROLLED AIRSPACE, AND AIRWAYS ARE ALSO SHOWN.

your man at center

Your man at center is really a team of men, backed up by a maze of electronic aides. Left: The sector controller team includes (seated, from right) radar controller, radar tracker, manual controller, (standing, from left) flight data processor, and sector supervisor. Each sector control panel has a horizontal (working) radar scope, a vertical backup scope, a series of air to ground UHF and VHF communications frequencies, a panel of transponder code selectors, telecon circuits between sectors and centers, weather information updated hourly, and a teleprinter from the flight planning computer (above). All ATC centers are not yet computer equipped.

which are then posted on a rack in front of the manual controller. The manual controller follows each aircraft, via telephone and interphone communications between all ATC units, noting takeoff time, delays enroute, etc. When a flight nears the sector, he notifies the radar tracker.

The tracker prints aircraft ID and altitude on a clear plastic chip, about an inch long and half inch wide, called a "shrimp boat." When the aircraft blip first appears on the radar scope and the sector is contacted by the pilot for positive ident (IFF Squawk), the plastic boat is placed on the scope atop the aircraft blip. The tracker pushes each boat along as its blip progresses across the sector.

The rest of the job is the radar controller's who must keep each IFR aircraft under surveillance. Aircraft passing near each other are alerted by the controller who will also direct a holding orbit or course change as required.

The sector supervisor is the fifth man on the team. He monitors all traffic activities and coordinates with adjoining sectors.

Note again that the previous operation concerns IFR traffic only. Here's why. Each sector scope is capable of displaying two types of radar contact: primary and secondary, and either or both can be shown on the scope at one time.

Primary radar blips are created by reflection of radar transmissions (painting) from solid objects such as wings and fuselage of aircraft, heavy cloud formation, trees and other ground obstacles. All traffic, except some small aircraft, can normally be tracked by this system. However, these blips are sometimes obliterated by radar reflections from cloud formations, ground objects, etc.

Secondary radar displays only those signals relayed by a squawking IFF transponder (radar beacon) which are not obliterated by weather or ground returns. When aircraft ident is requested by a controller, the IFF blip is intensified and enlarged.

It is SOP that the sector controller monitoring traffic below flight level 240 will use both primary and secondary radar. The primary signal is filtered to reduce weather and ground object returns. This filtration also cuts out the weak signals reflected by small aircraft.

If primary blips and ground clutter tend to confuse his identification or tracking of IFR blips, he will turn-off the primary signal and monitor beacon squawks only. However, the controller usually monitors the VFR transponder channel, Mode 3 - Code 06, so VFR aircraft, equipped with a radar beacon, will usually always be seen. Controller advisories to pilots about VFR traffic are limited though, because VFR altitude cannot be determined by either radar system.

The sector controllers for areas of positive control, either FL 180 or FL 240, normally use only the secondary signal, or radar beacon.

If your transponder is working OK, you can be sure you are being seen... and watched. (This is not 100 percent true with approach control systems using Moving Target Indicator radar - MTI. More about this later.) Your ident squawk can't be missed. It's like turning on a bright light at your position on the scope.

The sector radar controller can visually steer you around, under, or over all IFR traffic by heading and altitude. And if his total attention is not being demanded by high volume IFR traffic, he will advise of VFR flights in your vicinity. He does not know, so cannot advise, of VFR altitude.

If you request a vector direct to another point of your flight plan, he will cooperate, if time permits. First of all, he must check to see if you will conflict with other traffic in his sector. If clear, his manual controller must check with other sector controllers for the same reason. This takes time. To sacrifice his attention from 30 or 40 blips on the scope for one pilot's convenience, even for a couple of minutes, could be risking the safety of several flights.

However, if you're in trouble and declare an emergency, the situation is quite different. The controller will give you priority. For instance: You've got a sick bird and you determine you must find the nearest adequate airport. You squawk Mode 3, Code 77, enlarging your radar beacon blip. DOD flight planning procedures also advises immediate voice verification of the emergency by voice contact with the center controller, because emergency squawks of old WW II transponders are not picked up by ATCs current radar system. When you have advised the controller of your situation, he will ask for your intentions.

If your plan calls for a direct vector, the controller will advise a heading. If your plan includes flight into known adverse weather, or other situations known to ATC which would increase your problem, you will be so advised. However, you make the decision. The controller will use all possible means to open the way and assist in a safe recovery.

Flight assists given to pilots in distress by FAA facilities in 1967 totaled 3,697. This was 346 more than in 1966. Lost pilots topped the list with 2,219 incidents; 508 pilots with mechanical troubles were aided; 412 pilots had communications or navigational failure; 422 involved in bad weather; and 136 pilots with miscellaneous troubles were assisted. Radar was used in 1,146 of the incidents.

When you are about to leave the sector's control you are advised to tune a new sector frequency and report. At this time, your flight is "handed off" to the next sector controller team who is already aware of your impending arrival, as indicated by flight progress strips on the manual controllers board. Problems which can be caused by flight plan deviations are obvious.

However, allowances are made for planned deviation from flight schedules. You can request direct radar vectors to bypass standard instrument departure routes or to bypass an airway route by a direct vector to another point along your flight route. You simply alert ATC that you may request direct vectors at these points by noting this information in the "Remarks" section of DD Form 175.

Problems sometimes arise between aircraft and controller because of misinterpreting terminology. Occasionally, a pilot is held at the end of a runway awaiting clearance. Weather is VFR so he decides to go VFR and take his IFR clearance enroute. He advises the tower he will takeoff VFR and is cleared.

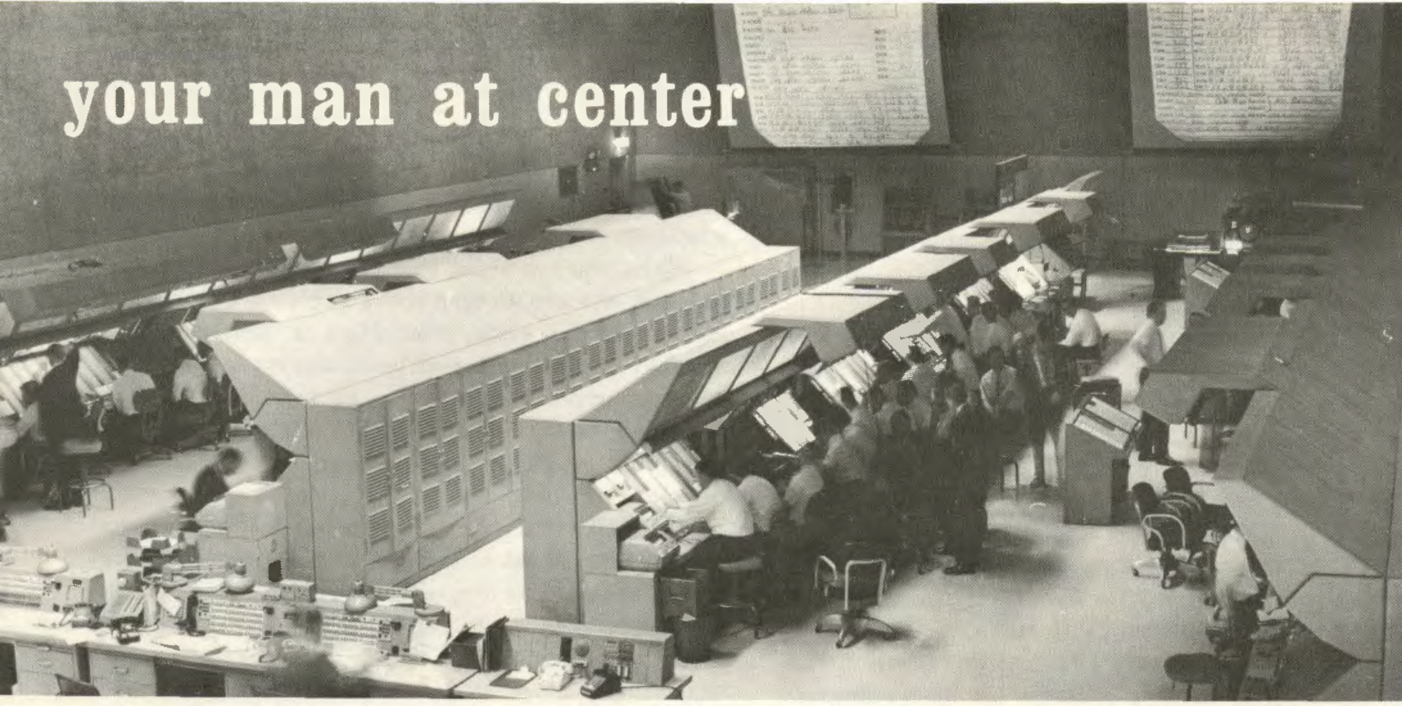
What he doesn't know is that the tower misunderstands and cancels the IFR flight plan. The pilot discovers the error when he makes his first planned contact with ATC, who, by that time has cancelled the plan, dumped the flight progress strips, and must start the whole procedure over again, causing further delay.

This can be avoided by advising the tower that you will accept your IFR clearance enroute or at a specific point on your planned route. However, this procedure has another risk and it concerns the reason for clearance delay.

It is important to determine from the tower controller, if the delay is resulting from heavy center traffic or from terminal congestion. A pilot will not help his situation by taking off VFR and heading into heavy center traffic without clearance. But if the delay is caused by congested terminal traffic, you will do yourself and ATC a favor by making a VFR takeoff to clear the terminal, receiving your clearance enroute. It is obvious that this procedure is not practical for turbojet traffic which would have to remain at low altitude until clearance is received for a flight level into controlled airspace.

Another misunderstanding often occurs concerning turbojet enroute penetration and enroute descent. The difference between these two separate proce-

your man at center



Washington Center is a typical ATC installation. Four banks of controller teams keep the center's 15 sectors under surveillance 24 hours a day. Continually updated weather information is projected on large screens (rear) in view of all controllers.

dures is not noted in the FLIP Planning Publication. Many pilots think both terms mean the same thing.

When a controller is requested to authorize an enroute penetration, he reads that you want to make a descent from your flight level to initial penetration altitude, terminating over the navaid where you will begin an approach using FLIP high altitude instrument approach charts.

If you request an enroute descent, the controller assumes that you want to descend from your assigned flight level by direct vector for a handoff to approach control. This usually means a random approach and requires coordination between enroute control and approach control before approval can be given. If approved, you will be vectored to an altitude and heading for an ILS, GCA or VFR approach. However, one very important point should not be overlooked. Before beginning the descent, you should be sure the controller understands your plan if radio failure occurs. Simply state the approach procedure you will use, as published in the high or low altitude terminal FLIPs. Failure to specify your emergency procedure can lead to a midair collision, or at best, add grey hair to those pilots who may be leaning on their fuel reserves as they're vectored to clear the air for a jock who has ignored a published flight procedure.

It is here too that radar surveillance is sometimes temporarily lost. Some approach control and terminal control systems (GCA for example) use radar with Moving Target Indicator (MTI) presentations. This system permits only moving targets to be presented. This eliminates confusing and undesirable scope images caused by radar returns from buildings, high terrain, and trees common to many aircraft terminals.

But it is still possible to "lose" a moving target temporarily. If this happens, the controller will request a change in speed or direction and the target will reappear.

Too often, an air traffic controller is forced into "sweats" when the cause of a situation is out of his control. Many TAC pilots spend considerable flying time on specific military operations; refueling, navigational exercises, range firing, aerobatics, etc.

Routine traffic is vectored around the perimeter of these space blocks by ATC. Everything works fine until the military jock, intent on his mission, is unaware that he has slipped outside the boundaries of his reserved air space. And it's not uncommon that, under these conditions, military aircraft are on a tactical communications frequency. It doesn't take much imagination to see the controller's dilemma. What direction would you vector a 500 mile-an-hour airliner whose path is being crisscrossed, at an unknown altitude, by an incommunicado fighter who believes he's in the clear? It is well to remember that a controller's sweats could be the beginning of an epitaph . . . the pilots.

Some of ATC's services are dependent on pilots themselves. The controller's scope is designed to eliminate most heavy weather so that radar contact is not lost because of these formations. So, he may not be aware of hazardous weather, storms, turbulence, icing, etc., especially of a local nature. But he would be happy to advise you if someone had advised him earlier. It only requires a short and concise pilot's report (PIREP) on the unexpected conditions. ATC will advise others who may soon be traveling the same route.

Who are these people who control the destiny of thousands of pilots every day? What are their qualifications?

The majority of the ARTCC controllers have previous military experience, either as rated officers or control tower operators. Controller training starts in the classroom. Each ARTCC is staffed and equipped to train their own personnel as well as maintain proficiency testing and training of fully qualified controllers. Classrooms are equipped with sector control consoles like those in the main control room.

Problems are created for the student controller, similar to the use of flight simulators for aircrew training. Before a controller is qualified, he has worked at most other positions in the center, from typing flight plans into the computer to performing each supporting job on a sector control team.

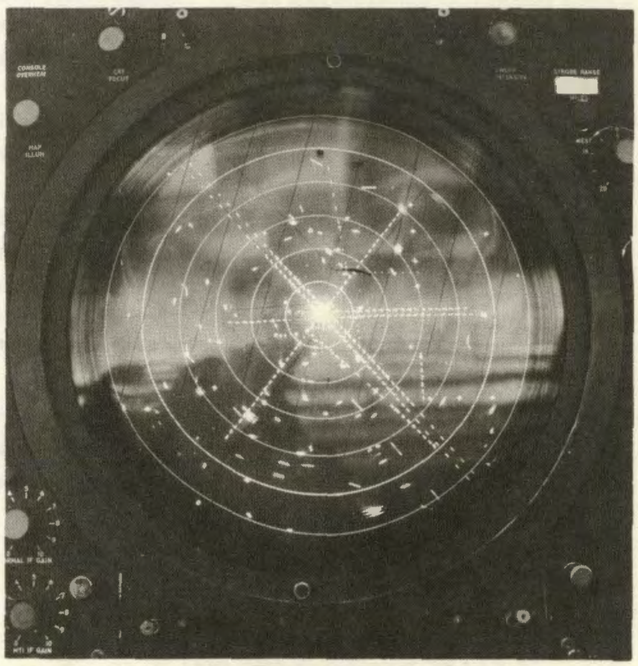
Twice a year the controller's technique is evaluated by an "over the shoulder" critique by the center's training officer. The controller is also tested twice a year by written examination, prepared by the FAA Academy at Oklahoma City. About 25 percent of the 100 question test is devoted to specific matters concerning the controller's own traffic area. Each controller must also meet qualifications annually of Second Class Airman medical examination.

Supervisory control over each sector is constant. This is the job of the team's fifth member: the sector supervisor. He has spent many years as a sector controller. Another important monitor of the controller team's efficiency, is a bank of magnetic tape recorders. Each of the couple-of-dozen reels of tape, which turn 24 hours a day, are recording 28 VHF and UHF channels and two channels of time signals. With this system, records are kept of all voice communications between controllers and aircraft.

Air traffic controllers take their job just as seriously as the man in the cockpit. Both are constantly aware that the unexpected can happen. Both are also human beings, possessing characteristics a little short of perfection. Both are dependent on each other. They will probably never meet, except by the invisible link of modern electronics. Occasionally, misunderstandings lead to frustrated operations. Both men are involved. The controller cannot go to the pilot, but the pilot can go to the controller. Almost every Air Force installation has an FAA air traffic representative and many bases have an officer assigned as liaison between the Air Force and FAA. The pilot or his squadron commander can consult with either of these men if a problem exists. And either of these men can arrange for pilot tours through an ATC center. FAA encourages aircrew visits to the centers.

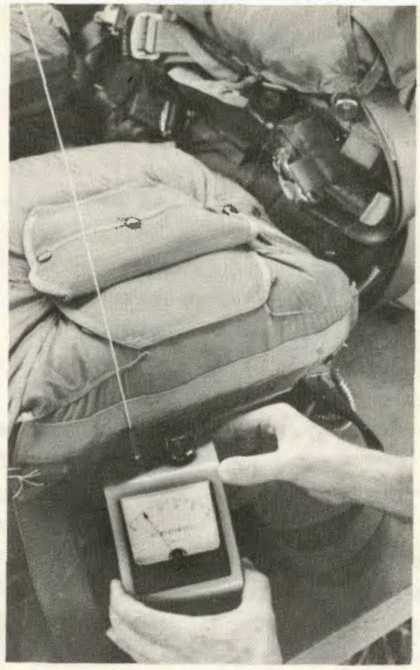
ATC is a service of FAA which has the awesome job of making rules of flight which will decrease the growing hazard of air collision and increase flight safety. Like any other service in great demand, there is always the need for expansion. ATC methods have progressed through the years and will continue to change with new demands.

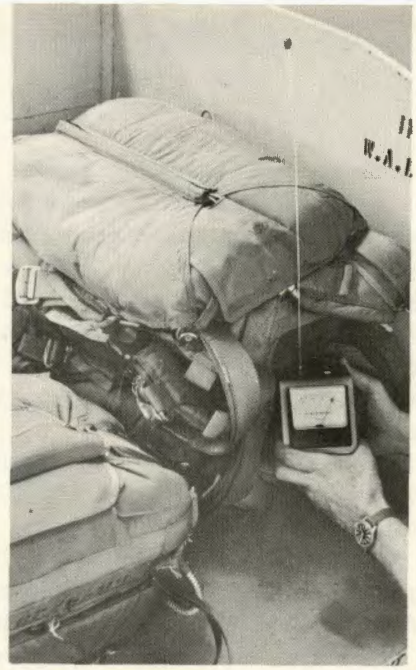
The pilot who is willing to shift gears with change is the man who will safely hold his place in our continuously shrinking sky.



Some flight control centers are nearing the saturation point for safe air traffic control. Master radar scope of ATC approach control at O'Hare International, Chicago, shows weekday, midmorning IFR and VFR traffic. Not all VFR light aircraft are shown on radar, but the 30-mile radius scope shows more than 100 aircraft. And only IFR flight altitudes are known. Chicago controllers report that during late afternoon and weekend rush periods, air traffic increases nearly 100 percent.

BETTER MOUSETRAP





Pin-pointing a chute with a malfunctioning beeper is simple with NASA's signal detector. When the general location is determined, detector sensitivity is reduced (left). Meter reading increases (right) as snooper nears the beeping chute.

A hurried search for an emergency locator beacon, inadvertently squawking from a flightline aircraft or the personal equipment shop, is not uncommon at most Air Force installations. Not only is the control tower operator at the mercy of the Guard Channel jammer, but so are aircrews if caught in a distress situation within the range of the beeping beacon. Dozens of men may have to search through hundreds of chutes, survival gear, and aircraft before the culprit is found.

This may soon be changed with the use of a beacon "snooper" designed at the NASA Langley Research Center. The signal detector requires no batteries or external power. It consists of a sensitive meter driven by beacon signal energy picked up with a short antenna and amplified by simple circuitry. It is made of about $30 worth of parts found in most Avionics shops.

Operating the detector is simple. Sensitivity is variable by turning a potentiometer knob, the only moving part. Lacking power, it is always in a "turned on" state. With the knob turned to maximum sensitivity, the unit can be held out an open window of a flightline vehicle, patrolling an aircraft parking area. The meter registers beacon radiation within a twenty foot range. When the offending aircraft is found and the detector taken inside, the meter will show a maximum reading and must be reduced in sensitivity by turning the knob. While walking through the aircraft, an increased reading indicates closure on the radiating beacon, which can be quickly spotted and silenced.

In a personal equipment shop, signal detectors can be permanently placed throughout the facility and periodically monitored. If a positive reading is indicated, the same detector can be hand carried to locate the bin of stowed gear and even detect which piece has the active beeper.

new sidewall summary

This drawing illustrates the sidewall information required for passenger tires by the new federal tire safety standards. Only the name of the particular tire design, in this case Custom Wide Tread Polyglas, is not required. The *manufacturer* must be identified either by name or code. The letters "DOT" indicate compliance with Department of Transportation standards. "F70-14" is the tire size. In the case of radial-ply tires, the word "Radial" must also appear.

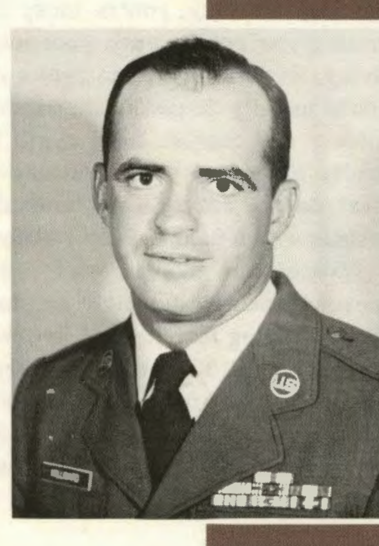
Courtesy of Goodyear Tire and Rubber Company

MAINTENANCE MAN OF THE MONTH

Staff Sergeant Douglas W. Sheldon, Det 1, 831st Air Division, Edwards Air Force Base, California, has been selected to receive the TAC Maintenance Man Safety Award. Sergeant Sheldon will receive a letter of appreciation from the Commander of Tactical Air Command and an engraved award.

SSgt Douglas W. Sheldon

TSgt Wilmar E. Millward

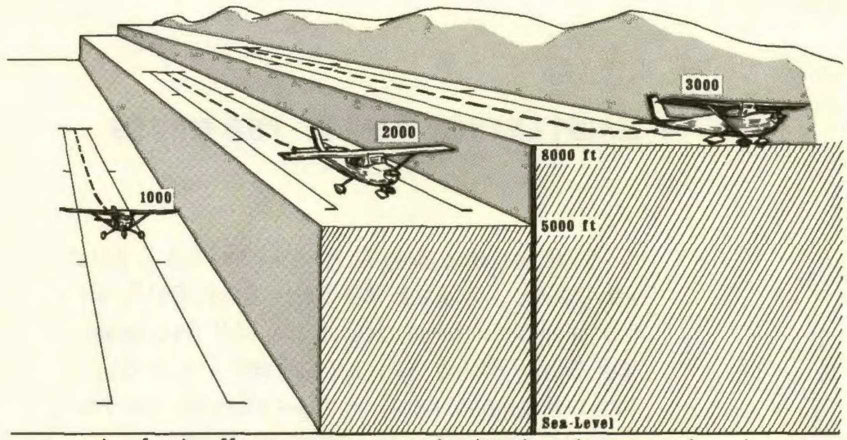


CREW CHIEF OF THE MONTH

Technical Sergeant Wilmar E. Millward of the 4525th Fighter Weapons Wing, Nellis Air Force Base, Nevada, has been selected to receive the TAC Crew Chief Safety Award. Sergeant Millward will receive a letter of appreciation from the Commander of Tactical Air Command and an engraved award.

flight-planning your vacation

By Major John M. Lowery



Length of takeoff run increases with altitude. Also remember that long grass, sand, mud, deep snow, puddled, or flooded runways can easily double your takeoff distance.

This time of year, those of us who fly for fun are deep into the planning phase of an outing in one of the Aero Club's family size airplanes. As servicemen we are very fortunate to have well-maintained Cessna 172s, Piper Cherokees, Mooney Mark 21s and the like, available for vacation travel at very reasonable rates. Many service families have discovered that it's cheaper to fly a (club) Cessna 172 from Seymour-Johnson AFB, N. C. to Denver or Cheyenne, for example, than it is to drive. It's certainly a lot more fun . . . and safer.

With proper planning you can fly 800 to 1000 miles per day. Driving, you're lucky to average 500 miles unless you really push yourself and the family. By flying, even if forced to rent a car at the other end, you'll usually come out ahead considering the price of motels and meals. Best of all, by flying you'll generally arrive at your destination in daylight of that first day of leave, safe from the road hazards and fatigue which usually accompany a long trip.

Sometimes though, we forget that flight planning a cross-country in a light airplane involves the identical planning factors that are needed to fly an F-100, F-105, or C-130. Failure to keep this thought in mind cost TAC the life of a combat-ready pilot last year. Would you believe that the iced-down fish he and three companions caught was just enough to prevent a safe flight home. Four grown men, some baggage, fishing gear, the fish, a hot, humid, summer day, plus a short airstrip, caused an otherwise pleasant outing to end in tragedy. They simply ran out of runway on takeoff.

To review some of the planning factors involved in a flying vacation, let's consider some of the basics. The first two are Center of Gravity (CG) and Gross Weight (GW).

CENTER OF GRAVITY

Let's say you have two semi-trained, overfed teenagers, a quiet, unassuming, devoted wife, and the four of you are flying the Aero Club Cessna 172 home to see the grandparents. We'll assume you're flying from Langley to Durango, Colorado. What can you carry and in what part of the airplane?

A look at the weight and balance section of the Cessna owner's manual (pilot's handbook) shows an aircraft loading chart. By following the sample problem you can easily figure your weight and CG limits. Without going into a lot of detail, you'll no doubt find that your combined weights (average of 170 pounds each) plus fuel and oil just about fill the aircraft to capacity (2300 pounds). Actually, without defueling to lighten your load, you can only carry 26 pounds of baggage. This gives you a CG within the allowable performance envelope.

Now cheat a little. You know the aircraft will fly with more weight than the book shows. So, throw about

100 pounds of vacation clothes and goodies into the baggage compartment. Now your weight and balance chart will show that your aircraft is out of balance ...tail heavy and overweight. The excess weight will obviously increase the takeoff roll. But an aft CG may cause the aircraft to over-rotate on takeoff. You may pull back slightly on the control column to lift the nose wheel. Suddenly the nose jumps up and the tail begins to drag. Often this over-rotation will cause you to become airborne below normal flying speed. Then you'll find yourself behind the power curve. In some non-spinnable aircraft with restricted elevator travel or with a severe aft CG, full forward elevator may not get your nose back down.

You must ALWAYS carefully calculate fuel, passenger, and baggage weight to insure proper CG of the aircraft. So don't cheat, even a little!

GROSS WEIGHT

Now let's suppose you and the family weigh-in at more than the average 170 pounds each. This extra weight may be a personal problem or it may be in the form of coats, coffee jugs, lunches, ice chest, or what have you. If this is the case, then you're going to go without baggage. Otherwise, you'll have to defuel to lighten the load. This, naturally, shortens your aircraft range. The Cessna 172, our example, is certified to 2300 pounds. So if your total weight exceeds that figure something has to go.

Flying overweight is unfortunately a common practice. But look at the hazards. The excessive weight, assuming proper CG, adds significantly to your takeoff roll, increases the stress on the landing gear during taxiing, takeoff, and landing; necessitates a high power setting for longer periods of time, both in climb and cruise (decreases engine life); and makes the airframe more sensitive to over stress in turbulence.

AIRCRAFT TOTAL PERFORMANCE

With these facts in mind, let's add "Skinny Air" which is characteristic of summer flying.

You took off earlier from Langley which is near sea level. Now at Durango, your airport elevation is 6688 feet and it's summer time. With vacation over you prepare to fly home.

The surface temperature is 80 degrees F. Since this is 50 degrees hotter than the closest standard day table in the owner's manual (7500 feet at 39 degrees F) you must add ten percent to your takeoff roll distance for each 25 degrees above standard. This makes your takeoff distance almost 1900 feet. If you have a power line to clear (50 feet obstacle) you'll need about 4500 feet of runway. Now look at the surrounding mountainous terrain and your rate of climb chart... 230 feet per minute. That's not a very fast climb in mountainous terrain. If you're overweight, you've really got troubles.

The problem revolves around density altitude. Simply stated this is pressure altitude as read on the altimeter with the barometric scale window set on 29.92, corrected for temperature (hotter or colder than standard). Hot temperatures and high humidities combine to decrease the performance of your airplane.

As density altitude goes up, engine power output goes down (unless you have a supercharger). At normal certified weights your takeoff roll is lengthened. Because the engine is producing less horsepower you'll have to roll farther to obtain flying speed. Obviously, if you are overloaded at an airport such as Durango, you'll never leave the local area. The bird just won't climb even if you're lucky enough to get it flying.

In the fatal accident referenced earlier, the pilot was departing a 1600 foot strip with hot, humid, light-wind conditions. He did manage to get airborne by skillful use of partial flaps. It was the 50 foot obstacle at the end of the runway, a power line, that led to the sudden stop.

AIRPLANE FLIGHT MANUAL

The owner's manual should always be in the airplane when you fly. After all it has the checklist and the performance charts. Use this book and the data provided to carefully plan your flight. If your handbook does not have a takeoff and landing table then the FAA has a new, and very accurate Denalt Performance Computer (U. S. Government Printing Office, Washington, D. C. 20402; price 50¢). This computer replaces the old, ultraconservative Koch Chart. Two versions are available, one for fixed pitch props and one for variable pitch. The computations work out for any of our commonly used Aero Club Airplanes.

CONCLUSIONS

In the summer months, aircraft performance falls off. This makes careful load and flight planning especially critical. If you're taking the family on a flying vacation, why not ship your suitcases, golf clubs, and heavy gear by bus or train three or four days in advance.

Remember the old saying, "Fly one, fly them all?" This, of course, referred to a pilot's ability to fly any airplane, anywhere, anytime. This may or may not be a truism. However, when it comes to flight planning, it fits. No matter what airplane you may be flying, the flight planning's the same.

LETTERS ...to the editor

I was very disappointed with your answer to Major Robert V. Vanden Heuvel's letter in the March 1968 TAC ATTACK.

The angle of attack indicator alone cannot possibly tell the pilot that he is on the glide path or the proper approach angle. Reference must be made to some aid outside the aircraft to enable it to arrive at the proper touchdown point at the proper airspeed and rate of descent. On instruments we use GCA or ILS to keep us on the glide path; VFR we use the old trained eyeball with helpful aid from VASI.

We instructors in the 4415 CCTS at Shaw warn our students in the RF-4C about falling into the very dangerous assumption you put forth in your answer to Maj Vanden Heuvel. We demonstrate to them that it is possible to fly an aircraft at the proper approach angle of attack while in any rate of climb or descent, even to do a loop "on-speed" all the way.

Please remember that the angle of attack indicator is only another aid and will give you and your wing man safe maneuvering and approach speeds but never assume that you have a safe rate of descent with reference to angle of attack alone.

Major Leland L. Johnson
Instructor Pilot, 4415 CCTS

Reference Maj R. J. Vanden-Heuvel's letter and your comment in the March TAC ATTACK.

Either I don't understand what the Angle of Attack indicator is trying to tell me or I don't understand your editor's comments. The last sentence in your comments indicates that the proper angle of attack on the final approach will get you a good safe landing. Not necessarily so. The angle of attack indicator tells you only the angle between the longitudinal axis of your aircraft and the relative wind passing over the angle of attack probe. A properly executed final approach includes a normal glide path and an "on speed" angle of attack. An exaggerated situation to show how an "on speed" condition could still be hazardous or fatal is a 20 degree glide path in landing configuration and an "on speed" indication. The point I am trying to make is that the angle of attack indicator knows nothing about aircraft pitch attitude in relation to the horizon but only in relation to the relative wind. It is sort of like a yaw string working on the side of an aircraft instead of the top. It doesn't show where you are going but does show your angle of relation to the relative wind.

The angle of attack indicator is a fine aid to the pilot to assist him in arriving at the touchdown point at the best landing attitude and speed if used to supplement other instruments.

Lt Col Austin C. Ayotte
75 TRW, Bergstrom AFB

* * * * * * *

You are reading something into both the article ("Using Angle of Attack in the Thunderchief," July 67) and the editorial answer (March 68) that is not stated nor intended. Since the letter-writers are F-4 pilots perhaps a quote from the F-4 Tech Order will help make the point clearer. Ref T.O. 1F-4(R)C-1, Page 2-32, second column "... the angle of attack indexer or on-speed indication represents optimum safe angle of attack and airspeed for all pattern work, including maneuvering. In addition, the on-speed indication provides sufficient airspeed cushion for any gusts that may be encountered in the pattern... Use the angle of attack indexer to maintain an on-speed indication since this represents optimum approach angle of attack which will automatically adjust airspeed for the gross weight of the aircraft. Flying a two and one-half degree to three degree glide slope will produce a mild rate of descent of about 700 feet per minute..."

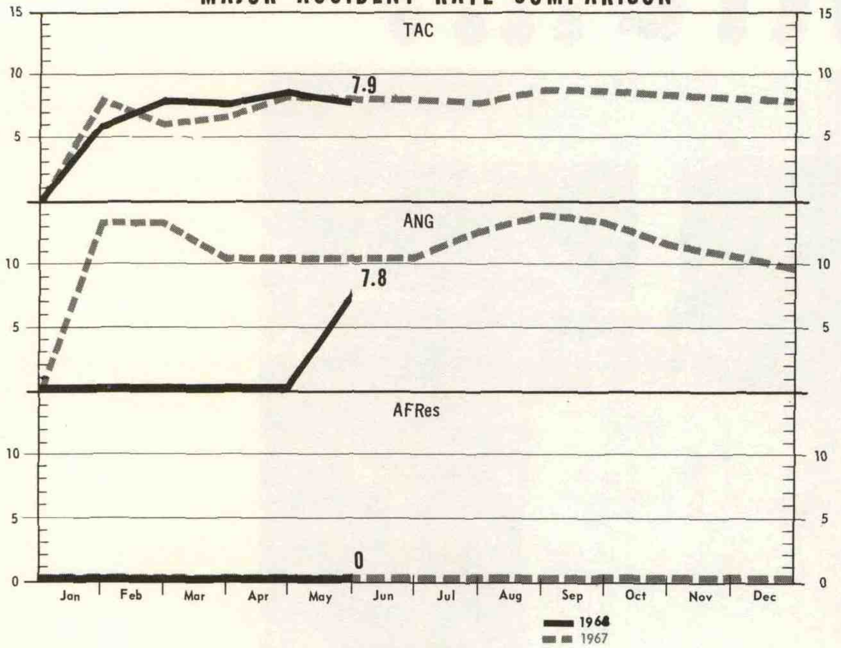
This essentially restates in a clearer fashion what the article and the editorial answer tried to convey. Your interest and response behooves us to make our point distinctly the first time around. We'll try harder.

Ed.

TAC TALLY

MAJOR AIRCRAFT ACCIDENT RATES AS OF 31 MAY 1968*

MAJOR ACCIDENT RATE COMPARISON



UNITS

	THRU MAY 1968	THRU MAY 1967		THRU MAY 1968	THRU MAY 1967
9 AF	6.3	9.2	12 AF	7.2	8.0
4 TFW	11.6	0	23 TFW	9.7	7.2
15 TFW	9.6	31.2	123 TRW	0	27.9
33 TFW	16.8	17.4	27 TFW	7.2	12.9
113 TFW	32.3	0	140 TFW	0	20.7
4531 TFW	11.6	0	479 TFW	16.0	9.4
363 TRW	0	11.9	474 TFW	51.3	0
64 TAW	0	0	67 TRW	0	0
316 TAW	0	0	75 TRW	0	24.1
317 TAW	0	0	313 TAW	0	0
464 TAW	0	0	516 TAW	0	0
4442 CCTW	0	15.1	4453 CCTW	10.6	0
			4510 CCTW	2.7	7.6
SPECIAL UNITS					
1 ACW	0	0	4500 ABW	0	0
4410 CCTW	17.9	3.3	4440 ADG	0	0
4409 SUP SQ	0	0	4525 FWW	30.2	30.0
			4416 TSQ	0	0

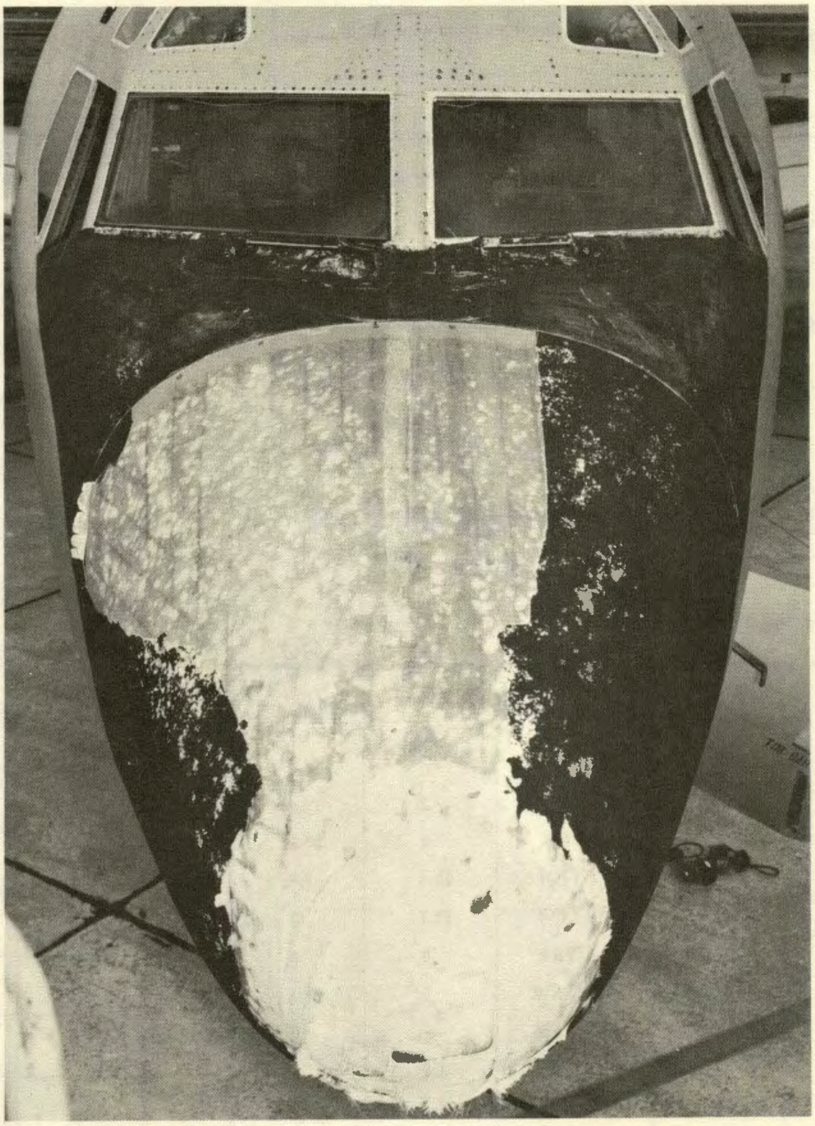
AIRCRAFT

THRU MAY 1968 / 1967

TYPE	TAC 1968	TAC 1967	ANG-AFR 1968	ANG-AFR 1967
A-1	57.5	13.8	0	0
RB-66	0	0	0	0
F/RF-84	0	0	6.8	18.2
F-86	0	0	23.5	0
F-111	69.8	0	0	0
F-100	13.1	13.9	0	10.1
RF-101	0	47.7	0	45.1
F-5	0	27.6	0	0
F-105	13.7	9.2	0	0
F-104	0	0	84.4	0
F/RF-4	10.4	14.5	0	0
C-47	0	0	0	0
KC-97	0	0	0	0
C-119	0	0	0	0
C-123	20.3	0	0	0
C-130	0	0	0	0
T-29	0	0	0	0
T-33	4.8	5.8	0	0
T-39	0	0	0	0
C-7	0	74.2	0	0
O-1	0	0	0	0

*ESTIMATED FLYING HOURS

HAIL...?



yes