

# TAC ATTACK

Tac Attack

JULY 1969



Hardison

Sabres and Angles....Page 4



for efficient tactical air power

# TAC ATTACK

JULY 1969  
Vol. 9 No. 7

TACTICAL AIR COMMAND

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Jamie sez;

"If you can no longer see any humor around the hole you are in, it's your grave!"

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### TACRP 127-1

Articles, accident briefs, and associated material in this magazine are non-directive in nature. All suggestions and recommendations are intended to remain within the scope of existing directives. Information used to brief accidents and incidents does not identify the persons, places, or units involved and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. Names, dates, and places used in conjunction with accident stories are fictitious. Air Force units are encouraged to republish the material contained herein; however, contents are not for public release. Written permission must be obtained from HQ TAC before material may be republished by other than Department of Defense organizations.

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# Angle of ATTACK

are you ready?

When we begin to have accidents because of failure of aircrews to follow emergency procedures, we have a problem. But where does the problem lie? Is it a true lack of knowledge, are pilots being caught unaware and getting behind, or are we up against that old square filler — rote knowledge?

Let's take an example, the F-100 abort. Each year at proficiency check time you duly scribble out your five boldface items and you're done — right? Not right! The Dash One says — "accomplish the following steps *as necessary*, in addition to using brakes." Now let's lay on a late abort, with ordnance and add that it's a late abort because you made a late decision.

Our poor friend who learned the abort procedure by rote to pass his proficiency check is in deep trouble. How would you do? It may be that to live, **YOU MUST DO THE ABORT PROCEDURE BACKWARDS!** Now that's a twist, but look at your position. Concrete is passing behind you at the rate of a thousand feet every two to three seconds and right now the only thing between you and a ride off into the toolies is your arresting hook. It must be down and stabilized before reaching the cable. If all you do is retard the throttle and drop the hook you're better off than fumbling through; **SPEED BRAKE — IN, DRAG CHUTE — DEPLOY, EXTERNAL LOAD — JETTISON (IF NECESSARY), and ARRESTING HOOK — RELEASE.**

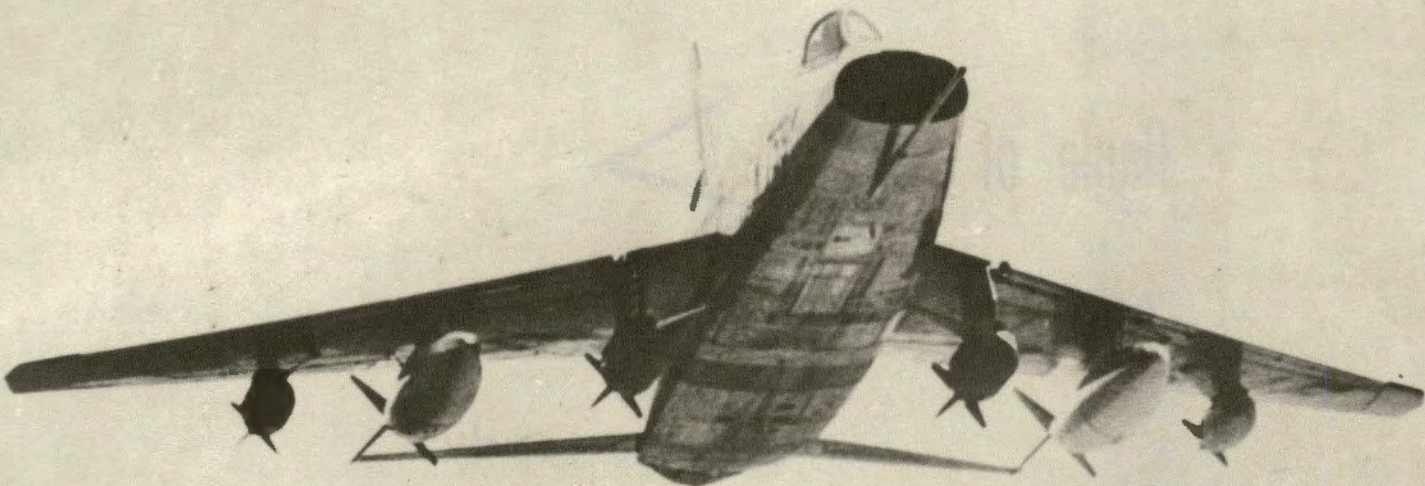
No one can predict how a man will react during a serious emergency, not even the man himself. You will be operating by instinct, on the knowledge you have about your systems. If your unit covers an emergency each day at the morning meeting, don't let your effort stop at merely hanging a board on the wall for all to read. Research it, discuss it, take it apart — **KNOW WHY** it reads as it does.



*R. L. Liles*

R. L. LILES, Colonel, USAF  
Chief of Safety





# SABRES and ANGLES

by Maj Robert D. Rasmussen  
4510th CCTW

*The following discussion is designed to be general enough to apply to all models of the F-100 (A/C/D/F). When specific data is presented, it is necessarily approximate, but is generally accurate to the nearest degree or ten knots. Its purpose is to highlight flight characteristics and handling qualities at altitude, in a maneuvering Super Sabre. Therefore, in illustrations, all data assumes a clean aircraft (no flaps) and at altitude (out of ground effect).*

## ANGLES AND ADVERSE ACTION

To introduce the subject, let's set up a hypothetical flight condition and then ask a question about it. The flight condition is 200 KIAS and 1G. The question is, "What is the inherent potential for 'adverse roll' due to aileron-induced adverse yaw?" Or, in other words, "If I apply left aileron, which direction should I expect to roll?" To appreciate this question, its answer, and the entire subject, let's review the dynamics of angle of attack and, in turn, adverse yaw and its effects.

Aircraft angle of attack is a function of these primary variables: airspeed, dive angle, altitude, gross weight, and

G load. The factor of dive angle can be disregarded as long as the G load factor is specified. The effect of changing altitude is minor in relation to other factors and can be disregarded for comparative purposes if a constant sample altitude is used. Likewise, the effect of gross weight can be disregarded if a constant is used for comparisons. Thus we have two primary determining factors: airspeed and G load — both variables.

The significance of these two variables is that an aircraft can be at the same angle of attack at higher speeds when "pulling G" as at a slow speed with 1G. Conversely, an aircraft can be at the same angle of attack, at slower speeds and less than 1G, as at higher speeds and 1G. For example, in 1G flight at 160 KIAS, the angle of attack is the same as in 4G at 320 KIAS, and the handling qualities are about the same. Similarly, the angle of attack at 200 KIAS and one-half G is about the same as 290 KIAS and 1 G and handling qualities are about the same.

This leads us to the relationship between angle of attack and aircraft handling quality. While aircraft angle of attack is a function of different variables, aircraft handling quality is a function of one primary factor — angle of attack. Aircraft angle of attack is the



most important item affecting the stability and control characteristics of the aircraft; and it is important to remember that the aircraft can be at a high (or low) angle of attack in any attitude or at any airspeed.

Handling characteristics at low speeds are influenced by angle of attack variations and the related drag, the latter affecting the demand for engine thrust, and the former dictating the quality of control effectiveness. Relating this to the landing phase of flight (1G), we find essentially two speed ranges exist; one, speeds above touchdown speed; and two, speeds from touchdown to stall.

At touchdown speed and above, flight characteristics are conventional, with normal control effectiveness and aircraft response — this fact helps determine the recommended touchdown speeds provided in TO 1F-100A-1-1.

The recommended touchdown speed is dictated by an angle of attack and varies as the aircraft's gross weight, but the "touchdown angle of attack" remains constant. This angle of attack is approximately 14 degrees (no flaps and out of ground effect).

Thus we can apply the following statement about control response relative to touchdown speed and the angle of attack. At 14 degrees angle of attack and below, flight characteristics are conventional.

As we further decrease airspeed below touchdown speed, we progress toward the aircraft stall speed, but an aircraft with 45 degrees wing sweep does not have a clearly defined stall. Instead, an airspeed (or angle of attack) is reached where mild buffet occurs, the flight characteristics begin to deteriorate, and the aircraft requires an increasing amount of control effort by the pilot. This is due to the wingtips stalling out and a resultant forward movement of the center of pressure. This buffet and accompanying mild "stick-force lightening" (sometimes called "pitch-up" or "dig-in"), caused by the stalling of the wingtips, is the first warning of approaching high angle of attack conditions. It is termed "minimum control speed," because as the aircraft slows further, lateral control deterioration occurs, making conventionally controlled flight more difficult.

While this minimum control speed also varies with the aircraft gross weight, it occurs at a constant angle of attack. That angle of attack dictating "minimum control speed" is approximately 18 degrees. In accelerated flight, these characteristics occur at essentially the same angle of attack as they do in 1G flight. In other words, the "minimum control speed" flight characteristics will be encountered at approximately 18 degrees angle of attack — regardless of airspeed.

As we decrease the airspeed through and below the minimum control speed, we finally arrive at "stall speed."

Again, while this speed varies with gross weight, it is dictated by an angle of attack. The control problems encountered at minimum control speed continue — and increase — and the rate of descent (in wings level flight) increases, but the airplane can be controlled down to as low as 100-110 knots before the stick reaches the aft stop. (The F-100 has 25 degrees of horizontal stabilizer leading edge down available, but only approximately 15 degrees is needed for landing.) The important point here is that the stall occurs at an angle of attack — that angle of attack is approximately 20+ degrees. The aircraft will stall at essentially the same angle of attack regardless of airspeed. (When encountered at higher airspeeds and G loads above one, it is commonly called an "accelerated stall.")

Adverse yaw (yaw in the direction opposite to aileron applied) occurs at all subsonic speeds. Any airplane which rolls has a certain amount of yaw in the opposite direction due to rolling velocity. But at high angles of attack in aileron equipped aircraft, the down aileron has considerably more drag than the up aileron. Added to the yaw due to rolling velocity, this yaw from differential drag on the ailerons, makes adverse yaw a major factor in aircraft control at high angles of attack. The degree of yawing moment induced by aileron drag varies with the angle of attack, increasing from an insignificant amount at 10 degrees and below, to a maximum at the stall angle and above. Because rudder effectiveness is decreasing with this increased angle of attack, a situation can be reached where the ailerons produce as much adverse yaw as the rudder can correct.

Dihedral effect is roll due to sideslip or yaw. As a swept wing aircraft yaws in one direction, the opposite wing moves forward and decreases its angle to the relative





## SABRES and ANGLES

wind, thus the airflow across the wing is at a reduced angle, increasing the lift from that wing. Conversely, the other wing is at an increased angle to the airflow, which reduces lift. The combination results in roll in the direction of yaw. Thus, the aircraft can be rolled to the right with right rudder (ailerons neutral). This dihedral effect increases with the angle of attack. At high angles of attack sideslipping (yaw) produces more rolling moment than the ailerons. Thus a situation develops where the most effective way to roll is by use of the rudder. This occurs at approximately 18 degrees angle of attack.

Because of all the foregoing flight characteristics and control peculiarities associated with angle of attack, an angle of attack insuring desirable control response and providing an adequate margin for safety is selected as a "landing pattern angle of attack." That angle of attack for an F-100 is approximately 10 degrees (no flaps). The pilot's handbook recommended pattern airspeeds are dictated by that angle of attack and vary with gross weight to achieve it.

It is easiest to describe (and learn in flight) an aircraft's high angle of attack handling characteristics in the context of a wings level, 1G, gradual deceleration. Assume an F-100, "at altitude," no flaps, at a gross weight of 28,000 pounds:

BASE	FINAL	TOUCH DOWN	MINIMUM CONTROL	STALL
10°/208K	10°/197K	14°/166K	18°/143K* 138K**	20+°/137K* 130K**
* Power off				
** Full military				

Studying these, remember that control effectiveness and aircraft response are completely normal at 10 degrees. While adverse yaw induced by aileron is increasing above this angle, conventional control response is still normal down through 14 degrees angle of attack. Above 14 degrees the ailerons are increasingly producing more adverse yaw and less roll, while the dihedral effect becomes more potent. At 18 degrees we have reached minimum control speed as the wingtips stall out, mild buffet occurs, and the nose tends to rise. It is at this point that the rudder has become more effective for roll than aileron. As we progress on through the stall — 20+ degrees — the ailerons become ineffective for roll, and at

angles above stall the ailerons can produce as much yaw as the rudder can correct.

Combining the adverse yaw induced by the down aileron at high angles of attack with the high dihedral effect also present at those angles can result in "adverse roll" . . . roll opposite the applied aileron, caused by dihedral effect. As the angle of attack builds up, it is possible to roll against a considerable amount of aileron deflection, for example, right aileron results in left roll! If the angle of attack is near stall, the use of aileron can induce a "snap" roll and/or entry to a spin, opposite the direction of applied aileron.

Your potential at 200 KIAS, 1G? The angle of attack for a 28,000 pound F-100 at altitude, at 200 KIAS and 1 G, is 10 degrees. From the previous presentation, it can be seen that "adverse roll" due to aileron-induced adverse yaw, at that angle of attack, should not occur. In other words, application of aileron should result in rolling moment in the direction of aileron applied. This is the same angle of attack as at 280 KIAS and 2G — or 340 KIAS and 3G! To answer the original question, there is no potential for "adverse roll" at the stated flight condition. In other words, use of aileron under these conditions will not result in adverse flight characteristics — unless an aircraft misrigging or some malfunction creates an unstable flight condition. This last statement applies to all conditions of flight, especially those at angles of attack above 5 degrees, the approximate angle at which the wing slats start extending. It might be noted that sticking or binding slats can have spectacular effects upon flight stability!

## TECHNIQUES AND PROCEDURES

Because of the above control characteristics related to angle of attack, certain pilot techniques and procedures have evolved for use with the F-100. The techniques generally involve (1) the use of rudder, as opposed to aileron, to maneuver the aircraft at high angles of attack, and (2) maintaining neutral ailerons at those angles. It can be seen that in much of our maneuvering flight — especially ACM — we will be flying the aircraft at an angle of attack greater than the landing angle of attack. While this is very normal, the required pilot techniques are relatively "abnormal." But they must be learned and used — and the conditions of flight requiring them must be recognized.

The single most important "procedure" resulting from these characteristics is that of decreasing the angle of attack when control problems develop. Section VI of the Dash One in discussing stalls, spirals, spin entry, and uncontrollable maneuvers in general, is full of advice to release back pressure, neutralize the stick or apply



forward stick. The reason, of course, is that those control problems are associated with high angles of attack. So, if they occur, reduce it. If the pilot "unloads" to 1G, he will regain the handling qualities at that airspeed and 1G. If that is not enough, he can "unload" to one-half G and further decrease his angle of attack by one-half! For example, if he is at 140 KIAS and 1G, with an angle of attack of 18 degrees, by "unloading" to one-half G, he can achieve an angle of attack of 9 degrees. It is fact that nearly all positive G or positive angle of attack uncontrollable maneuvers will terminate if the angle of attack or G load is decreased to one G or less (excluding steady-state spin). However, there is a limit to this "good thing" of decreasing G load which should be defined and taught. To be specific: While the pilot can gain improved handling by decreasing G load to zero, if he continues on into the negative angle of attack or negative G envelope, the handling qualities again deteriorate.

Some think that an angle of attack indicator in the F-100 might provide the pilot with a better capability to cope with this environment of less than one positive G, or negative G. It should be noted there is already an "angle of attack indicator," which can be useful in this area, the G meter. Perhaps it deserves more attention, especially when going for the benefits of a reduced angle of attack at less than one positive G.

For example, the following are the approximate "stall" conditions for a clean F-100D, 28,000 pounds, at 25,000 feet:

negative 2G	-	200 KIAS
" 1G	-	130 KIAS
" 1/2G	-	90 KIAS
" 0G	-	0 KIAS
positive 1/2G	-	90 KIAS
" 1G	-	130 KIAS
" 2G	-	200 KIAS

From this we can see there is no reason to go past zero G in hopes of gaining more or better aircraft performance. Zero G yields the minimum angle of attack and lowest stall speed possible. Also note that a negative one-half G will stall at about the same airspeed as a positive one-half G, and that a negative 1G will stall at about the same airspeed as a positive 1G. (Actually, because of slat design, "negative stalls" occur at slightly higher speeds than "positive stalls.") Thus, whenever we unload, we might as well set a limit at Zero G, and remember the G meter is available to help us.

The Dash One includes the following statements on the subject of spin prevention: "If spin accidents are to be avoided, some common sense rules must be followed. The

first and most obvious is 'Know Your Airplane' . . . know the 1G characteristics thoroughly; then work on smooth accelerated maneuvers. Recognize warnings with respect to angle of attack . . . remember the airplane responds to angle of attack. Ease off on angle of attack, and you will regain control."

If this Dash One philosophy prescribes the necessary ingredients of an optimum training approach, then it appears a thorough knowledge and understanding of the above information may be necessary for the conduct of that training. If you are a pilot, how does your knowledge and understanding stand up to that challenge? If you are responsible for training, how does your training program stand up? Let's hope the answer by all is: "Just fine, thank you!"





# TAC TIPS

...interest items, mishaps

## WARNING NOTE NOT NOTED

It was clear, visibility 30 miles. Negative turbulence. The C-119 crew practiced emergency procedures while cruising at 12,000 feet. Turning off the single-phase inverter, the copilot called out the resulting failed instruments. His answers were checked against the Dash One by the flight engineer. After he restored single-phase inverter power, the copilot turned his attention to the autopilot system.

With the autopilot engaged he turned off the autopilot inverter. Then he turned in an easy bank, verifying loss of his attitude indicator with autopilot inverter failure. Satisfied that his flight instruments were inop he rolled out, leveled off, and flipped the inverter switch to ON . . . autopilot control switches unchanged.

The Boxcar climbed abruptly, pitched down violently, reared back up, then nosed down. Both pilots tried overpowering the autopilot and punched their control wheel autopilot release buttons. They regained control of the bucking boxcar, but a little too late.

One man in the crew compartment hit the overhead hatch, cutting his forehead. A loadmaster bounced off the cargo compartment ceiling and floor, breaking both wrists and left elbow. Another unsuspecting crewman was tossed from his seat and bruised. He administered first aid to the injured.

The investigator concluded that the incident occurred because the autopilot servo clutch failed to disengage when the copilot turned off the inverter. He didn't criticize aircrew procedures and their autopilot system knowledge.

This was puzzling procedure; turning off a primary AC inverter, powering both the autopilot and copilot's flight instruments, in order to disengage the autopilot. It resembled controlling your closet light by shutdown of dynamos at the main power station. Logically, there should be a substation or switch somewhere in between. Especially in Air Force airplanes.

So, we checked the Dash One. It satisfied our

curiosity about system controls existing between the autopilot inverter and the flight control servo clutches. There's several. A required two-minute wait after autopilot inverter turn-on to bring system gyros up to speed; an off-on autopilot power switch with a two-minute amplifier warm-up requirement; a copilot's attitude indicator that cages erect and provides transit signals to the autopilot's elevator and aileron servos; a push-pull servo clutch switch for engaging autopilot servos when all else is ready; and servo clutch disengage buttons on both the pilot's and copilot's control wheels. There's lots of autopilot disengage options available.

The Dash One autopilot note that really shouted was entered under, "Moving the automatic pilot inverter switch to OFF."

## WARNING

"Disengage the automatic pilot prior to turning off the autopilot inverter or immediately upon detecting an autopilot inverter failure. On some aircraft the automatic pilot servo clutch will not disengage and violent maneuvers could result."

After that, we rechecked the "Warning" definition. It still reads, "Operating procedures, techniques, etc., which will result in personal injury or loss of life if not carefully followed."

What else is there to say?

## ASKING FOR IT

The leader of a flight of four F-86H aircraft was on his fifth strafing pass and fired further out than normal to make sure he would "winchester." He put Gs on the aircraft but continued straight ahead after firing intending to do a loose 360 to facilitate flight join-up. At about a hundred feet and slightly down range, he felt and heard a



## with morals, for the TAC aircrewman

loud explosion. Then noticed a hole in the left windscreen panel six inches long and one inch wide; the cockpit was covered with glass. He apparently flew through a ricochet, the round did not enter the cockpit. Luckily, the pilot had his visor down so was not injured. But he could have been our first ricochet accident in some time . . .

### IT MAY TAKE AWHILE...BUT

This F-4 crew was redeploying following completion of an exercise. Immediately following disconnect from their tanker, a sudden and complete double generator failure occurred. Neither generator would reset so the RAT was extended and generator switches turned off. After turning off all electrical equipment except the UHF, the pilot declared an emergency and requested a clearance to a lower altitude — he was IFR. The front cockpit began to fog and was eventually cleared by selecting Ram Dump.

About ten minutes after the generators failed, the pitot-static system iced up to complicate things. Without stab-aug aircraft control was very sloppy due to yaw and roll moments induced by the RAT. In addition, large pitch oscillations were experienced. The aircraft commander suspected an intermittent bellows failure due to icing. After descending to a lower altitude and VMC, aircraft control improved considerably and the pitot-static system began working again. The closest suitable airfield was selected and an uneventful approach end arrestment completed the flight.

The cause of all this misery was determined to be maintenance factor by persons unknown. During an engine change eight months earlier, a wire bundle to the number one engine generator was misrouted. Vibration caused a lead to break, the resulting short circuit failed the voltage regulator and supervisory panel. This, in turn, caused loss of both generators.

The aircraft commander handled this emergency like a pro. Just goes to show that you don't ever know what will strike, or where, or from what. It may take a while . . . so stay ready.

### FIREWORKS AND FANS

The C-119 gunship orbited on station. Number one engine started vibrating on its mounts. The crew didn't take time to research instrument indications when they saw sparks jumping around the engine nose section and prop regulator. They feathered it, fast. And called it a day.

Maintenance trouble shooters found a clogged oil passage serving the prop thrust bearing. Oil starvation and lack of lubrication would've led to prop separation in a matter of minutes — or seconds — it's anybody's guess. And free-wheeling props do strange, unpredictable nip-ups when the shaft freezes and lets go. There's an old recip ditty that says, "When sparks appear, separation's near. Don't delay, they won't go away." Follow the example of a smart gunship crew . . . don't fool with fireworks.

### ROCOCHET

The FAC sighted a large number of pack animals in the target area and decided to conduct a strike with his "Willie Peter" rockets. He rolled in from 1500 and fired a single at approximately 500 feet. He then continued the dive to observe rocket impact. The rocket hit in a paddy throwing chunks of mud up — he flew through this debris. A large chunk of mud hit and dented the right wing leading edge. He was lucky.

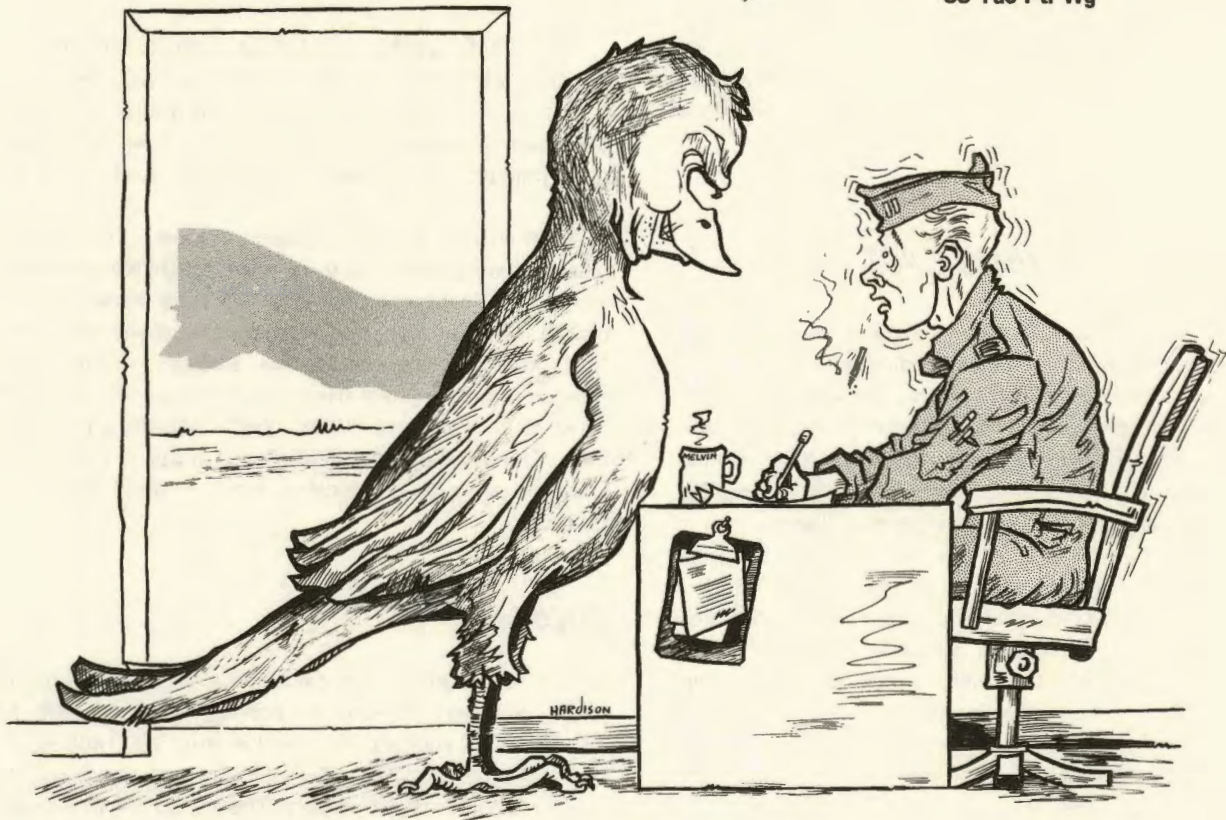
### CARRY A KNIFE ?

Here's an excerpt from a SEA accident report concerning ejection. "... one of the pilots was carrying a survival knife in a lower pocket of his flight suit. It was strapped to the outside of the suit with velcro tape. During the ejection, the knife was ripped from the flight suit as it contacted some object in the cockpit and inflicted a painful injury to his left ankle . . ."



# 40<sup>lb.</sup> Robin?

by Capt Alan W. Melvin  
33 Tac Ftr Wg



We saw this article in the 33rd Tac Ftr Wg magazine, "From The Hip", and with Captain Melvin's permission, filched it. It complements our Arresting Gear article on page 26 and contains some points every F-4 jock should think about. Ed.

1. How much does a 40 pound robin weigh?..
2. How much does a 46,000 pound F-4 weigh?
3. What is the maximum engagement speed for a 46,000 pound aircraft using the BAK-9 barriers on runway 01/19?

4. What is the maximum fuel you can have on board and make a half-flap approach end barrier engagement?

The following computations are the basis for this discussion. Since gross weights are within 500 pounds and landing speeds within one knot, we will consider the F-4D and F-4E as the same aircraft.



	F-4D		F-4E	
	WEIGHT	DRAG	WEIGHT	DRAG
Airplane Operating Weight	29,800		31,000	
Aero 27A Ejector Rack	51		51	
2 Wing Tank Pylons	184		184	
2 370 Tanks	616	12.8	616	12.8
1 MAU 12	254	2.6	254	2.6
1 MAU 12 & TER	359	6.8	359	6.8
1 LAU 32	49	3.0	49	3.0
3 2.75 RX	54		54	
1 SUU-21 4 BDU-33 2 MK-106	580	3.3	580	3.3
Nose Gun & 20MM			373	
SUU 23 Suspension Equipment	71	3.9		
SUU 23 & 20MM	1,739	8.1		
	33,757	40.5	33,620	28.5
Fuel	17,330		17,947	
Ramp Weight	51,087		51,567	
Start	-130		-130	
20 Min At Idle	-840		-840	
Run Up	-100		-100	
Take-off Weight	50,017		50,497	
Take-off Fuel	-725		-725	
WEIGHT IMMEDIATELY AFTER TAKE-OFF	49,292		49,772	
Landing Weight	33,600		33,500	
Final Approach	139½		138	
Speed, Zero Fuel				

A 40 pound robin will just about always gross out at 40 pounds.

A 46,000 pound F-4D weighs 49,292 pounds; an F-4E weighs 49,780 pounds. Since you'd be landing an aircraft that's more than 3000 pounds over maximum landing weight, just bending it around after takeoff and landing on 01 as so often is briefed is going to set you up for a pilot-error accident.

The time you spend reducing aircraft gross weight below 46,000 pounds will be dictated by the nature of the emergency. Jettisoning the external tanks will immediately reduce your gross weight to 44,000 pounds. Dumping fuel will take approximately 6.5 minutes at a power setting above 85%, and counting the fuel used milling around, dumping fuel will likewise reduce gross weight to 44,000 pounds. One procedure I have seen work well for reducing gross weight is to pull the AB ignition circuit breakers and slowly slip the throttles into the AB range. This doesn't always work without the ABs lighting off, but if you use slow throttle movements, it will work most of the time.

For a 46,000 pound aircraft the maximum engagement speed is 164, not much margin for error! If you jettison

tanks or dump fuel, final approach speed will be 160 knots, with the barrier good up to 168 knots. This still doesn't leave much room for 5 knots for your wife and each kid. As the good book says reduce gross weight to minimum practical prior to approach end barrier engagements.

Now let's suppose it has been one of those days and as you raise the gear handle the utility system fails, followed shortly thereafter by another emergency which requires you to land as soon as possible. Just how soon is possible? We jettison tanks, which makes landing speed 173 knots with the barrier being stressed for 169 knots. If we jettison tanks and dump fuel our F-4 will be down to a svelt 39,000 pounds; our half-flap landing speed will be 163 knots with the barrier good to 178 knots. This 15 knot pad looks good, but it is about as little a safety margin as I'd care to bet my F-4 on.

Some emergencies will dictate immediate landing regardless of approach speeds or barrier capability; others will give you the luxury of reducing gross weight prior to landing. All emergencies will require that you maintain aircraft control, then analyze the situation and, finally, take appropriate corrective action. ➤



# BETTER MOUSETRAP

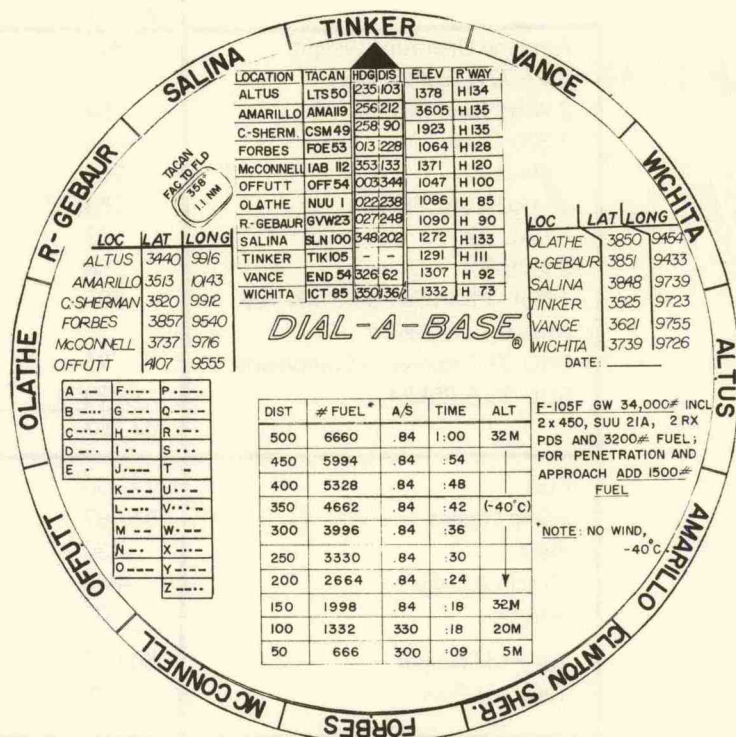
## Info / Computer DIAL

There are probably very few fighter pilots who don't have a story or two about arriving at their destination only to find the field "WOXOF" and flight plan alternates reporting more of the same. So with one eye on the gauges they usually reach for the "flips," hoping to pick a new alternate before their fuel indicators force practicing a PLF.

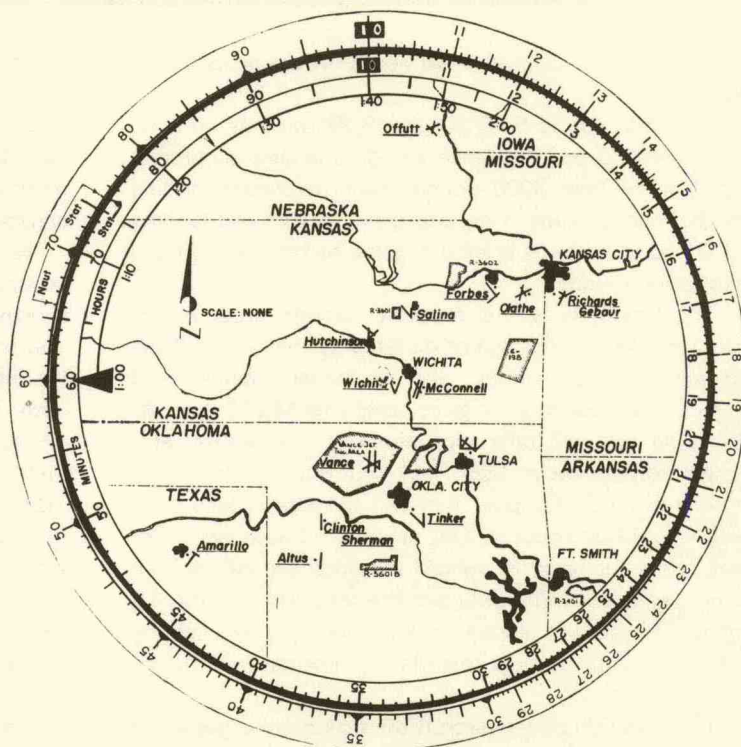
At this point wasted time can be critical, calling for quick decision and response. Homemade aids to help have been used by enterprising jocks for more years than we can remember. But a small pocket device designed by Major George M. Boyd, McConnell AFB, offers about as complete a system as we've come across. He calls it "Dial-A-Base" and it covers parts of the six state area centered on McConnell. It is specifically designed for the 105F but this information can be modified to suit any aircraft system.

Turn the top disk pointer to your present location. This gives you distance, heading, elevation, TACAN, and runway heading for eleven alternates. On the back side is a rotary time and distance computer plus a map of the six-state area. For instance, if you're over Tinker with 30-knot winds from 250 degrees and weather reports, "Amarillo and Forbes open," you'll probably set your course at 013' for most favorable winds, and pick up the Forbes TACAN on channel 53. Spin the dial to Forbes and it shows the base's TACAN is located at the field.

This kind of nav aid is not intended to replace conventional flight planning, but when designed for a given aircraft it can be a valuable tool for the pilots flying a lot of hours in the vicinity of their regular air patch.



This handy inflight navigational aid can be designed to give information needed for unexpected changes in flight plan, especially by pilots flying within a limited geographic area.

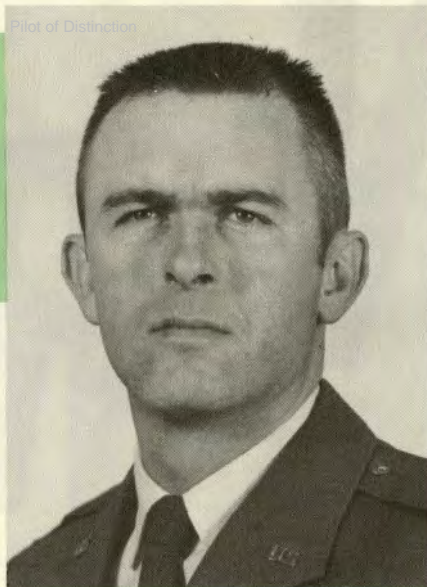




## TACTICAL AIR COMMAND

# *Pilot of Distinction*

Capt W. S. Secker



Captain William S. Secker of the 23 Tactical Fighter Wing, McConnell Air Force Base, Kansas, has been selected as a Tactical Air Command Pilot of Distinction.

Captain Secker was flying an F-105 on a ground attack gunnery mission. During the third strafing pass the engine overheat light came on. He initiated appropriate emergency procedures and turned toward a municipal airport 11 miles from the gunnery range. Captain Secker notified the flight leader and range officer of his emergency and directed that the FAA tower be advised he would be landing in about two minutes. Captain Secker slowed the aircraft, lowered the gear, and entered a long final approach. As he neared the field the cockpit filled

with acrid smoke. The flight leader, in a chase position, advised him that heavy smoke was coming from the aft section. Captain Secker decided he was close enough to the runway to land, rather than abandon the aircraft.

After a well executed approach and touchdown, the engine was shut down and emergency brakes used to stop the aircraft. Investigation revealed a fuel nozzle had burned a hole through the engine combustion and diffuser case.

Captain Secker's evaluation of an inflight emergency and prompt action saved a valuable aircraft and possible loss of life. This action readily qualifies Captain Secker as a Tactical Air Command Pilot of Distinction.





*Following is a narrative and some questions — no answers, concerning loss of command radio in-flight. Although the story is a routine “no sweat” trip, you need only change the weather or introduce an aircraft emergency into the script to set up loss of an aircraft.*

**D**estination weather was to be VFR from 150 miles out, scattered to broken lower clouds enroute. Our departure station was to be under the influence of a line of thunderstorms forty minutes after our proposed takeoff time. We got off on the dot and verified the approaching wall of bumpers during climb out. All was routine as we drove our trusty F-33 into the Positive Control Area and leveled at our assigned flight level, 310.

Just after passing our first check point forty minutes after takeoff, I heard the ominous ...click...click...click...in my headset. The UHF had died. But no sweat, we still had a receiver — our old reliable VHF Nav set. We crossed a Center boundary as I was tuning the TACAN to our next station. That was handy because they would pick up our radio failure right away, contact us on VHF and we’d be under control again by using our VHF Nav receiver and IFF — or so we thought. It was a short leg and while swinging the station, the expected call arrived.

“Air Force 12345, this is Howdy Radio, contact

Southern Center on 246.3.” He made the call twice, and that was it.

We squawked “flash” to let someone know we received the transmission and pressed on. Howdy Radio called again ten minutes later with the same message. We squawked again and wondered when someone would get OUR message.

As we crossed the next TACAN, we got another call. “Air Force 12345, this is Doody Radio, contact Southern Center on 242.6.” (They were thoughtful enough to give us a frequency change.) Doody radio called a little later with the same message — it then became evident that we might not ever receive any instructions on VHF other than UHF frequency changes. We were reasonably certain that Center radar was tracking us and just couldn’t figure out why they didn’t pass us a Center VHF frequency through Howdy or Doody radios.

We received no calls for the rest of the trip. I rechecked the two-way radio failure procedures in the In-Flight Supplement (to make sure the book was right) and tuned in an ATIS station below for some news. It confirmed what we could see below us — clouds. Because we were still two-fifty out, the rest of the information was useless.

At our final TACAN station, the ground showed up VFR as advertised by the WAG from weather. Forty miles later we arrived at our destination fix and started down. Passing 240 we squawked 06 and tuned in the VHF Approach Control frequency listed for our destination



fully expecting a call and instructions. We could hear people talking...but not to us. At five thousand we broke off the approach and tuned in the listed Tower VHF frequency (we never give up), but it didn't do any good.

On our own we began to figure which of the two runways below us looked like the best bet to terminate on and in what direction. Fuel was no problem, we had about 150 gallons over the field. On our second circle we caught an F-4 taking off. While setting up for that runway another F-4 landed on the other one. We switched plans, zigged to the second one and got on initial. After giving the NORDO salute we pitched out and...whoops, unsafe left main. We did a 360 and recycled the gear. As it indicated safe an F-4 on initial was breaking out — final was clear so we landed. As we rolled out with about a hundred gallons the fire trucks met us — but still no radio calls.

From the time our UHF failed until engine shut-down we monitored six VHF channels plus 121.5 and could receive on every one of them. We discovered later that no one is REQUIRED to chase us around on other frequencies. We had been followed by radar from the time our radio failed until we were on initial at destination.

We walked away from the landing so it must have been a good flight...but could it have turned out differently???

It's a fact that we take the command radio in our airplanes for granted. They have become very reliable through the years, but not reliable enough to get complacent.

The first thing that comes to mind after reading the narrative of this "no sweat" flight is to choose your

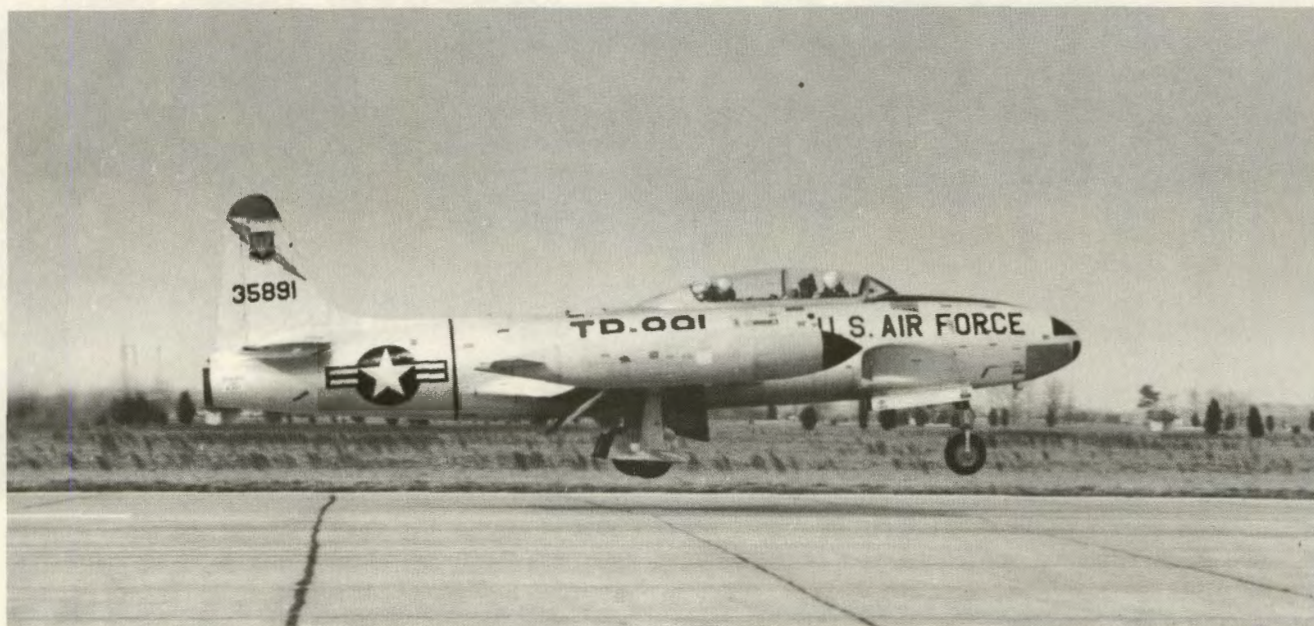
alternate very carefully. But since we don't fudge on figuring alternate fuel, we'll get on with it.

You should have a plan of your own for flying without radio contact with someone on the ground. Your plan should be renewed prior to each flight since your destination, alternate, and the weather will not be the same. And don't think that because you happen to be in a formation with the greatest leader in the world, that this doesn't apply to you. Just because you happen to be Blue 16 in the lineup doesn't mean that you won't end up alone or leading someone who is depending on you to recover him safely.

What's in a plan? You name it. How about a navigation system failure following the demise of your command radio? What about trapped fuel? An oxygen system failure? We could go on to fill this page. You know your airplane and it's systems most prone to failure — they should all be in your plan.

It's not possible to cover everything that could happen. If we were required to, the airplanes on the line would all have to be hangared to keep them from getting dusty — there would be no flying. But this doesn't prevent us from doing all in our power to get the bird on the ground safely.

There is no quick and dirty, black and white, two-way radio failure procedure in existence. You will make your own procedure using the guidance in the FLIP documents. You can make it easy on yourself by giving the subject some thought while you are relaxing with a cup of coffee — like the people who judge your actions will do. By the way, when was the last time you lost your radio?





# HERKY CHECKUP...

... X-Ray Goes to the Patient



X-ray reveals cracks in C-130 hot air T-duct without need of dismantling. The radiograph was made without removing thick insulation and shows two cracks at joint welds; the lower one extends into the duct body. This nondestructive inspection technique can examine, within minutes, parts and assemblies that previously required several manhours of maintenance time.



Some people get sick and don't know it, that is until unrecognized symptoms turn into full blown illnesses . . . sometimes fatal. Aircraft are no different.

Routine physical examinations are the answer: Medics for people, and Nondestructive Inspectors (NDI) for aircraft. And one of the techniques long used with people works just as well with mechanical birds: radiography, usually called X-ray.

If any doubt existed about the value and reliability of X-ray application to aircraft inspection and safety, pessimists are fading from the ramps at our several Herky bases since NDI men have shown up with their very portable electromagnetic eye.

A recent problem in the C-130 fleet was diagnosed as metal fatigue. Specifically, leaks in the hot air T-ducts leading from each of it's four turbo-prop engines. High temperatures and constant vibrations are developing cracks at welded joints and in some cases in the duct bodies. The cracks are not critical, except as symptoms of an impending crisis. When a crack develops into a break, escaping hot air can quickly melt wiring insulation in the nacelle, not to mention what it can do to the wing load of JP-4.

Spotting these cracks is a maintenance man's nightmare because the ducts are not only located in poorly accessible places but they are completely wrapped with thick insulation. This is where NDI has proven itself with greater accuracy than the best eyeball inspection. And with a time and material ratio that is worth talking about.

To dismantle, inspect, and replace a T-duct requires three to four manhours. New insulation must also be applied. This means up to 16 manhours, and a day of non-flight status for the bird. One NDI X-ray team (three men) can inspect six aircraft per day without dismantling except for removing one panel per engine, requiring a down-time of less than two hours per bird.

TAC started X-ray inspections in 1964 with one mobile NDI team. Since then 16 bases including three mobile teams in TAC have added the technique to their NDI facilities. Four more bases are presently installing X-ray equipment.

X-ray techniques are being used and developed for other kinds of NDI work. In



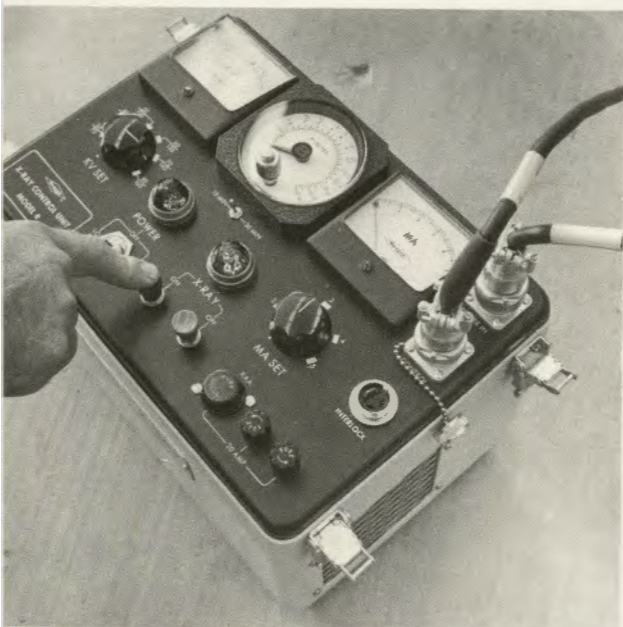
**Radiography teams are loners. Their work area must be completely evacuated because of hazardous X-ray radiation. At Sewart AFB the team positions an X-ray device atop the wing of a Herky, barricaded by ropes and warning lights. Radiation zone is from 110 feet to 650 feet radius depending on length of exposure, which is usually a minute or longer. During exposure, the NDI team operates the tube from a remote panel located outside the radiation zone.**



## Herky Checkup

fact, a couple maintenance supervisors have been caught short when routine X-ray inspections accidentally revealed defects in areas that were not even suspected. They obviously weren't happy to have their birds on the NOM list but it's our guess that some jocks were mighty happy to know that they wouldn't have to "find" the defect on a heavy-G pullup or a low-and-slow final.

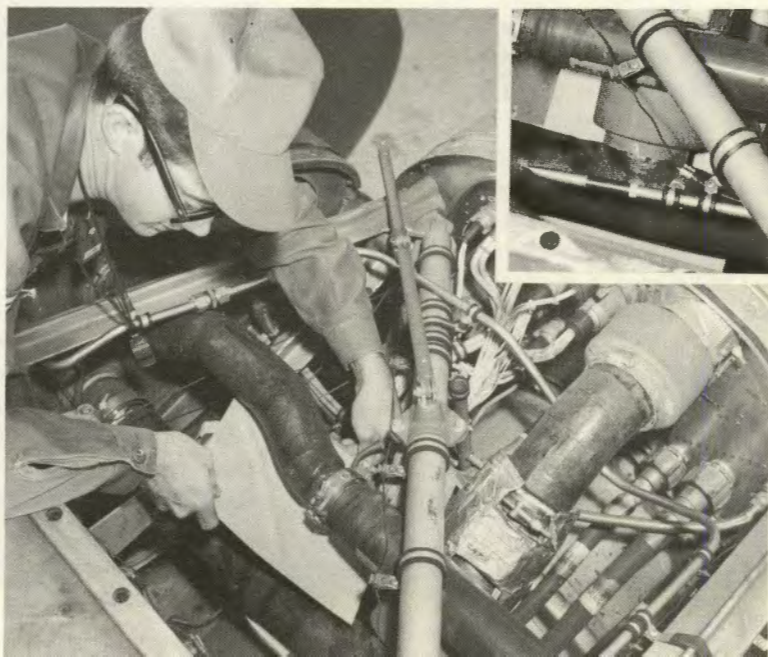
Now NDI teams move into the Herky fleet ever 600 hours for hot air T-duct inspections, freeing maintenance crews for other work. There is little doubt that some sharp-eyed maintenance men are going to suggest new ways to use X-ray inspections. Not only to save time, but because they know it offers a new avenue toward aircrew safety. ➤



X-ray film is placed behind heavily insulated T-duct in Herky nacelle. Films can be developed in minutes. Technique is considered 99 percent accurate and requires less than two hours NOM time.



Distance between tube head and part to be X-rayed determines exposure. Density of material is also a factor. Positioning tube head over a Herky No 4 nacelle at Sewart AFB are A1C Terry Logan (left) and TSgt Hiram Lunsford, NDI lab chief. Control panel, connected to the tube by long cables, is operated from outside radiation zone.





# USAF SAFETY AWARDS FOR 1968



## Flying Safety Plaque

For meritorious achievement in  
Flight Safety, 1968

1. 75th Tactical Reconnaissance Wing,  
Bergstrom AFB, Texas
2. 464th Tactical Airlift Wing, Pope AFB,  
North Carolina
3. 4442nd Combat Crew Training Wing,  
Sewart AFB, Tennessee



## Missile Safety Plaque

For meritorious achievement in  
Missile Safety, 1968

- Cat 1: 4510th Combat Crew Training Wing,  
Luke AFB, Arizona



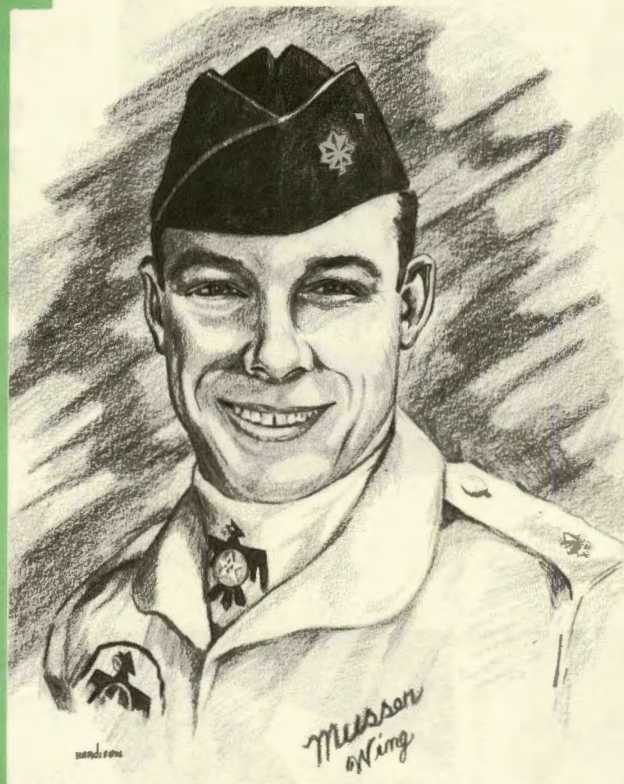


# Thunderbirds

## FORMATION TECHNIQUES

by Maj Stanton R. Musser  
Number Four Position

Major Musser was commissioned through the Air Force ROTC Program in 1958 and completed his basic pilot training in 1959. He served a four-year tour of duty in Germany, returning to the U.S. in 1964. Later that year, he logged 177 combat missions in Southeast Asia as a forward air controller. In 1966, he transferred to the U.S. Air Force Academy where he remained until assuming his present duty with the Thunderbirds.



I have heard many spectators say, "I don't see how they do it, they are absolutely perfect!" That's not quite true. We have never flown a perfect air show and probably never will, but we keep striving for it. We have come awfully close many, many times due to hard training, perfect weather, and everyone giving a top notch performance. Why then do many folks think it looks perfect? First of all they probably don't have the educated eye for picking out our mistakes and, secondly, we use many little techniques to make it look like perfection and at the same time provide adequate safety margins.

When enthusiastic fighter jocks ponder formation techniques, necessity requires that they emphasize lookout capability, mutual support, and maneuverability.

Pure show formation is somewhat divorced from these traditional considerations, however, application of some show techniques can enhance standard formation flying.

I am going to discuss a few of these techniques that have been developed and refined over the years since the team was started in 1953. Please understand that some of these deal only with show formation but may be interesting to many of you. Also, these techniques have not changed with the advent of the F-4E in our demonstrations. In other words, they are applicable to any type of fighter.

The first technique is the cockpit sitting position. We run our seats full down and bring the rudder pedals far aft to a comfortable position. This puts us in a position where the right arm is resting on the thigh at all times, giving



greater leverage on the stick grip. After attaining proper approval, the left wingman, right wingman, and myself use the F-4 back seat stick grip in the front seat. We found that the back grip with the dogleg in it sits two inches farther back and three-quarters of an inch higher than the front grip. With full forward trim this grip again gives us better leverage. The leader and solo pilot feel the front grip is more comfortable so they did not change.

This brings us to the use of forward trim. I am sure that many of you have heard we use full nose-down trim. This is very true, however, I don't recommend it for normal formation flying. We use it solely for greater longitudinal stability.

With full forward trim you are always pulling on the stick or letting off on it, but never pushing forward. This helps tremendously on over the top maneuvers because airspeed varies from 450 knots on entry to 150 knots on top. It takes a jock about three months before he develops sufficient strength to handle it throughout the complete show.

The F-4 is not nearly as heavy on the stick as the F-100, due to the bellows system compensating for various airspeeds. I do believe though that some nose-down trim in formation or on refueling missions will help many pilots be a little smoother.

Smoothness is the real key to great formation and will also keep you out of trouble with your aircraft. Every "Gung Ho" fighter pilot wants to look sharp on initial, and rightfully so, because that is the only time your crew chiefs and spectators really get a good look at you. The hardest thing for us to teach a new man coming on the team is to be smooth and easy with his corrections. When he slips out a foot or two he immediately wants to get back in there as fast as possible. This will only get him in trouble by over controlling the aircraft and, also, people on the ground notice it immediately.

So, when you are coming down initial and you move out a bit, just take your time and sneak back in there. This also makes your buddies out in Three and Four look a lot better if you are flying Two. If you ease back in, they aren't suddenly caught hanging when you move back into position.

A tremendous bond that we fighter jocks enjoy involves our covering for one another. There is a closeness and camaraderie among all fighter pilots that just doesn't exist anywhere else in the world. And it can, and should be there in formation flying as well as all your various sorties!

If you are number three in that flight of four turning initial and number two is having a bad day, eat as much of it as you can before moving out into number four. Then after you are on the ground, go ahead and talk about it. Too often we tend to just forget about it and yet there

may be some constructive advice you can give him. Constructive criticism never hurt anyone. All of our training missions at Indian Springs Aux Air Field are filmed on video tape and a critique sheet made out which has every maneuver on it.

Our debriefings usually last two hours or more, running the tape back and forth and giving each other advice on what to do. This includes the leader also. If his roll rates were too fast, or he didn't float enough on the top of a loop, he is critiqued on it. This must be tempered with good judgment and tact. You don't just walk up and say, "Sir, you sure messed up that rejoin when you racked it into me." Think about it and say, "Boss, that turn into me on that rejoin was a little tough. It wasn't any sweat, but I think I could've gotten in a little faster if the turn was just a hair easier." Every leader has had much constructive criticism, listened to it, analyzed it and made corrections. That is why he is the leader.

The last technique I will discuss probably only applies to show formation but many of you make flybys for various functions so this may be useful. We call this faking the audience. On some maneuvers we actually move high or low on the wing on one side of the formation to make it look perfectly symmetrical. This is due to the optical illusions involved in certain formations and at a certain point during the maneuver.

For example, our wedge closer on landing is made coming in perpendicular to the end of the runway and approximately 2,000 feet from the crowd. We pull up into a cloverleaf and enter down the runway for the diamond pitch up. As we start the pull up, the side away from the crowd must stack high on the wing to keep from looking like they are hanging low.

Another good example is the trail roll. It is always done from the crowd's right to left. As we start our run-in down the runway, the three of us in trail offset to the right edge of the fuselage on the man ahead of us. It normally isn't seen because we are parallel to the crowd. All of our rolls are done to the left, and as the roll starts we are already ahead of the game and perfectly in line by the time we reach the 90 degree point.

In the pitch up for landing number four must stack deep or the sudden loss of the leader's slipstream bunts my nose down as he pitches up. As we are turning on initial I call "Four's deep" and the wingmen both drop to a deep wing position to cover me. It's a faking game and yet it is teamwork and precision too. I know this is what all you pros strive for in anything you do — perfection!

These techniques are "food for thought" and may be helpful. But, one of the finest compliments you can be paid after you land and that proud crew chief climbs up the ladder is, "Sir, you all looked outstanding up there today!"



# CHOCK TALK

chock talk

*...incidents and incidentals*

## **WAYWARD WINDOW**

It was a "dollar ride," introducing student pilots to the ways and wonders of a C-123 assault landing. On touchdown the instructor pilot demonstrated prop reversal and minimum-run with reverse-open power application. That's when a rear cabin window was sucked out of the fuselage and joined battle with the inhaling prop. To avoid vacuuming more parts out of his bird, the pilot went back to forward thrust.

The metal-bound, wayward window dinged the prop. Besides scratching the blades it punched a three-inch piece out of one of them. A prop change followed. They couldn't find any traces of the window's rubber seal, but they're taking a sharper look at the window mounts on the rest of them during phase inspections.

## **NO PLACE FOR OLD FOLKS**

Following ejection, this F-100 pilot's AN/URT-21 beacon failed to transmit automatically. The beacon activation plug was not pulled on parachute opening because the distance between the plug and the actuator retaining loop was five and one-half inches instead of four. The plug is supposed to be tied to the beacon actuating lanyard with a surgeon's knot and locking overhand knot, this one was tied with a GRANNY . . . that slipped.

## **SHIFTY TANKS**

The Provider crew launched on a flare-drop mission. As soon as they broke ground the 123's crew and cargo compartments filled with fuel fumes. After a fast engine scan the flight engineer reported a massive fuel leak on number two engine nacelle. The pilot cut Two's mixture and pulled the emergency "T" handle. It feathered okay and they ventilated the bird, getting rid of the explosive concentration of fuel fumes. A pair of handy jet engines took care of their power problems during climbout and landing.

Maintenance troops found Two's nacelle tank quick-disconnect misaligned and spraying petrol. This was the second flight since new tank installation. The bird made it through its flight without fuel fume problems so they figured the tank shifted on the second, failing the

quick-disconnect. All this happened in spite of using proper procedures and correct torque valves initially. As a precautionary measure they've decided to inspect nacelle tank quick-disconnects and cone bolt torque after the first flight. Good maintenance types, and aircrews, don't want to associate with shifty tanks!

## **EYE-TO-EYE !**

Head-to-head or toe-to-toe?

It means a lot to rudder throw.

It's bad poetry, but so was the bolt installation on a Herky's rudder pedals.

The pilot checked freedom and full travel of his flight controls before takeoff. His rudder pedals snagged on something passing each other. When he put inward toe pressure on them, they'd lock; with outward pressure they'd slide freely. Not being enthusiastic about the prospect of hooked rudders, he aborted.

Maintenance investigators discovered that bolts installed in brake control arms were inserted toe-to-toe, binding as the rudders passed center position. They should be installed head-to-head. They also found some more toe-to-toes on other Herkys . . . plus a few head-to-toes.

Puzzled by this obvious lack of standardization, they checked the Dash Two and Dash Four assembly diagrams . . . they're very unclear as to proper direction of bolt insertion. As a result maintenance types have asked the AMA to resolve the discrepancy between Dash Two and Dash Four assembly diagrams and specify the right method.

## **MICROSWITCH MESS**

The C-7 instructor pilot demonstrated an actual feathering of number two prop for his eager student. After he expressed proper amazement and had a chance to "feel" engine-out handling, the trainee tried an engine restart. He pulled on the feathering button, but no response. The prop refused to budge out of feather . . . he could still read all the manufacturer's decals on the blades. After trying all the tricks of his trade, the IP called it a partly wasted day and returned for a single-engine landing.

Prop specialists found: broken wires leading to number two prop's feathering button; three loose and corroded wires on number two throttle's microswitches. They cleaned, resoldered, and adjusted wires for three



*with a maintenance slant.*

manhours and the prop behaved normally once more. Then they wondered how their phrase inspectors missed that microswitch mess.

### **LACKADAISICAL LAUNCH**

A T-39 maintenance supervisor assigned a routine maintenance check to a five-level staff sergeant and a three-level airman. The men taxied their bird to a run-up area for required fuel burn off. Soon after advancing both throttles to 85 percent, the aircraft moved forward, out of control. They finally came to a stop against another bird. About 100 hours work will put both ships back in shape.

A collateral board was set up to consider the following:

a. Sergeant did not consider fuel burnoff task same as engine run-up so he did not use run-up checklist, chocks, or tiedown bridle.

b. He set parking brakes and advanced both throttles to 85 percent.

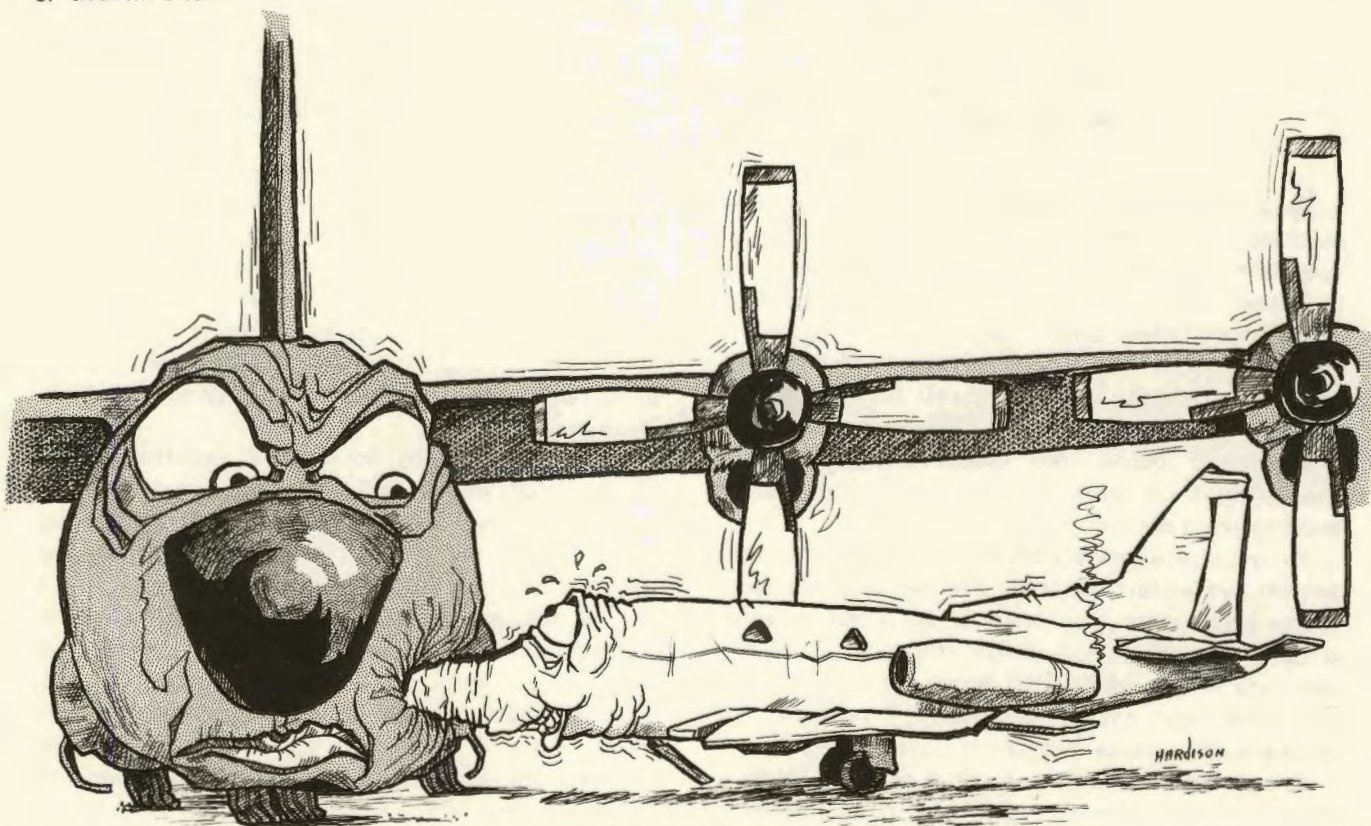
c. While monitoring gauges he decided to add additional braking with toe pressure (not knowing this would release parking brakes).

d. When aircraft began to move, the sergeant applied more brake pressure and tried to engage nose wheel steering. He panicked when neither worked and appeared to be failing.

e. The T-39 traveled more than 200 feet, including nearly 100 feet of heavy skid marks which resulted in left tire failure.

f. Immediately before impact with the other aircraft, the airman pulled throttles from 85 percent to off.

g. When assigning the task, the supervisor knew that it was the sergeant's initial attempt to perform check without supervision. No briefing was offered.





# OVERSTRESSED/ OVERDRAWN



**Maj F. N. Frizzell**  
**Hq TAC, OSF**

**H**ave you ever been "overstressed" by the embarrassing realization: your checking account's overdrawn! Maybe your better-half didn't have time to fill out that "silly little stub" before dashing off to the supermarket or neighborhood news bureau (beauty parlor). Possibly, although unlikely with your steel-trap mind and close attention to detail, you contributed to the no-funds problem with poor arithmetic. Whatever the reason, whoever's to blame, the impact on your future checkwriting's the same. No more, until you add some bucks to your bank account.

We can draw a parallel between an overdrawn checking account and aircraft operation. And we can see a more serious result when you overdraw an aircraft's "stress account." Specifically, six inflight structural failures and seven lost aircrewmembers in TAC during the last five years. The equipment expenditure when "overdrawn" is calculable; the personal devastation is incalculable.

Comparing the transactions of a personal checking account with an aircraft's "stress account" requires some understanding of a plane's structural background. In

designing our birds, aeronautical engineers strive for an aircraft as strong as tactically necessary, with minimum weight, and at lowest cost. Their ability to realize these goals determines the performance capability of the airplane, and acceptance of their design. So, three primary factors, strength, weight, and cost interrelate in their structural considerations. The resulting end-product airplane enters the world of flight with a designed service life. Actually, a "stress endowment" of a specified amount to be expended over a given service life . . . a sort of aircraft checking account. Careful "checkwriting" by pilots can make it double as a life-savings account. More about that later.

We're accustomed to hearing about aircraft service life as thousands of flying hours. This can be a little misleading . . . especially to fighter pilots. It implies that flying time is the prime consideration in determining aircraft operational capability and aging. In reality, service life is the ability of the bird to withstand the accumulation of a multiplicity of recurring stresses and that insidious deduction, corrosion. If a bird just sits, corrosion will steal its service life account; it will crumble on the ramp. If the aircraft flies, it accumulates stress "withdrawals" and eventually disburses its total, original deposit. Between stress and corrosion, the bird's service life is depleted. The onset of both aren't geared to a



specified number of flying hours.

Corrosion has long been recognized as an enemy of all aircraft and our maintainers wage a constant battle against it. Their maintenance procedures, techniques, inspections, and treatments are greatly improved. They provide earlier detection and a better defense against the thief called corrosion.

The most difficult service life problem involves determination of aircraft stress accumulation. The desired cyclic stress endurance to be built into the bird is defined in the original specifications submitted to design engineers. And engineers are acutely aware that, like any piece of metal, an aircraft can be bent (stressed) just so many times before it bends permanently. Or worse, fails. Therefore, their final design will withstand "X" number of assorted cyclic stresses, depending on their magnitude and frequency of application.

For example, let's say we have an original endowment of 400,000 cyclic stress units built into a new airplane. This is the original deposit in the bird's service-life account. In the course of a tactical mission a 6G pullout may write off 100 stress units, while a 4G pullout withdraws only 10 stress units. With this kind of checkwriting during the airplane's service life we can absorb four thousand 6G pullouts, or forty thousand of the 4G variety. As you can see, flying hours aren't the primary consideration. It's what goes on stress-wise during those sorties. Once the account's principle of 400,000 stress units is written off, we can expect the bird to close out its flight account . . . lack of funds.

A significant point to recognize: the original specifications on stress endurance established for the design engineers are, at best, educated guesses with an added margin for safety.

The actual stresses an aircraft encounters can be determined with accuracy only by instrumenting a typical bird and recording its stresses while performing its assigned mission. Instrumentation and subsequent data analysis allows a recomputation of service life estimates and effectiveness of modifications, adding (or subtracting!) to the remaining principle in the service life account. In this way, maintainers and engineers do their utmost to guarantee a full return of the bird's specified service life.

Unfortunately, the most troublesome and unnecessary withdrawals from an aircraft's account are pilot-induced stresses. A jock can close out his bird's service life balance in one "le grande" maneuver, or missed attempt. As the sole executor of the airplane's account on any particular day, each pilot must exercise great restraint.

Use the frugal approach. Budget your check writing closely. Operate your bird without abusing it. That way it won't let you . . . or some other pilot . . . down. If you happen to overstress an aircraft in any way, write it up. Let maintenance types inspect and audit the books to insure you a remaining balance in the bird's service life account.

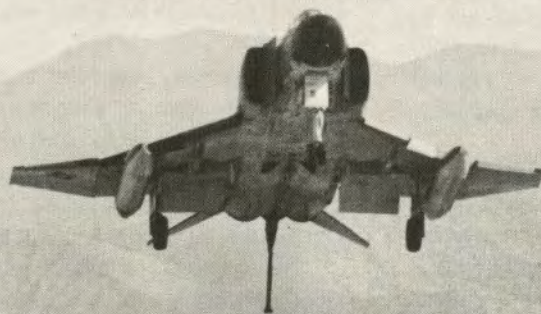
None of us want to launch in an overstressed/overdrawn bird. You might lose your "interest" in flying. ➔





# BAK-9...

# or BAK-12 ??



**T**hrough the years we have been "barriered" to death with charts giving speeds, weights, and specs of the bird catchers on our runways. Recently, another variation of the arrestment game has reared it's head — WHICH A—GEAR SHOULD I USE? This article is intended to stimulate some thinking along this line. Although there are other arresting systems in use, we will only concern ourselves here with the BAK-9 and BAK-12, 950-foot runout models. If you use different equipment the same analogies can be run using data from your aircraft Dash One and the arresting gear tech order.

Our problem was identified in a Hq TAC Civil Engineer's letter to Ops and Safety. They cited two approach end engagements by F-4's, one a potential accident. In the first, an F-4 engaged a BAK-9 at 175

knots weighing 46,000 pounds. The aircraft was 10 knots over max engagement speed — fortunately both tapes failed simultaneously. The other was a successful engagement into a BAK-9 at a reported speed of 148 knots, weighing 37,300 pounds. Max engagement speed for this weight is 180 knots or . . . max weight for 148 knots would be 56,000 pounds. This engagement was not anywhere near the capability of the BAK-9 but the speed and gross weight combination was in an area that automatically required a tape change. It cost \$3,500 and that arresting gear's capability while it was down. In both cases, arresting gear with a higher energy capability, BAK-12's, were also installed. The reasons for selecting the BAK-9 for these catches is not known, nor is it important as you read this. Neither is the \$3,500 price



tag for the tape change — but the down time of the BAK-9 is important.

So what's the answer? BAK-12 all the way? Half of the time? BAK-12 for heavy airplanes and the BAK-9 for light ones? There is an answer but you'll have to figure it out yourself. There are many considerations that enter into the decision that determines what A-gear to use, both on a continuing basis and for selected emergencies. If you should happen to have BAK-9's and BAK-12's installed on your airpatch, whoever makes the decision of which one to use should know the capabilities of each system and what it will cost you in arrestment capability. You'll pay every time but a little planning will allow you to determine which pocket the capability comes from. That last emergency arrestment may not be the last of the day — you could have two in the next hour.

Before we go on let's take a brief look at the differences between the BAK-9 and the 12. Basically the BAK-12 is just a big brother of the BAK-9 (by 10 million foot pounds of energy absorption capability), their principle of operation is the same. Your hook pulls on the pendant cable, which turns the tape reels, which drives a hydraulic pump, which puts the brake on, and pulls back on your hook. Simple, huh? Both systems use the same pendant cable but the BAK-12 tapes are beefier and it has two stopping engines instead of one as in the BAK-9 system. This brings us to a subtle, but important difference between the two sets of gear. **ALTHOUGH THE BAK-12 IS THE STRONGER OF THE TWO, IT ALSO IMPOSES HIGHER HOOK LOADS AT ENGAGEMENT!** In other words, your hook has to pull harder to get the extra weight in motion. Translated into useful information, it means that an aircraft that is hook limited can engage the BAK-9 at a higher speed than the BAK-12!

As we mentioned earlier, the decision of which A-gear to use lies with each individual base. From the many possibilities that would enter into a final decision we picked three to comment on which are pretty much universal — they will affect you all. The first is the urgency of the situation. It needs no explanation to a point, if an aircraft has to recover right now he'll just have to take pot luck. Another variation on this theme is the airborne emergency that becomes critical due to fuel. It's not too farfetched to imagine an aircraft circling while the A-gear is rigged, only to get a hook skip and have to go around and try again. There is a case on record of an F-4 making three unsuccessful tries at an approach end engagement and then recovering at his alternate on fumes. It can't happen? Remember the pilot who flamed out on final because he waited for a strip of foam to be laid on the runway — his gas gauge was just a little bit off.

Secondly, the type aircraft to be arrested and the type



engagement planned should be considered in the light of that small but subtle difference in engagement speeds mentioned earlier. With the exception of the F-4 and F-100, all other TAC aircraft are hook limited to some degree. At the low end of the totem pole is the F-105 with the weakest hook in the inventory. The Dash One shows that a takeoff abort can be critical even though it's at the far end of the runway. Let's take a look at the difference between engaging the BAK-9 or a BAK-12. The good book lists the maximum BAK-9 engagement speed at 132 knots for a gross weight of 45,000 pounds, **FOR THE BAK-12 IT IS ONLY 118 KNOTS.** There is a 14 knot difference between the two — and the speeds given are to hook yield! For 55,000 pounds the speeds are 112 knots and 96 knots respectively — you wouldn't give five knots away to your blood brother, much less 14 or 16 on a heavy weight abort.

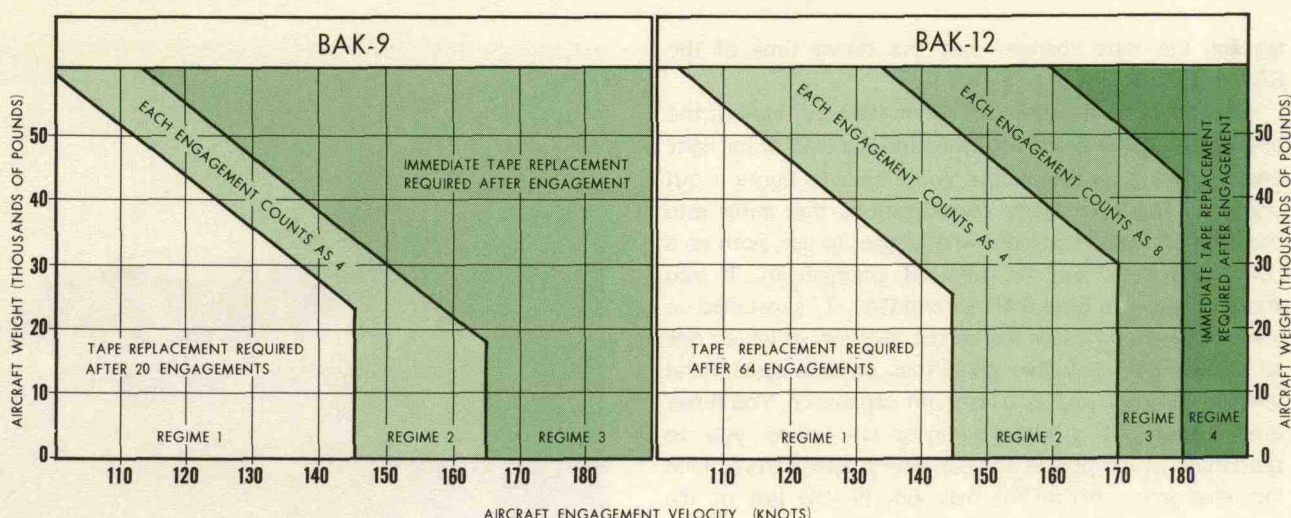
On the other hand, the F-4 in our first example would have been in hog's heaven with the BAK-12. At his weight of 46,000 pounds he was nine knots below limit speed . . . or he could have weighed 50,000 pounds. Our A-gear doesn't know the difference between an F-4 or an F-105 nor could it care less. It is programmed and reacts mechanically whenever the pull of a hook sets the machinery in motion. In the end it will either tear your hook off, be torn up by you, or stop your aircraft inside of 950 feet. You can control the outcome only by programming the right hook to pick up the right pendant cable.

Our third item is the number of arrestments remaining prior to mandatory tape change. If you are running a heavy flying program . . . and using the F-4, this subject should be of particular interest. From the chart you can see that the BAK-9 tapes are good for 20 engagements in regime I while the BAK-12 will go to 64. This is only true



# ...WHICH BAK??

## PURCHASE TAPE REPLACEMENT CRITERIA



if the tapes are newly installed, other factors enter into the tape change cycle but will not be discussed here — see your barrier crew for details. Here is where you pay the piper and get to decide which account it comes from.

Now assume this hypothetical situation: you have two runways, one with BAK-9's and one with BAK-12's — all four arresting gear are in battery. We'll now use our three examples, the two F-4's and the F-105 on each runway, followed by a mix. First the runway with BAK-9's. Our F-4 number one makes an approach end at 175 knots, 46,000 pounds. Result, BAK-9 torn up, tape change. F-4 number two follows after repairs with another approach end at 148 knots, 37,300 pounds. Result, safe stop, tape change. F-105 on an aborted takeoff engages far end at 132 knots, 45,000 pounds. Result, safe stop in regime II, arrestment counts four leaving 16. Net result: one potential F-4 accident, one F-105 save, two complete tape changes, and one-fifth of the far end A-gear tape capability used up.

Now to the runway with BAK-12's installed: F-4 number one makes approach end at 175 knots, 46,000 pounds. Result, safe stop in regime III, arrestment counts eight leaving 56. F-4 number two is next at 148 knots, 37,300 pounds. Result, safe stop in regime II, arrestment counts four leaving 52. F-105 on aborted takeoff engages far end at 132 knots, 45,000 pounds. Result, hook torn off, aircraft runs off end and burns. Net result: one aircraft destroyed, 12 of 64 arrestments used on approach end A-gear.

For the mix we'll simply abort the F-105 on the BAK-9 runway and put our two F-4's into the approach end BAK-12. Net result: three safe stops, four of twenty engagements used on far end BAK-9 and 12 of 64 engagements used on approach end BAK-12. Now, you might think, "He really made it easy for himself, getting

to pick the parameters." Not so, the F-4 examples are true and did, in fact, occur at TAC bases. The F-105 example was chosen at random using the 45,000 pound gross weight to simulate a training takeoff. You might say that it worked out accidentally — the same way it's going to happen to you.

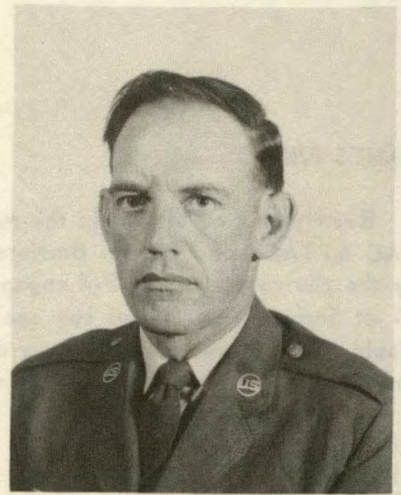
The three items discussed above: urgency, type aircraft/engagement, and tape change criteria only scratch the surface of this subject. Some other consideration might be your type aircraft and other types which transit your station regularly, such as F-105's deploying to George. The placement of your A-gear and type overrun will certainly enter into your plan along with severe seasonal weather if your area experiences something along that line. The F-4 mentioned earlier was trying to snatch the cable with only a thousand feet of overrun in 400 and 1 in rain, approaching over a busy highway 300 feet from the overrun. If all of your A-gear is on one runway you may want to have a BAK-12 in battery on the approach end and a BAK-9 to catch aborts. The F-4's will be taken care of and aborting hook limited aircraft will get a break.

As was mentioned earlier, the \$3,500 per tape change should not be a consideration in your decision. The A-gear installed on your runways is there for only one purpose — to stop airplanes. If you could keep from engaging the BAK-9 for 18 months, it automatically counts as nine engagements. Adding the one-half engagement for each monthly inspection, in those 18 months you would total 18 engagements and would have to change the tape very shortly anyway. Efficient management of your arresting gear to prevent accidents should be an integral part of your local safety program. We'll leave you here with the hope that you will give some thought to this subject. And when the question, "What A-gear should I use?" comes up — you'll have the answer.



## CREW CHIEF OF THE MONTH

Staff Sergeant Thomas E. Bower of Det 1, 831 Air Division, Edwards Air Force Base, California, has been selected to receive the TAC Crew Chief Safety Award. Sergeant Bower will receive a letter of appreciation from the Commander of Tactical Air Command and an engraved award.



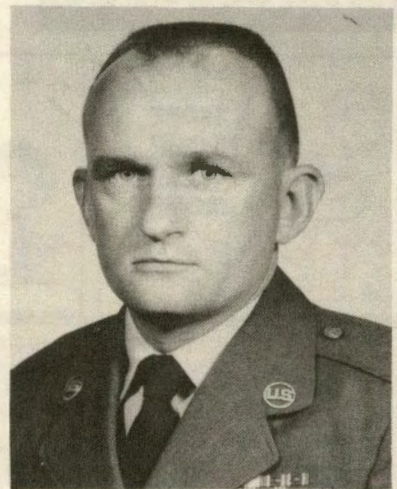
SSgt Bower



TSgt Forsman

## MAINTENANCE MAN OF THE MONTH

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





# Letters to the Editor

## WANTS PHOTO

Read your fine article in the May 1969 issue of TAC ATTACK on "Barrier Barriers." Was intrigued by the photograph of the F-4 engagement on Runway 21 at Somewhere. If you can see your way clear, would like to have an 8 x 10 copy of that photograph (suitable for framing) for the office wall.

Major Dave Elliot  
AFIAS-F3, Norton AFB

*The only photo we have is the one used to illustrate the barrier story, it's yours. As a sidelight, your letter disrupted all the work in progress while we tried to figure out where "Somewhere" is. Our conclusion? George AFB. Ed.*

Staff Sergeant Raymond E. Komorowski, 1969 Communications Squadron, APO New York 09125, submitted the suggestion for the back cover of this

issue of TAC ATTACK. Many thanks Sergeant Komorowski for your excellent idea. Ed.

## FROM OUR BIG BUDDIES

I have recently had the opportunity to read several issues of your fine safety magazine, TAC ATTACK. You are doing an excellent job of in-depth coverage. I'm wondering whether it would be possible to get on your distribution list for about five copies. Here at ICEG we do the flight evaluation work for the entire Strategic Air Command and I feel that our evaluators could glean many gems of wisdom from your publication that they could then pass out to the field on their evaluation visits.

Major Ronald G. Angus  
1st Combat Evaluation Group  
Barksdale AFB

*Thanks for the kind words, you're on for five. Hope TAC ATTACK is useful in your program. Ed.*

## PEANUTS

Courtesy of Daily Press, Newport News, Va.  
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# TAC TALLY

## AIRCRAFT ACCIDENT RATES

### MAJOR ACCIDENT RATE COMPARISON

	TAC		ANG		AFRes	
	1969	1968	1969	1968	1969	1968
JAN	6.8	5.6	28.9	0	0	0
FEB	6.2	7.3	12.8	0	0	0
MAR	6.8	7.1	12.6	0	0	0
APR	7.0	8.7	15.1	1.9	0	0
MAY*	7.3	8.0	13.1	7.5	0	0
JUN		8.5		7.4		0
JUL		9.3		6.3		0
AUG		9.4		8.2		2.3
SEP		9.1		7.4		2.0
OCT		9.3		6.7		1.8
NOV		8.6		6.9		1.7
DEC		8.8		7.8		3.2

### UNITS

THRU MAY	1969 *	1968	THRU MAY	1969 *	1968
9 AF	2.9	6.3	12 AF	9.0	7.3
4 TFW	9.1	11.8	23 TFW	12.3	9.8
15 TFW	0	9.4	27 TFW	0	7.4
33 TFW	21.2	16.6	49 TFW	0	0
113 TFW	0	21.7	479 TFW	9.5	16.2
4531 TFW	0	12.0	474 TFW	25.3	56.8
363 TRW	6.7	0	67 TRW	0	0
			75 TRW	8.6	0
			123 TRW	35.4	0
64 TAW	0	0	313 TAW	0	0
316 TAW	0	0	516 TAW	0	0
317 TAW	0	0			
464 TAW	0	0			
4442 CCTW	0	0	4453 CCTW	0	11.0
			4510 CCTW	15.3	2.7
TAC SPECIAL UNITS					
1 SOW	14.1	0	4440 ADG	0	0
4409 SUP SQ	0	0	4500 ABW	9.2	0
4410 CCTW	2.9	17.3	4525 FWW	20.9	32.8
4416 TSQ	0	0			

\* Estimated

Flying accidents declined slightly during May, seven accidents with four fatalities. Although two very similar accidents occurred during practice acrobatics, no trend for the month, or this year has shown up.

Two accidents concerned engines, an F-4 had an engine fire on takeoff and an F-100 engine failed in flight. Along with this general category, a third was caused by a double engine flame-out on takeoff, an F-4. Both engine fuel shut-off valves were found closed. The board could not determine a failure or malfunction that caused the electrical system to drive the valves closed. To complicate things, a screwdriver was found in the wreckage during the investigation.

Another resulted from fuel starvation. At some-time during the emergency aircraft control was lost. The resulting crash caused two of our fatalities. Two

other accidents occurred from loss of control during acrobatics. Both pilots were doing barrel rolls, neither got out before impact. Our seventh accident is classified.

The lead article in this issue contains some pertinent information on recovery from an out-of-control maneuver. The basic ideas are applicable to aircraft other than F-100s. The secret, of course, is to recognize that your aircraft is about to go it's own way with or without your concurrence. Unloading at this point is your only course of action. Once in an out-of-control situation, it may be too late to do anything except punch out. The solution to this problem lies in knowing your system (and some flying skill naturally). But all the skill you possess can't make an airplane fly when it decides to quit...nor can your pride.



For Safety ....

1969

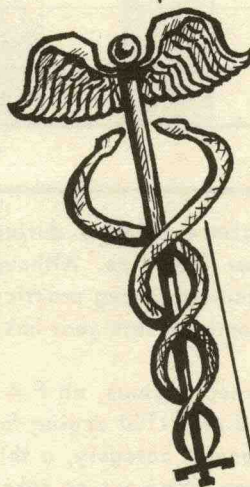
Date

Name

Prescription

R<sub>x</sub>

*Use a mixture of caution  
and courtesy to prevent  
upset or disorder.*



DRIVE CAREFULLY