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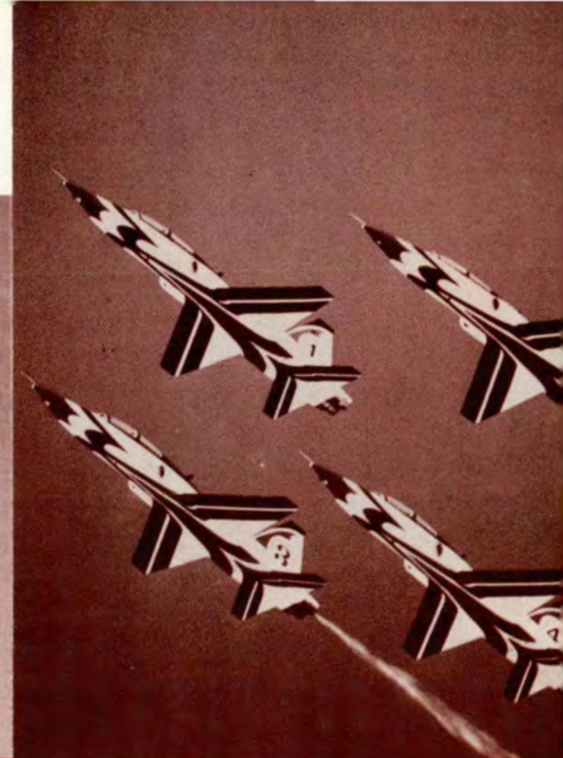
MAY 1976

ARMED FORCES WEEK MAY 8-15




UNITED STATES AIR FORCE MAY 1976

aerospace SAFETY

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

THE MISSION - - - - - - SAFELY!

SPECIAL FEATURES

REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

MAY 1976 AFRP 127-2 VOLUME 32 NUMBER 5

COMING!

SPECIAL FEATURE FOR AIRCREWS... SURVIVAL

CAPTAIN RONALD E. VIVION
Chief, Programs and Current Operations
3636 CCTW, Fairchild AFB WA

Survival training. I'm sure that very term elicits a definite and different mental picture for each aircrewman. Some remember the August week they spent sweating through the deadfall and slash north of Fairchild. Others still can't figure out how that Negrito could hide so well in the jungle. Of course, there's Miami in the winter (yes, salt water really is salty). Choco Indians appearing from, and then disappearing into, nowhere, and let's not forget beautiful downtown Alaska at −40 degrees Celsius. But for most aircrew members, survival is just a memory, or better stated, not an ongoing part of their aircrew duties.

We, of the Survival Wing Staff, feel that our first shot (no pun intended) at you, gave the basics of survival. To be an effective survivor and really make the "That They Shall Return" system work, you need to be reminded of all those "woodsy-did-you-know" things we provided at the schools. To this end, we are taking a lesson from the very fine articles on Instrument Procedures, written by the folks at IFC, that appear monthly in this publication. Starting with next month's *Aerospace Safety,* and each month thereafter, we will produce articles pertinent to a particular facet of survival. They are intended to help refresh your memory, and in some cases, provide information that isn't available because of school closures.

In any case, they will be here for you, the aircrew member, to review and use. Of course, we wholeheartedly hope that the skills of survival won't be necessary, but the odds aren't in our favor.

To help us in this enterprise, we solicit your support and comments. If you have a particular subject that you would like emphasized, please let us know. Also, if you have specific questions that can be answered via a phone call or letter, we'll be glad to accommodate. Please address any correspondence to:

3636 CCTW/TTP
Fairchild AFB WA 99011

or call AUTOVON 352-5470. ★

TWO IN THE SPACE FOR ONE

OR...."I THOUGHT HE WAS WELL CLEAR"

MAJOR BRIAN C. BERNET, CF
Directorate of Aerospace Safety

Midair collisions destroyed 189 USAF aircraft during the 11-year period from January 1965 through December 1975. This is one heck of a drain on our limited resources. We have learned many lessons during the last 11 years, but apparently not all have been learned well enough because we started 1976 by losing four fighter aircraft during the month of January.

Many words have been spoken during preflight briefings about operational rules and procedures designed for our safety, but we have accidents to prove some do not always follow them. Most of the time, everyone does a first class job, but every now and then a bad situation develops. I am sure every fighter jock has been involved in or witnessed a situation that was "pretty close." Some avoid a midair by knowledge and skill, others are lucky, and far too many——collide!

I hesitate to preach too loudly to you first line jocks in the field about the latest intricacies of formation flying, intercepts, ACM or the specific details of what is safe and what it not. What I can do, however, is describe briefly three recent accidents and let you decide for yourself what mistakes were made.

A flight of three was performing a two-on-one, self set-up, tactical hook ID intercept to be followed by an ACM engagement. The lead interceptor was in search mode. He pulled up at 6 NM to a 60 degree nose high position, but lost radar contact with the target when it was 40 degrees left at 2 NM and level. The wingman was flying a radar-out shooter position. Shortly after Lead began his pull-up, the wingman began a right chandelle assuming the target was at Lead's 12 o'clock position. The target actually was 4000 to 6000 feet to the left.

About this time, the target saw both attackers and commenced a descending turn toward the wingman, and shortly after decided to attack the lead aircraft. To do so, he rolled into a left climbing turn which caused his wing to block his view of the wingman. His WSO could not maintain radar contact with both aircraft at this short range because of altitude differential. The wingman collided with the target aircraft, his left wing contacting the target's aft fuselage.

The lead pilot of a formation was on his first night VFR traffic pattern. The overhead pattern was normal with spacing on downwind at 3000 to 4000 feet. When about to turn base, Lead decided to break out of the pattern due to conflicting traffic. While attempting a rejoin, the IP took his eyes off lead to adjust his cockpit lighting and check his airspeed. When he looked up he did not see Lead's rotating beacon, so he transmitted "turn your beacon on." Lead knew his beacon was on, thought there must be a misunderstanding, so turned it off. The IP saw a beacon approximately where he thought Lead should be and attempted to rejoin, but it was not Lead. He collided with Lead without seeing him.

A flight of two was making a night weather penetration. Number two was a NORDO aircraft on Lead's left wing. Lead successfully used a visual signal for gear extension. However, the wingman did not see the visual signal for flap extension or see lead's flaps extend. The wingman was unable to maintain normal formation position due to lead's deceleration. Relative to the lead aircraft, the wingman began moving under and to the right, reaching a point slightly ahead of a normal formation position and to the right of the lead aircraft centerline. From this position, he began a cross-under to the left to regain his original position. During the cross-under, he collided with Lead.

There are two types of midair collisions. One is where two aircraft of the same flight collide. The other type is where two non-associated aircraft collide, with the crews probably unaware that they were in close proximity or on a collision course. The USAF lost eight aircraft in a recent 3-month period in the first type of mishap. Let's look at the last 11 years experience to give you a feel for where a collision between aircraft of the same flight is most likely to occur.

Collision between members of the same flight accounted for 64 percent (172) of the total number of midair collisions. Out of a total of 92 collisions in close formation, only five occurred in weather and five at night. All intercept collisions occurred in visual conditions: 11 were between members of the same flight and seven were at night. Approximately 50 percent of all collisions between aircraft in close formation resulted in the loss of both aircraft.

A breakdown of these occurrences is as follows:

COLLISION OF AIRCRAFT IN THE SAME FLIGHT BY PHASE OF FLIGHT
1 January 1965 - 31 December 1975

Phase of Flight		Number of Occurrences
Takeoff:	Roll	11
Climb:	Initial	12
	Prolonged	7
Cruise:	Straight & Level	28
	Turning	23
Descent		6
Landing:	Initial	3
	Pattern	3
	Final	7
	Roll	19
Go-Around		2
Air/Air:	Intercepts	11
Air/Ground:	FAC	1
	Delivery	1
	Recovery	1
	Pattern	2
ACM		17
Acrobatics		8
Air Show		7
*Other		3
		172

*Other includes: F-84F knocking lead's gear down.
F-106 breaking in front of target.
O-1E unauthorized close formation.

COLLISION BY AIRCRAFT IN THE SAME FLIGHT BY TYPE FORMATION ACTIVITY
1 January 1965 - 31 December 1975

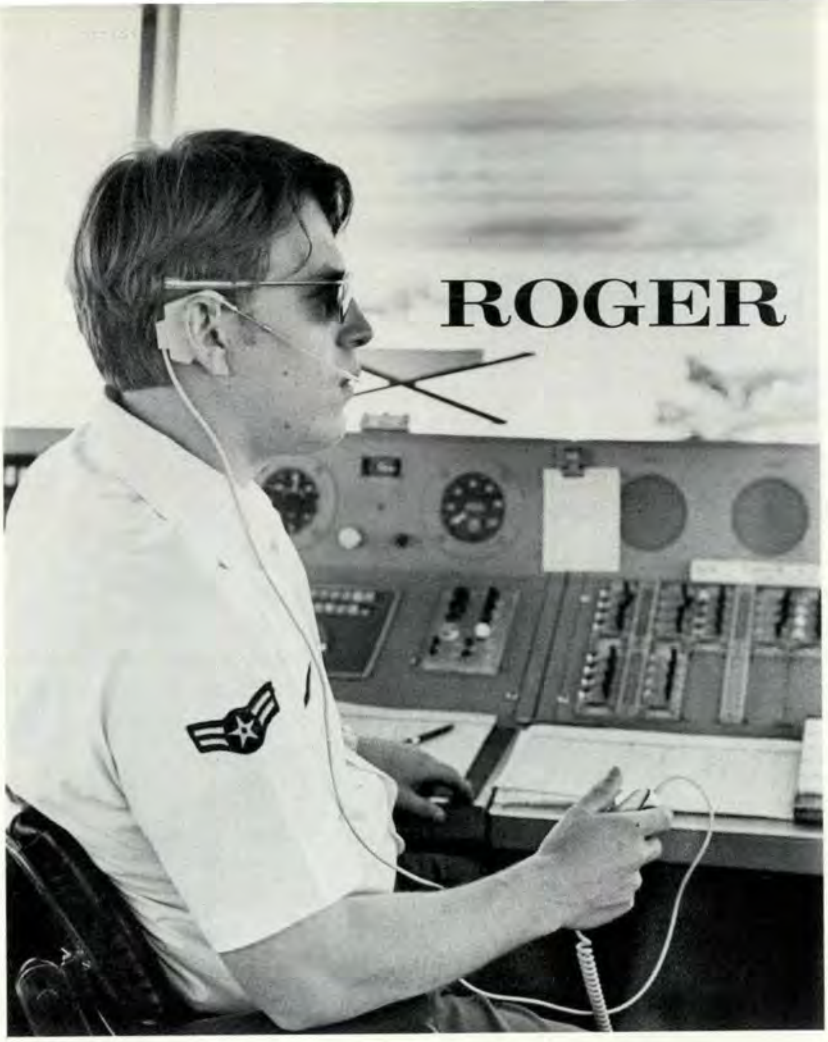
Type Activity	Number of Occurrences
Close	92
Route	3
Trail	10
Join/Rejoin	26
Crossover/Under	4
Change Lead	3
Tactical	3
Fighting Wing	8
ACM (Attack Phase Only)	7
Air/Air Intercepts	11
Air/Ground Pattern	2
Other	3
	172

Data provided by Safety Analysis Branch, AFISC.

If we consider pure numbers only and disregard the amount of exposure to the different types of formation, the most hazardous activity is close formation in *visual conditions*. During the last 11 years, 82 of the close formation collisions occurred during daylight VMC. The next most hazardous activity is joining or rejoining formation. This resulted in 26 collisions of which six were at night. The third most hazardous single activity is an air-to-air intercept.

Having looked at the statistics, what are some lessons learned? Any flying maneuver which places two or more aircraft in close proximity requires a great amount of mutual aircrew discipline. Each aircrew member in a flight or formation must clearly know where the other aircraft are and what they are doing. Problems arise when something unusual occurs or someone gets out of position. Flight discipline becomes particularly essential when a flight member loses sight of his element or flight lead, or some other aircraft he should be tracking visually. This is not the time to freeze and merely hope Lead will reappear, or to expect the other aircraft will see you and take avoiding action.

Aircrews must know and clearly understand the proper breakaway procedures required if they lose sight of Lead or the other flight, whether it is day or night, VFR or weather formation, or intercept/ACM practice. Supervisors should emphasize to their aircrews—*do not try to regain formation position if there is risk of collision.* Discipline or judgment, whatever name you choose, requires that aircrews take immediate and positive action to reduce the possibility of collision. The other flight members should be advised immediately of what is happening. Remember, a breakaway in the safest direction with clear airspace is worth any loss of ego, or chewing out in debriefing, for having executed a poor maneuver. ★



ROGER Means Everything But Negative

CAPTAIN GREGORY ULRICH
22d Air Refueling Squadron
March AFB CA

According to the *Airman's Information Manual,* the definition of "roger" is "I have received all of your last transmission (to acknowledge receipt, shall not be used for other purposes)." Unfortunately, the definition is contrary to common practice and represents an insidious weakness in aircraft communications.

In several accidents, radio terminology has either been listed as the cause or it contributed in some degree to the problem. In one case an aircraft was well below the assigned altitude and descending at the rate of 1200 ft per minute. A controller observing this on radar asked rather ambiguously, "Eastern 401, how are things coming?" The crew, which was working on a system malfunction, apparently interpreted the transmission as a reference to the malfunction and never noted the deviation in altitude. The crew was unaware that the altitude hold function of the autopilot was not engaged. Less than one minute later the aircraft crashed, killing more than 100 people. The correct terminology used by the controller should have been "verify present altitude."

In another incident, an aircraft was advised twice by a GCA controller of conflicting traffic. The pilot replied "roger." Moments later the aircraft collided with a light aircraft and all occupants of both planes were killed. The GCA controller stated he believed the crew members had the traffic in sight when they replied "roger."

The final case is the TWA Flight 514 that crashed while on approach to Dulles Airport in December of 1974. The flight crew misconstrued an approach clearance as clearance to descend. On the same day, a previous aircraft did not understand a clearance similar to the one issued to Flight 514. The other crew questioned the clearance and received additional instructions. They are alive today.

The line of continuity I wish to draw between these accidents is that there is no room for interpretation when air traffic control is involved.

The following points, which apply to all radio calls, will help reduce the volume of traffic on congested frequencies and aid the controller in determining exactly what the pilot is asking for. If at any time the instructions are vague or any crew member is not clear as to the procedure to follow, the pilot should question the controller. When issued traffic advisories, the pilot should reply with "in sight" or "tally-ho." If traffic is not visible, he should report "not in sight" or "no joy."

In all radio communications, brevity is imperative. Keep calls concise and specific. Use the vernacular common to aviation to the maximum extent possible. As an example, the term "request" rather than the phrase "we would like to . . ." helps eliminate wordy confusing messages.

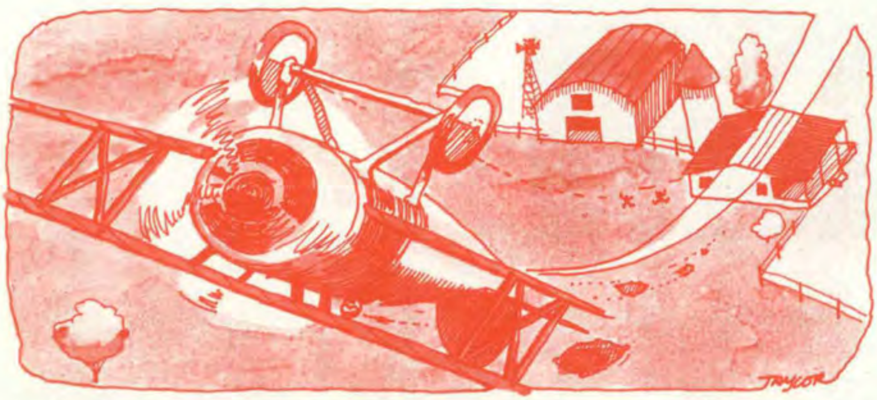
The FAA is in the process of publishing a pilot-controller glossary which will consolidate aviation terminology. It should be available in May 1976. Also, there is a glossary of aviation terms in the *Airman's Information Manual,* Part I.

Finally, the term "roger" should only be used by the pilot when he wants to say "I have received your last transmission." That is all it means. ★

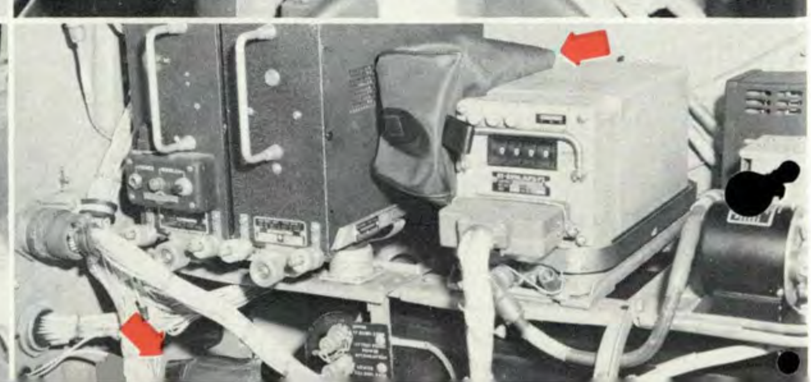
OF EMPTY COCKPITS--- STORAGE SPACE--- AND THINGS---

MAJOR LAWRENCE E. WAGY, Directorate of Aerospace Safety

Rumor has it that a famous (if not too bright), early aviator took some morbid pleasure in "bombing" friends' houses with 100 pound sacks of horse manure. I also have heard he had few friends. His loading procedure apparently involved placing the "bomb" in one open air cockpit of his two cockpit flying machine. His bombing technique was to make a low altitude pass over the target, roll inverted and let the "chips" fall where they may. It is not known if his fatal error was in the loading phase or during delivery. Investigators found the remains of the "bomb" lodged in the controls and deduced that insufficient forward stick was available for the inverted portion of the flight.



I recall a similar incident that occurred during a tactical "war game" at a deployment base beyond the blue Mediterranean. This particular exercise involved my setting alert with an F-100F, an imitation bomb, a low level map, a range target, and $5.40 poker money. After a day of loading my bomb, studying my target and losing my money, the alert whistle sounded and off I ran to make a 15-minute launch. As I scrambled up the



ladder, a very old and wise sergeant ran up behind me to strap down the unoccupied rear seat; but being a young and not very experienced 1st lieutenant I ordered him away from my aircraft. I made my take-off, flew my low level and missed my target. On the way home I soothed my wounds by practicing inverted flight.

When I returned to base for an overhead pattern, the most I could accomplish was a 60-degree bank, knife-edge pass down the runway. Much to my surprise I found I didn't have enough back stick to turn the aircraft. I was eventually able to land by using the thrust lever as an up and down lever, but I aged quickly in a brace and explaining to the squadron commander how the rear seat pack got between the stick and the seat.

Obviously I wasn't surprised in early 1974 when a solo student pilot in a T-38A rediscovered "Wagy's Law" that an unsecured rear cockpit seat cushion must always end up between the stick and the seat. He also recovered with an exciting straight-in approach and a brace in front of the commander.

In 1974, a friend, and highly experienced F-100 instructor pilot, packed an empty two-seater rear cockpit in a way that interferred with the throttle. He crashed and was killed when he attempted a reduced thrust approach at night.

A few years ago, a pair of T-37B pilots were returning from a cross-country flight to a southwestern US airbase. The ramp temperature was above 100 degrees F when they taxied clear of the runway. I responded to their emergency call and discovered the crew was about to explosively remove the canopy which refused to open in any other way. An enterprising crew chief passed a wrench to the crew through the emergency jettison door and they proceeded to disconnect the canopy from the actuator. As the very dehydrated crew was being carted off to a cooler area, we found their clothes bag had been eaten up by the canopy actuator, locking the canopy in the down position.

Recently a T-38A crew packed an unneeded LPU under the ejection seat, lowered the seat and cracked the cockpit floor. This incident sounds mundane but it takes very little imagination to envision much more serious results.

A realistic approach to aircraft packing problems must concede that when a fighter/trainer type aircraft and crew leave their home grounds for greener pastures and wetter waterholes, we can expect them to carry at least a change of socks. The responsibility for seeing that aircraft are correctly packed and unneeded equipment is properly secured does not rest solely with the pilot. Supervisors must define baggage/equipment limits and provide instructions for securing this baggage in consonance with available storage space.

Although travel pods can be a partial solution, they do not alleviate concern. Scehduling cross-country aircraft to insure the correct configuration can be a difficult proposition. Aircraft aborts and last minute schedule changes may result in a pilot arriving at the aircraft with everything but his kitchen sink, only to find an aircraft without a travel pod. The golf clubs or the tennis rackets are likely to go anyway.

Supervisors face a two-fold problem. When storage space is scarce, the question is basically "where will the pilot put it?" When storage space is ample, the question may be, "what will the pilot put in it?" Center of gravity computations do not normally account for removal of 150 pounds of ammo cans to be replaced by 20 pounds of glad rags. Nor are computations made to include 45 pounds of live Maine lobsters packed in dry ice in the forward electronics bay. Experience alone has provided the following working formula for supervisors to use when computing required storage space for cross-country operations.

$$\left.\begin{matrix}\text{STORAGE}\\\text{SPACE}\\\text{REQUIRED}\end{matrix}\right\rangle = \frac{\text{DURATION OF TDY} \times \text{DISTANCE OF DEPLOYMENT}}{\text{AMOUNT OF SUPERVISION}}$$

Astute mathematicians recognize the denominator to be the controlling factor. As the amount of supervision goes down, the storage space required approaches infinity. In fact, with no supervision, the formula can be simplified to the following:

$$\left.\begin{matrix}\text{STORAGE}\\\text{SPACE}\\\text{REQUIRED}\end{matrix}\right\rangle = \left\langle\begin{matrix}\text{STORAGE}\\\text{SPACE}\\\text{AVAILABLE}\\+ \text{5 cu. ft.}\end{matrix}\right.$$

In summary, with no supervision, the second formula will prevail and accidents become inevitable. The extra 5 cubic feet will be found.

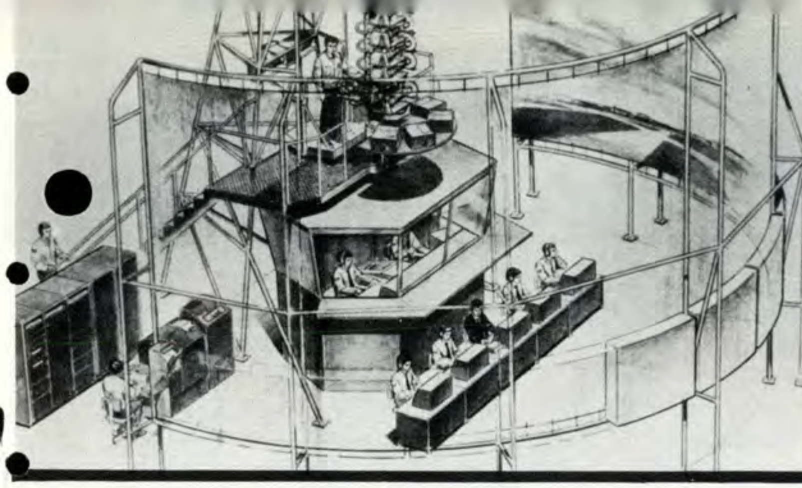
I am reminded of a suave F-100 pilot who nonchalantly confided that his coveted Arabic rug was brought home in the cockpit. He described how the crew chief had guided the rolled rug into the cockpit around his arms and legs then back up behind the ejection seat. Startled, I asked if it hadn't interferred with the flight controls. "Only on right hand turns," he replied. ★

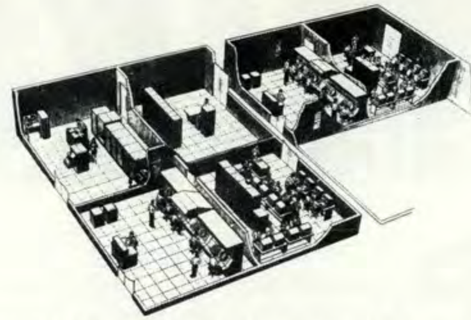
WHEN IT COMES TO SIMULATORS, THOSE THE AIR TRAFFIC CONTROLLERS ARE LEARNING IN ARE . . .

Like The Real Thing ALMOST

The next generation of pilots and navigators will receive much of their training in simulators. This worries some, because they envision something like the following: Joe student goes through UPT in a simulator—a machine just like an aircraft except for one very important thing: it never leaves the ground.

UPT successfully completed, Joe graduates and is assigned to an operational command and trains in its current first line aircraft. Again he





Artist concept of new VFR tower cab simulator, left, radar labs above. Four radar labs operate off two computers 12 hours a day.

never leaves the ground and eventually becomes combat ready, say in a fighter bomber. Then the balloon goes up and Joe finds himself flying combat missions. In unit aircraft? No, Joe controls the aircraft from a bunker miles from the target through television display on the console in front of him. It's just like the real thing, except that Joe is in no danger.

The chances of such a situation developing at some point in the future seems remote. But the fact is that there is going to be a lot more learning through simulation rather than the real thing and not just for pilots. For example, student air traffic controllers these days are learning how to deal with the problems they will face in their profession by the use of computerized simulators that do better—for training—than the real environment.

The AN/GNP T-3 radar target simulator gives the student just about every situation he will ever face, plus an understanding of what it's like on the other side of the scope. Students can "fly" 12 aircraft targets manually; the simulator can supply another 30. The T-3 can simulate ECM and radar beacons for aircraft identification as well as weather patterns, wind conditions, the use of circular polarization and moving target indicator, which is used to reduce the normal ground clutter at most facilities. Airways, navaids and fixes are depicted.

Another important feature is instant replay by which the instructor can rerun up to 10 minutes of a student's performance, a valuable teaching tool that helps the student see the reactions of the target to his instructions.

The Air Force also has coming soon a simulator that will train tower controllers in controlling aircraft under VFR conditions. It consists of a tower cab mockup encircled to 210 degrees by a cylindrical screen. Film projectors provide the VFR environment, showing buildings, runways, navaids and even moving targets such as aircraft and ground vehicles.

Special effects include night operations, clouds, rain, and fog. Students can operate airport lighting and, in general, experience the job of a tower controller in a realistic environment.

The T-3 is currently in use at Keesler AFB in the Air Traffic Control Operator Course. The VFR simulator is scheduled for delivery to Keesler this summer.

What does the future hold in simulation? Consider this. An aircrew flies a complete mission, in a simulator. They take off, fly the mission and return to land all under the control of people operating other simulators. After the mission, Maintenance clears the squawks on the aircraft. Yep, by computerized simulation. Over and out. ★

THE IFC APPROACH

Pilots are aware that in order to fly and successfully land from most non-precision approaches, they should descend to the published Minimum Descent Altitude (MDA) and begin a visual descent (assuming the runway environment is in sight and a safe landing can be made) prior to the missed approach point. Many pilots, however, do not consider the position from which a visual descent should be initiated. This month's article will discuss a technique for estimating the location of this position. Let's call it a Visual Descent Point (VDP).

What is the value of a VDP? First, it provides a point from which a safe transition to a visual approach and landing can be made using the descent gradient for your aircraft. Second, the use of a VDP will assist in avoiding a premature descent from the MDA and a subsequently flat and possibly dangerous approach. Finally, it forces us to think consciously about where the Missed Approach Point (MAP) is in relation to the runway threshold. For example, the approach in Figure 2 will place you 482 feet directly above the threshold at the MAP of a runway only 6003 feet long.

Before we take a look at the steps involved, one point needs to be made. Descent gradients may be expressed in either degrees or feet per mile. For instance, a 3° descent gradient may also be expressed as approximately 300 feet per mile (altitude to lose per mile).

Assume we have been cleared for the TACAN Rwy 12 approach in Figure 1.

Our problem now is to locate the VDP. To define the VDP we should accomplish the following five steps:

STEP 1: DETERMINE THE VISUAL DESCENT GRADIENT TO LANDING.

In other words, what gradient do we normally use for visual approaches? Since this may vary for different types of aircraft, let's use 2.5° gradient as an example.

STEP 2. DETERMINE HEIGHT ABOVE TOUCHDOWN (HAT). From the minima block we see that the MDA is 365 feet above the runway.

STEP 3. DETERMINE THE VISUAL DESCENT POINT. The question we should ask here is, "at 365 feet above the runway, how far from the runway should we be when we start a visual descent using a 2.5° gradient?" To do this we'll use the information from Steps 1 and 2. Divide the HAT by (Visual gradient in degrees X 100) in order to determine the VDP in miles from the end of the runway.

$$\frac{365}{2.5 \times 100} = \text{approximately } 1.5$$

miles *from the end of the runway.* Caution must be used as the distance we calculated is measured *from the runway* and *not* necessarily the DME reading that will be displayed at the VDP.

STEP 4. DETERMINE COCKPIT INDICATION OF THE VDP. Now we must convert the VDP found in Step 3 into a DME reading. From the aerodrome sketch we can estimate that the approach end

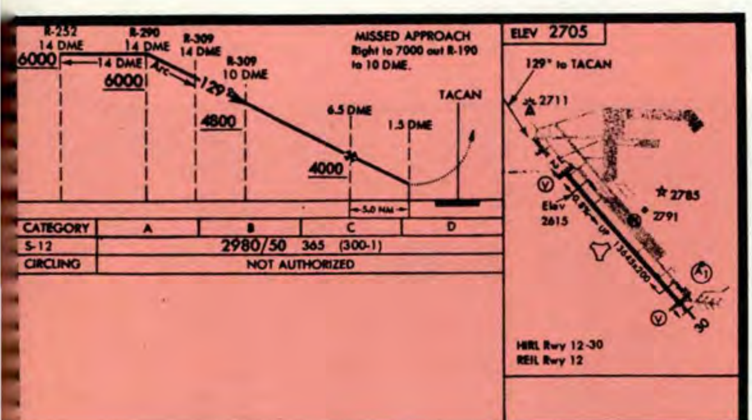
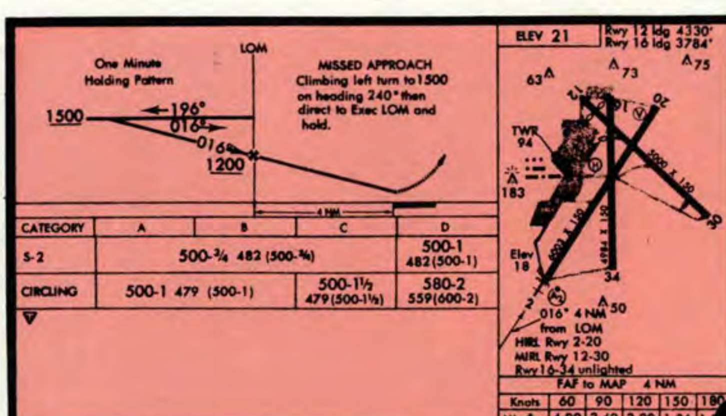


FIG. 1

FIG. 2



By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

of RWY 12 is approximately 1 mile from the TACAN. To this add the 1.5 miles from Step 3. The result is 2.5 DME. Therefore, starting a descent at 2.5 DME and using a 2.5° gradient will get us to the approach end of the runway. Make sure, however, that conversions to DME are done correctly.

STEP 5. DETERMINE THE GRADIENT FROM THE FAF TO VDP. Now we should figure a gradient that will get us to the MDA at or before the VDP. We must descend approximately 1000 feet (4000-2980) in 4 miles (6.5 - 2.5) or about 250 feet per mile $(\frac{1000}{4})$. That means we must use at least a 2.5° gradient from the Final Approach Fix (FAF) in order to reach the VDP at the published MDA.

Now let's look at an approach without DME. Before you read any farther, try to figure a VDP for the NDB RWY 2 depicted in Figure 2 using a 2.5° visual descent gradient. Let's see how you did.

STEP 1. We'll use a visual gradient of 2.5°.

STEP 2. HAT is 482 feet.

STEP 3. The VDP will be approximately 2 miles $(\frac{482}{2.5 \times 100})$ from the approach end of RWY 2.

STEP 4. Our problem varies from the first example. We should ask, "How far is the VDP from the FAF?" Since we must be 2 miles from the approach end of the runway, we can see from the profile view that it will require 2 miles from the FAF to the VDP. The only means we have to identify the VDP for this approach is timing. If our ground speed were 120 knots, our timing to the missed approach point would be 2 minutes and to the VDP, one minute. Therefore, one minute after the FAF we should be at the MDA.

STEP 5. In 2 miles we must descend 700 feet (1200 - 500). This will require a 350 foot per mile $(\frac{700}{2})$ descent gradient (or a 3.5° gradient).

One more important point. If this technique is to be used, enough time should be allotted for the required calculations. Just prior to the FAF or halfway through a penetration is not the time to compute a VDP. The ideal time and place is during mission planning at base operations.

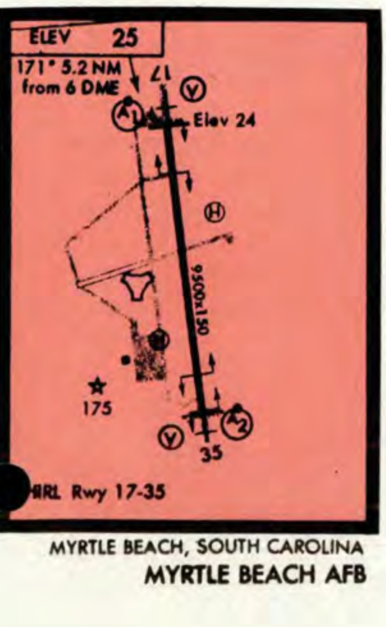
In approximately one year, VDPs will be portrayed on approaches, thus eliminating the need for the pilot to perform some of these computations. Until then, you may find this technique valuable.

INTERPRETATION OF ARRESTING SYSTEMS

Recent discussions with several pilots have revealed that the listing of Jet Barrier/Arresting Gear (J-BAR/A-GEAR) information in the DOD FLIP IFR Supplement is subject to misinterpretation. This area may best be clarified by referring to the following excerpts from the IFR Supplement and Instrument Approach Procedures (Terminal).

Consider runways 17 and 35 in the aerodrome sketch (Figure 3).

FIG. 3



MYRTLE BEACH, SOUTH CAROLINA
MYRTLE BEACH AFB

FIG. 4

AERODROME/FACILITY DIRECTORY 293

MYRTLE BEACH AFB. SC 33°41'N 78°56'W GMT–5(–4DT) **H–4, L–20–27**
AF 25 BL4, 6, 7, 8, 9 H95 (ASP/CON) (S50, T110, TT220, TDT650) (1) (KMYR)

JASU- 1(MA–1A), 1(MA–2) 1(MD–3M), 1(MC–1A), 1(MC–2A)

FUEL- J4, SP, O–128–133–148 SOAP PRESAIR LPOX LOX

J-BAR/A-GEAR

RWY 17 MA–1A/BAK–9(B) (2) BAK–12(B) — BAK–12(B) BAK–9(B)/MA–1A (2) RWY 35
(150' OVRN) (50' OVRN) (1450') (1300') (50' OVRN) (155' OVRN)

EXPLOSIVES CAPABILITY- A/1/1/1–B/1/20/20/20/PPR 7144

AERODROME REMARKS- CAUTION–Flush mounted strobe and apch lgt within 150' of BAK-9 pendant may deflect arresting hook. CAUTION–Copter trng area lctd E of the apch end of rwy 17 with copter opr 500' and below. CAUTION–Conway-Horry Co Arpt VFR tfc pat vcnty downwind leg of Radar Apch rwy 17. Overhead tfc pat 1700'. Large birds vcnty of A/D dur migratory season. Opr 1200–0400Z (DT 1100–0300Z). Dur non opr hr ctc Wg comd post for emerg afld lgt. A/D is clsd 1st Sat of ea month fr 1200–1700Z (DT 1100–1600Z) for preventive maint, exc for sked Civ Air Carriers. Acft carrying dangerous cargo will relay rqr info thru PTD prior to ldg. Unable to handle C–5 acft with dangerous cargo. Use extreme caution for unctl VFR tfc freq violating lcl airspace. Tran ldg copter apch fr E or W below 500'. IFR dep and arr rte over water, floatation gear advs. Over-water survival eqpt not avbl for issue. Tran alert svc avbl A/D opr hr only. Tran acft can exp arr and dep delays dur periods of stu trng Mon–Fri to incl rstd to one apch and ldg. (1) PPR for T and TT acft with higher GWT. (2) 20 min prior ntc rqr.

Continued Next Page . . . .

J-BAR/A-GEAR equipment is installed on these runways as indicated by the symbols ⌐ and ⁞ . In order to determine the type, exact location, and usability of the arresting systems, refer to the IFR Supplement (Figure 4).

The arresting gear is depicted as it is located on the runway and should be read left to right for RWY 17 or right to left for RWY 35. Proper interpretation of the arresting systems on RWY 17 is as follows: The MA-1A (indicated by ⁞ in the aerodrome sketch) is a web barrier located in the overrun 150 feet from the approach end of RWY 17. This is indicated by "(150' OVRN)" directly below MA-1A. It is not used for approach end engagements. The BAK-9(B), indicated by ⌐ in the aerodrome sketch, is also located in the overrun, 50 feet from the runway surface. The BAK-9 is bi-directional, as indicated by the arrows in the aerodrome sketch and by the symbol "(B)" in the IFR Supplement. The BAK-12(B) is located on the runway surface 1450 feet from the approach end. If you understand the discussion to this point, you should be able to interpret the remaining system without any problem. Further barrier information, such as terminology and operational characteristics, can be found in the front of the IFR Supplement.

CORRECTION

Our December 1975 article contained an error. In the center column, about a quarter of the way down, the sentences should read, "That is, passing FL 250 you have 15,000 feet to lose, 25 − *10 = 15* × 2 = *30 NM, 25 + 30 = 55 DME.* If you are closer than *55 DME,* increase rate of descent and if you're at say *65 DME,* decrease rate of descent."

Thanks to those of you who brought the error to our attention. It is rewarding to know that you are reading the articles with an inquisitive eye. ★

Don't Let Your Wingman Down

(without oxygen, that is)

CAPTAIN THOMAS B. LAIRD
ATC Aerospace Physiology Training Aids Center
Randolph AFB, Texas

A recent hypoxia incident involving a student pilot brings to mind an important fact. Oxygen regulators occasionally *do* fail, either completely or partially. It happened at least six times in 1975.

Take for example a Monday morning when you realize after takeoff that your T-38 isn't giving advertised pressurization. So you elect to press on and stay below FL 250. Combine this with a faulty regulator and a student who gets his personal hypoxia symptom(s) but doesn't do anything about it. That's another fact; people do occasionally fail to use their training. And refamiliarization with your hypoxia symptoms is one reason, perhaps the biggest one, why we give you a chamber flight every 3 years.

Back to the hypoxic student. Now add a wingman who sees the student making seemingly purposeless movements (continuously cycling his helmet visors, putting his head down, then repeating the action several times), but who doesn't even tactfully ask if he feels O.K.

Now the good news. The "hypoxia" aircraft was a dual bird. After the flight, the student raised the question about what might have happened had he been solo. Good thinking!

Now for you wingmen; remember TIME OF USEFUL CONSCIOUSNESS? Don't hesitate. Later on the other guy might still be conscious, but not usefully, so he can't make his hands do what you're telling him needs to be done—like gangloading his regulator, and initiating a descent. Awareness by the other formation crewmembers of objective hypoxia signs, such as those displayed by the student above, or slurred speech, sloppy flying, and belligerence, should cue a life-saving query—one that will come in time for corrective action. ★

Did I Do Something Wrong, Coach?

Wg Cdr MARK PERRETT, RAAF
Directorate of Aerospace Safety

A T-39 crew attempted a battery start at a base of another service after the ground power unit failed to power the starter. The first start attempt was discontinued when the starter button popped out. A second start attempt was made after a one minute wait, with battery voltage indicating 21. A ten-knot tailwind was blowing. The second start attempt was normal until the rpm hung at 30 percent. EGT rose to 630-700 degrees and stayed there for about 5 seconds. The throttle was selected OFF. The engine was changed following a hot start inspection, and turbine components required replacement.

T-39's often visit bases whose transient personnel are not very familiar with the aircraft. (In a recent incident, the civilian contractor started gravity refueling a T-39 through the sextant port.) Maybe people are reluctant to admit unfamiliarity with such an apparently simple aircraft. In any case, the aircrew must be aware that such mishandling could occur at any time. Naturally, also, the aircrew must be thoroughly familiar with the requirements for ground handling—refueling procedures, AGE requirements and starting procedures.

When external power is not available, battery starts have to be made—that's a fact. But first, make sure that external power really is not available. Ensure that transient crews are clear on the type of starting power you need. The Navy, for instance, has different names for similar AGE. Ask yourself if you are allowing the pressure of priority passengers or delay times to influence your decision.

If, ultimately, you decide a battery start is necessary, consider the following points:

- TO 1T-39A-1 states that battery voltage should be a minimum of 21 for start. You know, and I know, that the closer the voltage is to 21, the less the chance of a good start.
- Any sort of a tailwind will inhibit the start, and if any other starting parameter is approached a tailwind may be the last straw.
- If you introduce fuel and ignition at 8% rpm vice 10%, your chances of a hung start are substantially increased.
- An unsuccessful first attempt could deplete the battery sufficiently to prevent starting, could also cause significant internal heating of the batteries, and induce thermal runaway.

The values of 30 seconds with motoring or 2 minutes draining are absolute minima to eliminate excessive fuel following a stopped start. Have that engine checked for excess fuel even after those precautions, to ensure against a hot start.

- Finally, monitor all available engine instruments particularly the combination of rpm, fuel flow and EGT. At the slightest indication of a hang up, stop the start.

There are many pressures on T-39 pilots when operating on administrative support flights. It is nice to think of yourself as a professional who gets the job done. It is, however, much easier to live down a delayed start than an unnecessary engine change. ★

Those Days Of The LEATHER HELMET

MSGT DAVE SYLVA
63 MAW, Norton AFB CA

Minds of men fashioned a crate of thunder

Sent it high, into the blue

Hands of men, blasted the skies asunder

How they lived, God only knew

Souls of men, dreaming of skies to conquer

Gave us wings ever to soar

In echelon, we'll carry on

And nothing will stop the Army Air Corps

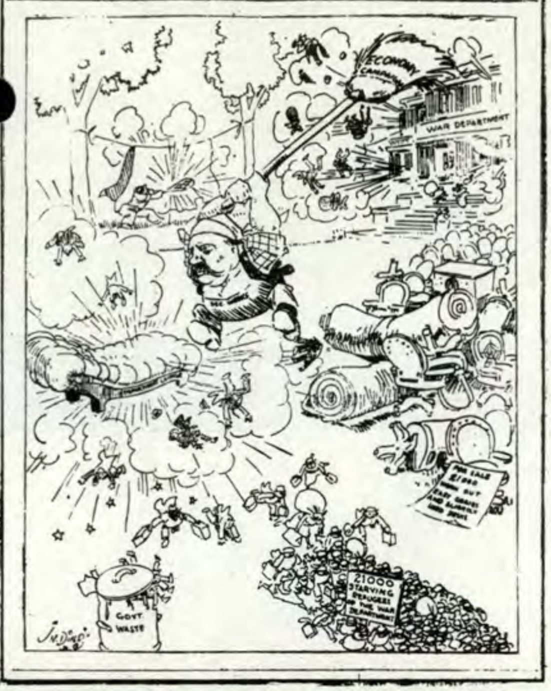
**From The Army Air Corps Song
By Robert Crawford**

What made it so damned ironic, was the fact that the newspapers were carrying both stories at the same time. The Disarmament Conference was getting big play. At the same time, in the same issues, there were smaller articles that spoke of the tests being conducted off the Virginia Cape to study the effects of aerial bombs on surface vessels. Very few people seemed to sense any connection or contradiction in the two stories.

If our press was not terribly impressed with the tests, the impact of the bombs on the *Ostfriedland* were not lost to the rest of the world. In a public statement, the Japanese military attache said, "Very great experiment. Profoundly exciting. Our people will cheer your great

LY SUN, FRIDAY, JULY 22, 1921

So Far the Weeks Family Seems To Be the First To Get Its House Cleaning Done



AIR BOMBS SINK ARMORED SHIP

Projectiles Weighing Ton Dropped From Planes on Ostfriesland

(By Associated Press Leased Wire)

ON BOARD THE DESTROYER LEARY, Enroute to Norfolk, Va., July 21.—The ability of the airplane to destroy the capital ship, was demonstrated to the satisfaction of the War Department officials today off the Virginia capes.

Army bombers, launching projectiles weighing one ton, sank the former German battleship Ostfriesland, a 23,000 ton heavily armored ship in exactly 25 minutes after they opened their attack at 12:15 p. m. from an altitude of approximately 1,700 feet. Two bombs which landed overboard within a few yards of the port quarter gave the ship her death blows.

Seven of the one ton m... many ar...

Ironically, while front page stories announced tests of aircraft vs ships, the disarmament conference was getting big play and cartoons on the editorial page marked the dismantling of the War Department.

Page 14, first aerial refueling with Wesley May transferring from one plane to other with gas can on his back. Left, crew of the Question Mark (see story) Maj Carl Spatz, Maj Ira Eaker, Lt H. A. Halverzon, Lt E. R. Quesada, Sgt Roy C. Hooe.

Mitchell (Billy Mitchell) and you may be sure, will study his experiments. There is much to learn here. It would be gravely embarrassing to the American people if the ideas of your General Mitchell were more appreciated in Japan than in the United States . . . but then, gratitude is not one of the attributes of democracy."

It was July 1921 and the first great World War had been over less than three years. The American people, sickened by the deceit of European power politics and by the carnage on the battlefields of France, had withdrawn behind the oceans. With friendly Canada and Mexico to the North and South, there was nothing to fear from those quarters. The British Navy guarded the Atlantic. Our great Pacific Fleet guarded the Western border. We were safe from attack and would not allow ourselves to become involved in another foreign war. One senator summed it up for the people; "I would adhere closely to the advice of Washington—no entangling foreign alliances, expressed or implied."

The military had been demobilized. The Air Service was slashed by 95 percent, from 200,000 men down to 10,000. The appropriations for the Air Service were cut as badly.

America, the inventor of the airplane, had fought the war in British, French and Italian airplanes. The only American built combat plane was the British designed De Haviland 4 which Mitchell branded "the flaming coffin." At that, of the 3,000 DH-4s produced in America, only 169 reached France. Now with the war behind them, the Air Service could look ahead to more belt tightening and less support for new equipment. After all, the airplane was an attack weapon and America wasn't going to attack anyone. Again, a single congressman's comment summed up the overall feeling; "What is the Air Service complaining about? They have a plane. Let them take turns flying it."

The unofficial motto of today's Air Force; "To Fly and Fight," would have suited the Air Service equally well, or better. For fight they did. They fought for recognition, for appropriations, for newer and better airplanes, for indepen-

Col Wm (Billy) Mitchell and counsel at his famous court martial.

A DH-4B transcontinental air mail plane. Sonic booms were yet to come.

An early refueling experiment with DH-4Bs. Lts Sowell H. Smith and P. Richter were pilots.

1929—world endurance record flight. Trimotor Fokker "Question Mark" refueling over Burbank, California.

Lt James Doolittle is congratulated by Maj Shepler Fitzgerald at end of one-stop coast-coast flight, September 11, 1922; Pablo Beach, Florida, to Rockwell Field, California.

dence from the ground minded Army's General Staff, and for simple survival of the flyers.

Bases around the world are named after the men who died in the crashes of their obsolete and unsafe machines; Lt Col Horace M. Hickam, Major Harry Geiger, Colonel Les MacDill, Captain Ernie Harmon, Colonel Bill McChord and Lt Gene H. Barksdale.

The times between the wars, the twenties and thirties, were some of the darkest days in the story of American airpower. They saw the Mitchell courts-martial and the exile of the advocates of flying to non-flying posts. The same times saw the Army's ill-starred attempt to fly the airmail and recorded the casualties that followed.

But if the times were bad, they were some of our best years as well, because that is the Air Force story. A story of triumph and defeat, sacrifice and apathy, faith and betrayal.

Looking back at those days, we see some of the giant steps that were taken. By themselves, they were wonderful accomplishments but when viewed in the light of struggle that was going on for simple survival the successes become fantastic.

Like Wesley May hanging onto the wing strut of a *Lincoln Standard* with a five gallon gas can strapped on his back. His pilot, Frank Hawks, held the bird straight and level as Earl Daugherty maneuvered his *Curtis JN-4 "Jenny"* in above them. The can didn't weigh much, only 35 pounds or so, but it was awkward and one misstep would have ruined May's day. As the *Jenny* slid in closer, May let go of his grip on the strut and grabbed for the Jenny's wing skid. Trying not to look down he clambered aboard, worked his way over to the fuselage taking the full blast of the prop wash in the face, poured the gas into the *Jenny's* tank.

A year and a half later in June, 1923, two DH-4s flown by Lowell Smith and John Richter transferred fuel through a pipeline while flying over San Diego. The two Air Service lieutenants improved on May's technique and made air to air refueling a fact.

A little more than five years later, another Air Service crew, Tooey Spaatz, Ira Eaker, Pete Quesada, Harry Halverson and Roy Hooe, set a still remarkable record when they kept a *Fokker C-2* airborne more than six days. Flying over Los Angeles, the *Question Mark* took on food, mail, spare parts and over 5,000 gallons of gas.

Lts Kelly and Mcready, Fokker T-2, which they flew non-stop from New York to San Diego in 26 hours.

T-2 equipped for blind flying. Right, Maj A. F. Hegenberger, conceived system. First flight 1932, first hooded solo landing on May 9, 1932.

Douglas D-WC World Cruisers which Air Service crews flew around world in 1924. Team set many new records.

Douglas B-19 bomber at March Field, California, in June 1941. Biggest aircraft of its day, it became research craft.

While AAR was being tried and tested, other strides were being taken. A very young Lieutenant Jimmy Doolittle crossed the continent in less than a day averaging 100 mph in his DH-4. Eight months later, two Air Service types, Lts Kelly and Macready earned the DFC and the Mackay trophy for repeating the performance—but non-stop this time. Their *Fokker T-2* made it from New York to San Diego in 26 hours. Less than a year later, in 1924, four Air Service planes, Douglas *"World Cruisers,"* started out on a globe circling flight. Only two of them made it and it took them 175 days for the two to finish, but considering transient alert facilities in outer Mongolia, it wasn't too shabby. The flying time was only 363 hours. While they were at it, they also set a new record, the first trans-Pacific flight and the first westbound Atlantic run.

Doolittle's name keeps coming up when we look back. In addition to his now famous land plane speed records, he also flew the first successful outside loop in 1927. Other pilots had flown the loop, but had failed to land successfully because of wing separation. Two years later, Lt Doolittle made the first all-blind flight at Mitchell Field. He had the stick but there was a guy in back who could see. Three years later Captain A. F. Hegenberger tried it solo and made it with no one to pull him out at the last minute. By 1932, an Air Service Captain, C. J. Crane, had invented an automatic landing system. Captain George Holloman tested it and made the first "hands-off" landing in history.

The list goes on and on: Speed records, endurance flights, new systems, new techniques and new planes. The time between the wars saw the change from the old, slow pursuit planes to the sleek forerunners of the modern fighter; the *Lightning,* the *Aircobra* and the *Warhawk*. It saw the change from the open cockpit long range bombers (400 miles) to the truly long range heavy bombardment *Fortress,* the *Liberator* and the *Superfortress.*

It must have been a frustrating time for the men who knew what the airplane was going to do to the future of man. It was the time that strained men's loyalty to their beliefs to the breaking point. Luckily for us, the men of the leather helmet, goggles and scarf era were pretty sturdy stock. They stayed with it in spite of the ignorance, indifference and hostility they faced. They were a pretty special breed. ★

TWO PERCEPTIONS

MAJOR THOMAS L. SUTTON
463 TAW, Dyess AFB TX

Who was to blame for the near accident? Maintenance? Or the pilot? Or did the both conspire to nearly cost the pilot his life?

The sparse jungle and grassland rolled away to the dim horizon in every direction. It all looked silent. Nothing moved. The bright sunlight betrayed the apparent peace as it flickered like thousands of muzzle flashes from the stagnant pools living partially concealed in the foliage below. Lightning's voice whispered raspily into my headset jarring me from my musing. I could hear explosions of mortar shells and snapping of small arms fire behind his voice.

"Walt, Walt, this is Lightning," he whispered. We've got 'em pinpointed. Lay the CBU right along the creekbed between the two big, dead trees. And be careful. They're shooting at you too."

"Roger Lightning, get your heads down."

I rolled my O-1 into a steep diving turn, lined the nose up on the nearest tree, and squeezed off a white phosphorous rocket. Then I cleared the flight of F-4s in hot with CBU.

"Walt! Right on target," Lightning screamed.

A few passes later we pulled off as Lightning promised a good BDA. I told him that I was out of rockets and would go get some more, if he could spare me.

"Go ahead, Walt. Just hurry back. There's no telling what's down in that creekbed."

I cobbed the power to my aerospace vehicle and roared toward home base at 70 knots max airspeed. Even though the firing had stopped back there, I knew that Lightning might need my help again soon so I wanted to hurry. I pointed my bird right toward the center of the 2500 foot red dirt airstrip as it came into view and relayed my requirements for a quick turnaround.

In order to shave off a few extra minutes I decided to eliminate the normal box pattern. I flew across the approach end of the runway outbound at a thirty degree angle while checking my fuel, carb heat, mixture, and prop setting. I also noticed the covey of VNAF and US Army pilots standing around a VNAF O-1 that had recently ground looped half way down the runway. A few fellow FACs were there too. What an audience. This one had to be good. After clearing the final approach course, I rolled into a modified split-S to a very steep final approach.

I began to apply back pressure on the stick to slow my screaming descent, but the immediate sensation was that my nose was going down faster than ever. It's the same sensation you get when you apply the brakes at an icy intersection and seem to suddenly leap ahead into the cross traffic.

My first thought was that I had runaway nose down electric trim. My heart jumped into my throat and my stomach began burning a new hole. In less than a second I had convinced myself that there was no such thing as runaway electrical trim on an aircraft that was purportedly built by the Wright Brothers. The fact remained, however, that I was still diving straight into the ground. The stick would not come back.

Not choosing to consider all of the alternatives, I did what all cool, level-headed pilots would have done. I grabbed the stick with both hands and yanked with all my strength. The stick came begrudgingly back into my lap and the tail of the bird rotated down rapidly. The timing was perfect. The O-1 touched down in a precise three point landing. The only deficiency was that the rate of descent was in the vicinity of infinity.

Riding the Cessna spring gear down until the bottom of the fuselage was in the dirt, I immediately found myself being propelled back into the air by the force of those mighty springs. Taking advantage of the situation, I rammed the throttle forward and found myself remaining airborne above stall speed. That was small satisfaction, for the rudders were jerking angrily back and forth and the tail was right in synch with them. I was not sure that the tail was going to stay with me. The burning in my stomach turned to lead.

I continued to climb out making very small control movements. At a safe altitude I inspected the damage and found that my tail wheel was broken off and was hanging from the aircraft by one bungee cord. As it flailed back and forth, it dragged the rudder with it causing a wild hula motion. Feeling a bit relieved, I performed a few approach and landing stalls and was pleased that the elevator seemed to work all right. After some coordination with the guys in the radio jeep, I made an uneventful wheels landing and came to a stop dragging my tail behind me.

I was met by a huge crowd of jeering troops. I was appalled. They were chiding me for a very inept landing. They would not believe that I had actually had control problems. The crew chief casually inspected the bird and pronounced it in excellent shape except for a missing tail wheel and a few wrinkles in the skin. I began to wonder myself if I had really had a control problem.

Then I noticed our chief mechanic crawling out of the tail cone from behind the radio rack. His jaw was set in anger and his right hand clutched a pair of pliers. My anger grew as I learned that the pliers had apparently been left in the tail cone after the last periodic inspection and that they had vibrated into a position where they were jamming the elevator control cable. My anger subsided, however, as I noticed that my image had been spared and that I was being congratulated for having survived another of the maintenance booby traps so skillfully laid for unwary pilots. Maintenance had tried to kill me and had failed. For seven years I have thought that this was the case, but now I have a new perception.

* * *

It was getting late in the evening. Airman Hotshot was wrapping up his inspection. Two thoughts were jockeying for position in his forebrain.

Why couldn't I be down at Cam Rahn crewin' a Phantom? Now there is something I could really get my hands on. Oh, oh, I've got to get to the service club. The USO show tonight is real American.

A few more turns on the safety wire and he says, "There, it's all safetied. Now just button it up and I'll get out of here. Sarge, this hunk of junk is finished."

"Okay, Hotshot. Look okay?"

"Sure it's okay. What can go wrong with a powered kite?"

"Not much I guess. Get on down to the club. I'll sign it off."

Closing up his tool box, Hotshot says, "Funny, thought I had my pliers here somewhere. Oh well, they'll turn up."

"Wait a minute, Hotshot. You know it's dangerous to leave tools unaccounted for."

"Oh look, Sarge. If we had F-4s here, we'd be worried, right? But this engine can't swallow nothin'. The electric and hydraulic systems are impossible to find with the naked eye. These birds are just chewing gum and bailing wire. What can happen even if the pliers are in it, which I doubt? What can go wrong? That tool accountability is just for real airplanes."

"Well, I guess you're right. Besides, we'll find them in the morning."

As Hotshot went out the door the Sarge thought for a moment about looking for the pliers, but then, *Hotshot's right. What can go wrong? Besides I gotta get to the club too. Can't wait to see a real round eye.*

Careless? Yes. Unprofessional? Of course. Normal? I hope not. An accident cause? Not necessarily. Only if certain other events occur in a proper sequence will an accident occur. However, if the pliers had been accounted for, they would not have become a necessary link in a future chain of events.

* * *

The Bird dog was picked up early the next morning and flown back to the forward site. Two missions were flown uneventfully. Ten hours were logged. Then on another normal mission, troops in contact.

"I'm out of rockets, Lightning. If you can hold on I'll get some more."

"Go ahead, Walt. Just hurry back. There's no telling what's down in that creekbed."

I was a mission hacker. I was proud of getting the job done no matter what. It was great to sit at the bar and have the Grunts buy drinks and with great oratory extol the virtues of any guy who would sit in a kite right above the fighting with absolutely no logs to hide behind.

I've got an image to defend here.

Those guys who bend their airplanes just don't know how to fly and fight like I do. Besides, we gotta help the Grunts.

Typical hotrock pilot reasoning, isn't it? The kind of mission hacker attitude your flight commander likes to hear.

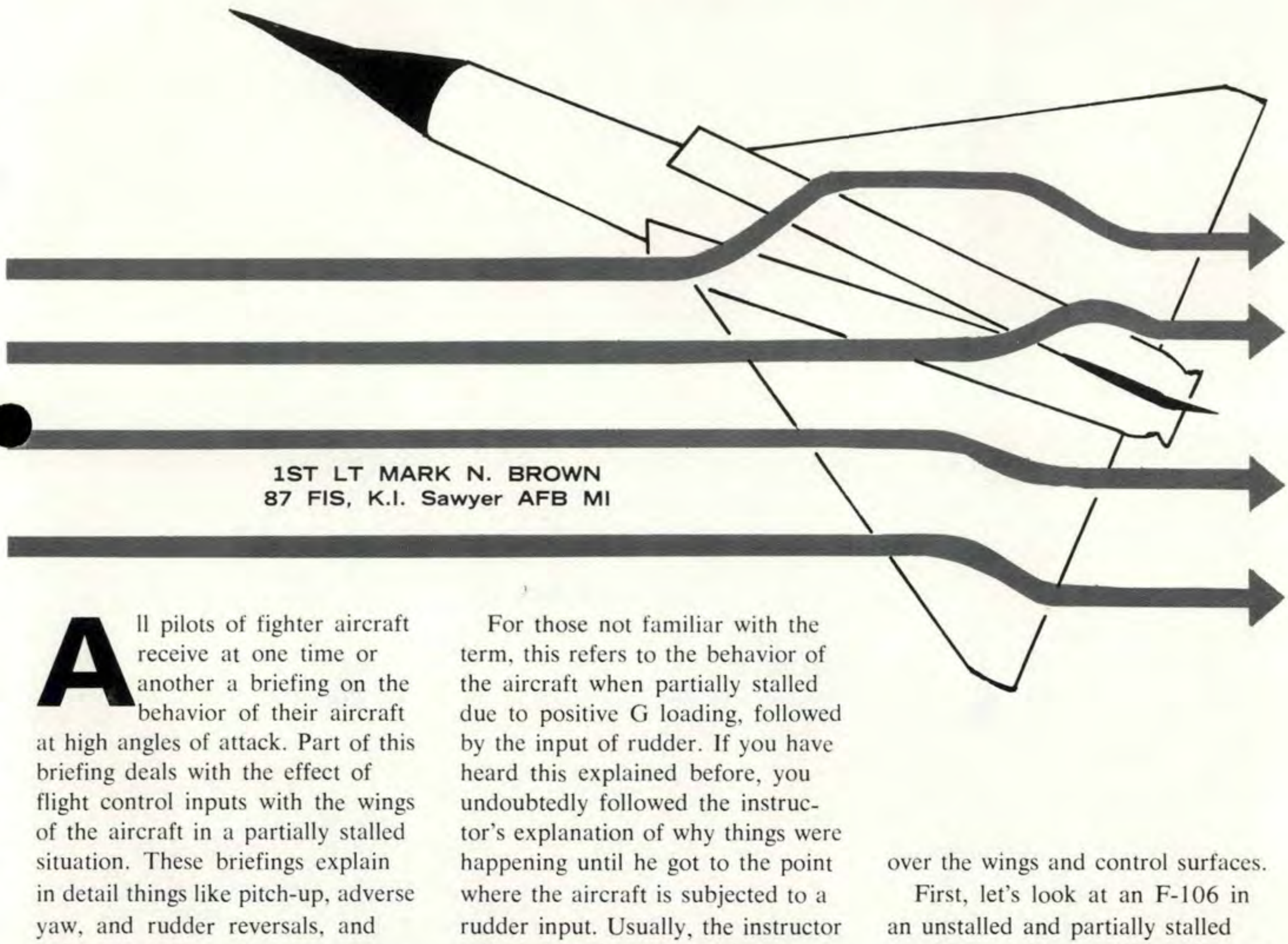
Aha, look at that VNAF O-1. Ground looped right in the runway. Those guys need a lesson in how the pros do it. I'll just bend it around really steep here and show 'em how it's done.

A few more links are pounded solidly into a chain that is now long enough to hang something on. Self-control? No. Overconfidence? Yes. Professional? No.

Was it all predestined? Of course not. The pliers could have stayed in the tail cone for weeks. Hotshot could have found them on the next periodic inspection and no one would have been the wiser. The mission could have been completed, but the pilot was busy explaining to the squadron commander how inept the maintenance men were.

Thinking back over my flying career, I suspect that there have been many events lurking behind the 4500 hours that I have spent in the air without an accident. Events that never got welded into a chain to hang me on another limb. When an accident has been prevented by cool professionalism, no one ever knows. We can't keep statistics on the ones that never happen. The forging of a chain of events is stopped every day by people doing their job—really doing their job. Those people aren't aware that they have prevented a catastrophe. They just know that they go home each night with the satisfaction that they are really doing a job. They are seeing to it that the organization hacks the mission and at a minimum risk. They are the professional chain breakers and my hat is off to them. ★

A NEW LOOK AT AERODYNAMIC COUPLING



1ST LT MARK N. BROWN
87 FIS, K.I. Sawyer AFB MI

All pilots of fighter aircraft receive at one time or another a briefing on the behavior of their aircraft at high angles of attack. Part of this briefing deals with the effect of flight control inputs with the wings of the aircraft in a partially stalled situation. These briefings explain in detail things like pitch-up, adverse yaw, and rudder reversals, and point out quite clearly why you should never put your aircraft in such an unfriendly situation. Unfortunately, the explanations of why the aircraft will respond in this manner usually leave something to be desired. In one case in particular this is especially evident. That is the explanation for a rudder reversal with positive G loading.

For those not familiar with the term, this refers to the behavior of the aircraft when partially stalled due to positive G loading, followed by the input of rudder. If you have heard this explained before, you undoubtedly followed the instructor's explanation of why things were happening until he got to the point where the aircraft is subjected to a rudder input. Usually, the instructor will flash a diagram, similar to the one in Fig 1, on the wall and tell you that the following snap roll into a spin is caused by aerodynamic coupling. I have yet to meet a person who can simply and understandably explain that diagram. With this in mind, let's take a new look at what's happening to the aircraft in respect to the airflow over the wings and control surfaces.

First, let's look at an F-106 in an unstalled and partially stalled condition as shown in Fig 2. For an unstalled aircraft where the relative wind is straight off the nose, there is only a slight deflection of the airflow over the wing toward the wing tips due to the sweepback of the wing. Now, as the angle of attack is increased until the stall begins we notice that the stall begins first at the wing tips and gradually

FIG. 1

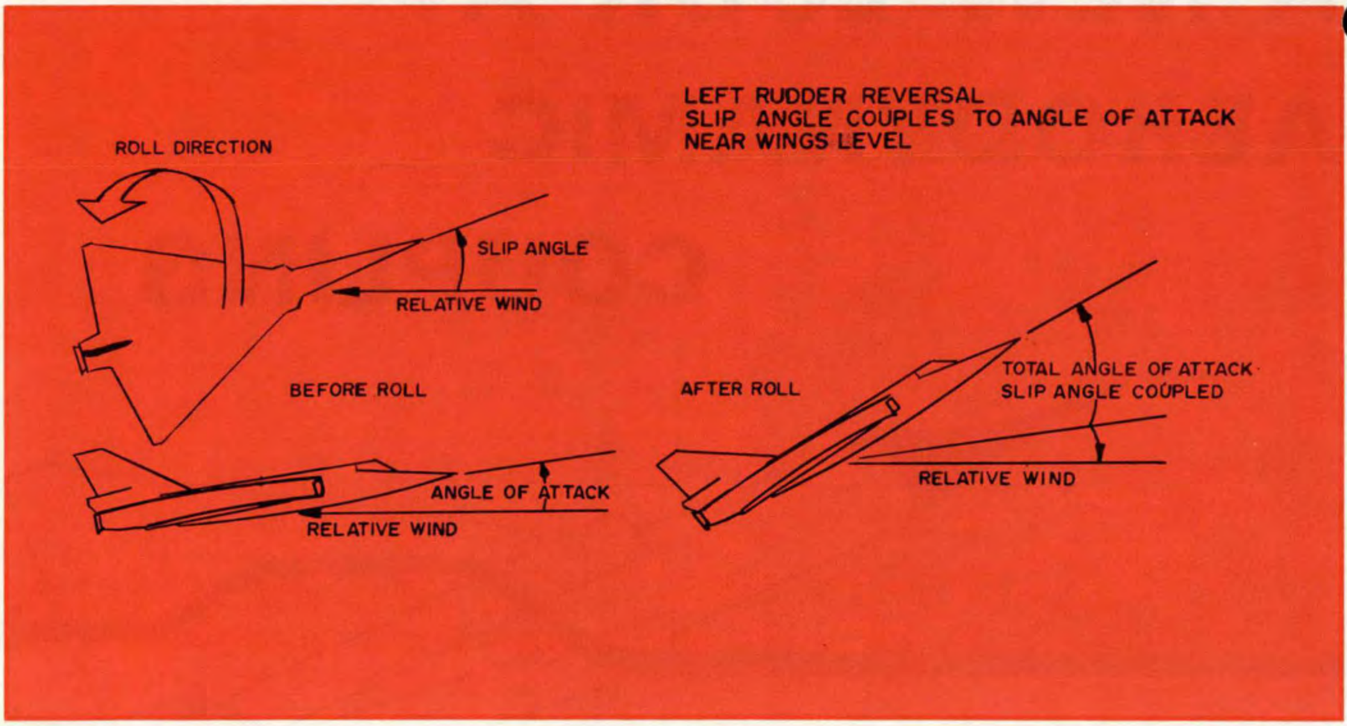


FIG. 2

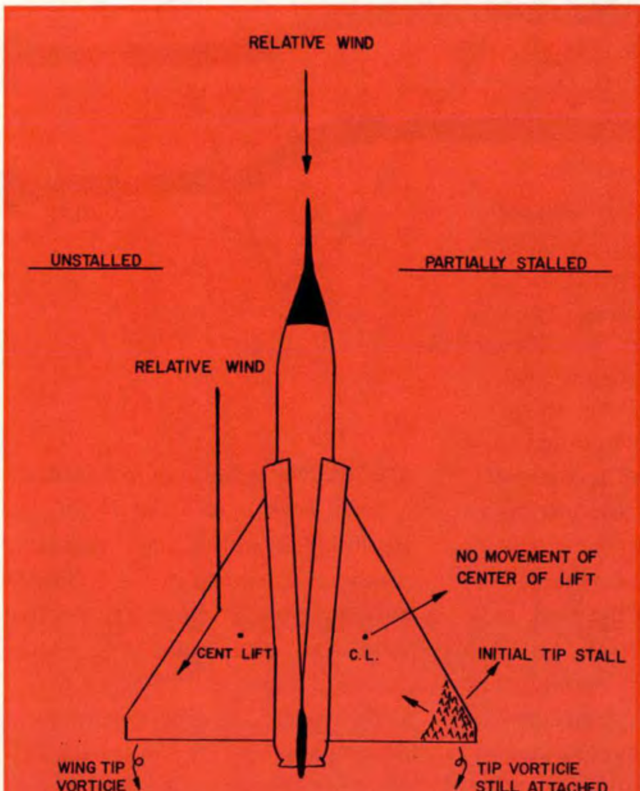
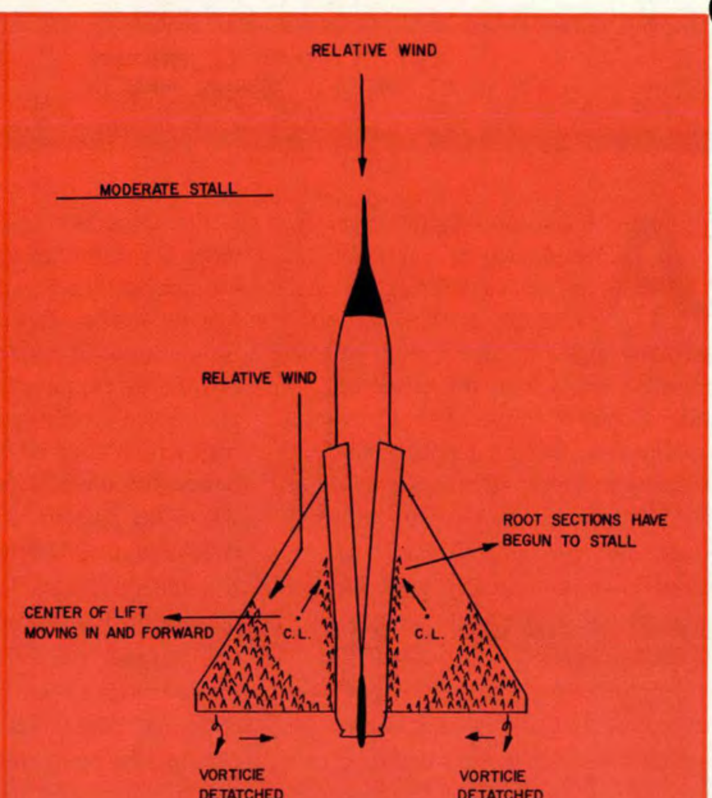


FIG. 3

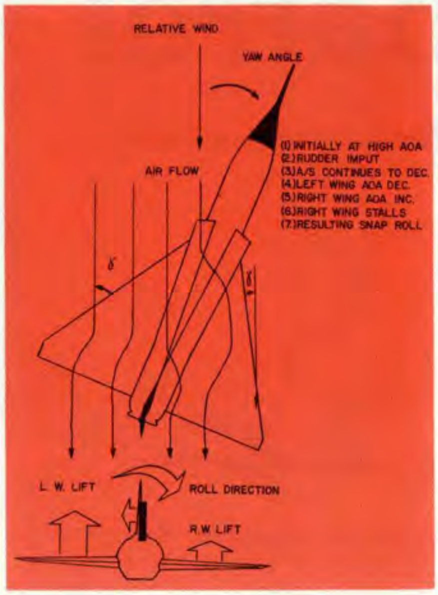


moves in on the wing. At this point the wing tip vortices are still attached to the tips and the center of lift of the wing has not yet moved.

As the AOA is increased farther into the moderate stall area, many things begin to happen at once (see Fig 3). First, the stall which was only at the wing tip has now grown to cover the entire wing tip and most of the trailing edge of the wing. The root of the wing near the fuselage has also begun to stall. Due to the increased area now stalled, the center of lift begins to move forward and in on the wing, beginning what is known as the pitch-up. At the same time the wing tip vortices have now detached from the tips and begun moving in on the wings. The effect on the aircraft of these changes is now noticeable. The increase of stalled wing area has partially blanked out the elevons, setting the stage for adverse yaw from pilot inputs. The stall beginning at the wing root is generating turbulent air which flows along the fuselage and across the bottom portion of the rudder.

Most important is the detachment of the wing tip vortices. They generally detach from each wing tip at slightly different AOA's and move independently of each other in towards the tail. Since they do not move together they cause the aircraft to yaw and roll slightly, back and forth, as the vortices move. It is at this point where the pilot has the tendency to make an elevon input to keep the wings level. The adverse yaw that would result, of course, would only compound the problem. Besides, the pilot knows better so he corrects with rudder. If the stall is not yet moderate and the rudder input is small it may indeed work. However, if the stall is indeed moderate, the pilot has a big surprise coming.

FIG. 4



The input of rudder at this time moves the relative wind from directly off the nose of the aircraft to one side (see Fig 4.). As this occurs, the relative wind affecting each wing changes drastically. As in the situation depicted in Fig 4 for a right rudder input, it is apparent that the relative wind now flows directly across the left wing while it flows almost parallel to the leading edge of the right wing. This change unstalls a moderate portion of the aft middle of the left wing, thereby increasing significantly the lift generated by that wing. Unfortunately, the change in relative wind results in most of the airflow reaching the right wing having passed over the fuselage. As it does so it blanks out most of the root section stalling it completely. In addition, it blows the turbulent air from the stalled root over the rest of the wing. In other words, this change in the relative wind had decreased the overall angle of attack on the left wing and increased the angle of attack on the right.

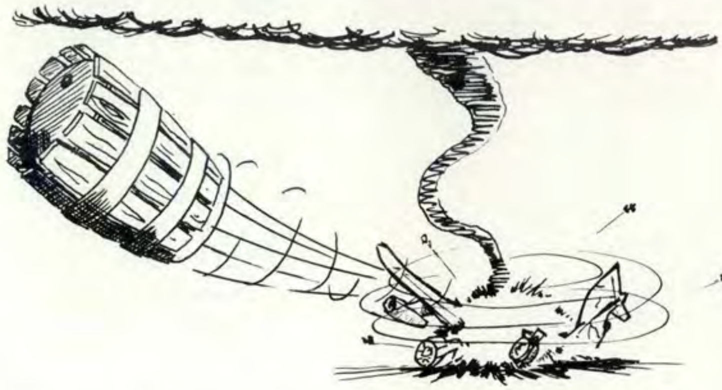
Considering that, prior to the rudder input, both wings were at or near the stall angle of attack, and that the airspeed of the aircraft was steadily decreasing, results in these changes being extremely rapid and irreversible. The left wing is now generating considerably more lift than before the rudder input. The right wing is almost completely stalled. The difference in lift generates an extremely rapid snap roll and a resulting spin. Scope films taken during this snap roll show a rate of roll that is amazing. This rapid change resulting from the rudder input is the result of the aerodynamic coupling of the yaw angle coupled to the angles of attack of the wings.

I hope that this explanation from an airflow standpoint has been more meaningful than a discussion on how the yaw angle induced by the rudder input couples with the angles of attack of both wings. ★

ABOUT THE AUTHOR

A native of Indiana, Lt Brown entered the Air Force through ROTC with a BS degree in aeronautical—astronautical engineering from Purdue University. Since pilot training he has been stationed at K.I. Sawyer AFB with the 87th Fighter Interceptor Squadron.

HURRICANE in a barrel



LT COL ROBERT J. BRUN, Directorate of Aerospace Safety

Some jet engine builders might take exception to calling their product a barrel but none can deny that the forces generated inside these powerplants are comparable to a hurricane. Air Force personnel injury statistics lend ample support to this comparison and the need for increased respect in terms of minimum safe distances from operating engines. This is especially true of the engines on jumbo-sized aircraft.

Facility planning guides for jumbo operators list the area within a 25-foot arc of the intake as a danger zone which should be clear of personnel and loose equipment when the engine is operating above idle thrust. At break-away power (11,000 lb thrust) the exhaust core speed is 80 MPH for a distance of 100 feet, decreasing to 65 MPH at 200 feet. These velocities are doubled at takeoff thrust and the effective distance increases as well. All aircrew and ground support personnel should be aware of this and the fact that the larger diameter of these engines results in a broad band of dangerous turbulence as opposed to the narrow higher velocity wake of the smaller jets. We learned an expensive lesson on the strength and range of the jumbo's wake during ground operations just this past summer.

A heavy jet was being taxied from the fuel pit to the ramp with all four engines operating. A twin engine fighter was parked on a hardstand 800 feet away with its tail pointed toward the jumbo's. Both engines on the fighter were motorized and ingested enough sand to require replacement. This episode should dispell all doubt as to the muscle and staying power in the tremendous volume of air processed by the large turbofan engine. However, one of the worst engine wake accidents we've experienced involved a single engine fighter.

An F-100 was on a maintenance runup pad with the engine operating at approximately 70 percent rpm. The crew chief of a nearby aircraft, who was wearing a newly-acquired set of ear defenders, was running across the ramp to his plane. He failed to see or hear the frantic warnings from several personnel nearby and cut diagonally across the engine wake about 30 feet behind the tailpipe. He suffered fatal injuries when he was lifted up and cartwheeled 78 feet across the pavement.

The intake side has also accounted for its share of damage to humankind. In most cases the victim met fate more than halfway, through inattention or carelessness. A minimum safe distance of 25 feet from the inlet of an operating engine is pretty standard, even on the smaller jets. It is mindboggling to read about people who "backed into the inlet," "peered around the lip," and "inadvertently moved forward from alongside" while working on operating engines. These actions re-

Left, top down, airman removing chocks must be aware of APU exhaust; checking flight controls with engines running; checking fasteners with engine running. Above, engine check with engine at high power setting; ground observer with microphone and earphones during engine check.

sulted in severe injuries such as the following:

- The airman was drawn backward into the engine. His right arm was amputated below the elbow.
- As the engine was pulled back to idle, the airman moved forward to get away from the surge bleed valve. He was drawn into the inlet and lost all the fingers on his right hand.
- The airman was adjusting linkage at the fuel control. He stepped in front of the engine, was drawn into the intake, and lost his left forearm.

The three mishaps above all occurred on C-135 aircraft. In the first case the ground crew were dressed in rainwear with hoods. This and the second mishap both took place at night. Although there is a definite message intended in stating these adverse conditions, it is equally significant to note that the last mishap happened in fair weather at high noon.

Support personnel on B-58 and B-66 aircraft had several vis-a-vis encounters with the first stage compressor section but it appears they were luckier in the degree of injury that resulted. One ground crewman was pulled in up to his hips before the rest of the crew reacted and yanked him out again. He came away with relatively minor internal injuries. The luckiest of the bomber group was a B-66 navigator. He had deplaned to make a pre-shutdown check and accidentally walked into jet blast. He sustained a broken collarbone and second degree burns which were limited by his nomex, the lower edge of his helmet, and a fully closed visor. He narrowly missed having his face seriously burned.

Small fighters and trainers probably have more of these mishaps than our records indicate since a nondamaging/no injury occurrence involving a close call with a small intake isn't necessarily reportable. The increased seriousness of personnel/intake encounters in the big double barreled F/TF's more than makes up for this.

Both the F-101 and F-4 have lifted people from the ground ahead of the intakes. One such mishap in the former type caused a broken collarbone, then a skull fracture when the compressor stalled and ejected the man back onto the ramp. An F-4 fuel specialist was ingested during engines running troubleshooting of a centerline tank problem. The pilot had his head in the cockpit when the airman came out from under the fuselage and stood up. The engines were running at 85 percent and the man was pulled into nr 1 intake. His belt caught on the bellows air probe preventing further ingestion, but it also produced a deep wound in his lower back.

Some of the examples listed above reach back pretty far and some do not involve aircrew members, but there is an aircrew lesson in every one. The size and power of our jet engines are ever increasing and, for those who people our flightline activities, the importance of learning these lessons—the easy way—grows in direct and infinite proportion. ★

OPS TOPICS

FIRE EXTINGUISHER LEAK

A crew chief was performing a postflight when he accidentally struck the installed A-20 fire extinguisher with his foot. This caused a discharge of chlorobromomethane into the cockpit. The lower level hinge pin had fallen out of the extinguisher negating all safing and locking features and thereby allowing discharge from a slight pressure. The hinge pin in question did not have riveted heads or self locking nuts. Instead it was a "press fit" straight brass pin. After the pin had worn slightly, normal aircraft vibration caused the pin to drop out. It's a good thing the mishap did not occur at 35,000 feet.

A LITTLE LOW

A sister service UH-1 was returning to base after a mission when it struck an electrical wire. The wire damaged the Huey control tube slightly and caused a fire on the ground which burned approximately one-half acre.

IN-FLIGHT FIRE ALMOST

An RF-4 crew returning from a cross-country had stored the downlocks, extra drag chute and their personal baggage in the aft camera compartment. A plastic hang up bag was touching the hot air duct going to the rain removal system. This should not have been a problem since the rain removal switch was off and the pipe should have remained cool. However, the rain removal bypass valve failed, allowing hot bleed air to enter the pipe. The heat from the pipe melted the plastic bag and burned a civilian sport coat and shirt beyond repair. Fortunately a fire did not break out. There have been quite a few close calls and some major accidents because of items like this stored in aircraft. Next time you pack your equipment take an extra minute to be sure that you won't get an unpleasant surprise.

SAFETY FEATURE OVERRIDE

A civilian instructor and his student were practicing approaches and landings in a light plane with retractable gear. When the instructor decided to demonstrate a 180 degree accuracy landing, he put the gear handle in the override position so it would not come down automatically on downwind but could be put down on final. The instructor explained what he was doing throughout the maneuver until touchdown. Then after the aircraft slid to a stop on the belly, the instructor tried to explain why he forgot to lower the gear.

TRAFFIC CONGESTION

A C-141 had an emergency shortly after takeoff. After burning down fuel it landed without incident. During rollout the pilots observed a light civilian aircraft sitting on the edge of the runway about 2000 feet from the departure end. The two aircraft had landed simultaneously on opposite directions on the same runway. The student pilot in the light plane apparently became confused and landed at the air base instead of the nearby municipal airport. An accident was probably averted when the lightplane pilot reported on the ground and the civil base controller realized he must be on the military base and directed him to clear the runway and report on the military tower frequency.

Editor's note: Aero club instructors: Are your students familiar with the airports they fly to? Or, could they be involved in such an event?

OPS TOPICS

AIR TRAFFIC HAZARD REPORTING

The Air Force is developing a new method for reporting hazards involving air traffic to give better tracking and response in this area. Air traffic hazards, including near midair collision reports will be removed from AFR 127-6 and incorporated in a new, as yet unnamed, regulation. There will also be a special form for these reports. The new regulation is scheduled for publication in July and there is already a test of the form in progress. So be on the lookout for the new system. Also ALSAFECOM 09/75 announced USAF endorsement of the FAA Aviation Safety Reporting Program. A message address was provided so that our hazard reports involving air traffic would be entered in the FAA System. Effective 15 April 1976, NASA assumed responsibility for the Aviation Safety Reporting System (ASRS). Our air traffic hazard reports are now being addressed to NASA. We continue to encourage USAF participation in the ASRS by completing a NASA report for those events not reported through the USAF Hazard Report Program. The NASA Report Forms (NASA ARC Form 277) are available through the local General Aviation District Office (GADO) and at any FAA air traffic services office. Details of the ASRS are given in FAA Advisory Circular 00-46A which was distributed in April 1976.

T-39s VS BARRIERS

Shortly after the T-39 crossed a BAK-12 cable on takeoff, the right main gear collapsed resulting in a major accident. While the final investigation is not complete, the major command has issued a message reminding pilots of the caution notes in TO 1T-39A-1 about crossing barriers at high speed.

NEW RADAR

The Air Force has received the first production model of a new approach control radar. This new system, the AN/TPN-19, is a sophisticated and highly mobile all weather ground approach control facility. It is effective and reliable even in heavy rainfall. The big advantage to the TPN-19 is its mobility. It can be set up quickly in a variety of tactical situations and is adaptable to use in natural disasters where permanent facilities have been damaged. The three "packages" which make up the unit are transportable by tac airlift, helicopter or surface means. They include an operations facility, a 60-mile radius surveillance radar and a precision radar effective out to 20 miles. Eventually the Air Force will have 11 of the TPN-19's.

FROM BAD TO WORSE

The pilot was on his first night transition mission in the A-7D and everything was okay until the landing roll. At about 40 knots the pilot turned off the antiskid, then he realized he was going too fast to make the turnoff he wanted. He applied brakes with sufficient force to lock both main wheels and blow the tires. He didn't know the tires had blown and did a 180 back to the turnoff. Since it was night the pilot did not see the rubber pieces (from his tires) on the runway and taxied over them back off the runway to the dearm area. Once there, the dearm crew told him about the blown tires, so he shut down the aircraft. A later maintenance investigation uncovered damage to the engine from ingested rubber. ★

CONFLICT ALERT

By the time you read this, all FAA ARTC Centers will have commissioned a Conflict Alert System. Computers at these Centers are now programmed to scan all traffic every six seconds. When aircraft are projected to get closer than minimum separation standards, their identification tags on the controllers' radar scope will flash or blink to alert the controller. In addition, a clear text message will appear on the scope advising the controller of the identification of these aircraft that are in conflict.

Conflict predictions are made by the program upon analyzing altitude (Mode C/reported/assigned) and track data (present heading of the aircraft without regard to the Flight Plan Route) and predicting where an aircraft will be two minutes in the future.

Visualize a cylinder of airspace and an aircraft within the center of this piece of airspace. (Figure 1.).

The dimensions of this cylinder are five miles across and 1,000 feet below and above the aircraft at altitudes above 29,000 feet. At 28,000 feet and below, vertical dimensions become 500 feet above and below.

Any time these two cylinders of airspace are projected (computed) to touch within two minutes (Figure 2) an alert will flash on the radar scope. Furthermore, an immediate alert will flash any time the cylinders of airspace are penetrated vertically by approximately 300 feet.

The system is now in use at 18,000 feet and above. Some centers are in a test status to cover the airspace down to 12,500. It is expected that all centers will soon be able to activate the system at 12,500 and above. (All aircraft operating above 12,500 feet MSL in controlled airspace are required to have a functioning altitude reporting beacon. —ed.) ★

From Air Canada Grapevine

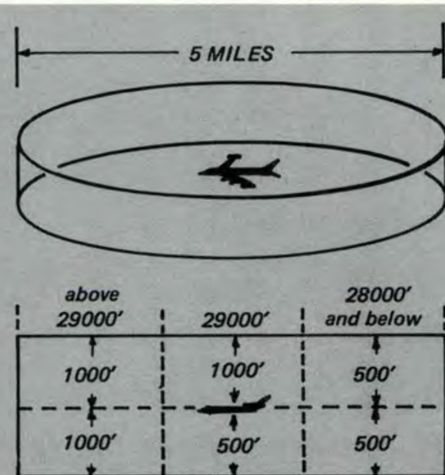


FIGURE 1

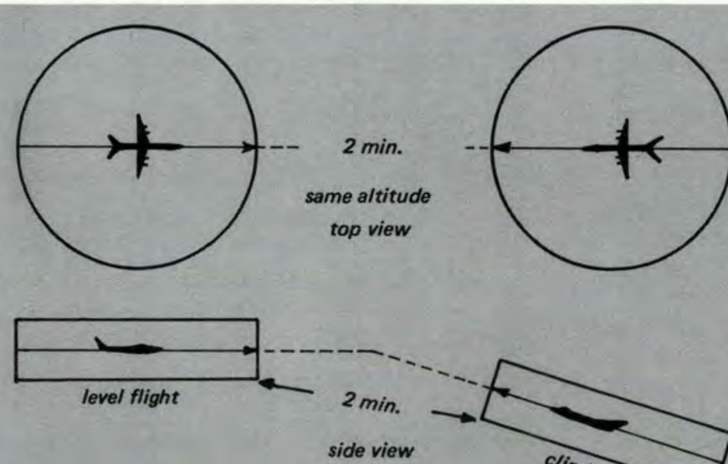


FIGURE 2

☆U.S. GOVERNMENT PRINTING OFFICE 1976 789/855/33

UNITED STATES AIR FORCE

Well Done Award

Presented for outstanding airmanship and professional performance during a hazardous situation and for a significant contribution to the United States Air Force Accident Prevention Program.

Capt ROGER E. LAMAN
3d Tactical Fighter Squadron
388th Tactical Fighter Wing

On 24 June 1975 Captain Roger E. Laman was flying as nr 2 in a six ship A-7D deployment mission from Anderson AFB, Guam to NAS Barbers Point, Hawaii. Captain Laman was level at FL270 and had just completed his third refueling disconnect when his engine started to compressor stall. Captain Laman retarded the throttle to idle, lowered the nose to increase airspeed, and when this didn't clear the stalls, switched to manual fuel. This action had no effect and the compressor stalls continued. The turbine outlet temperature started to rise and it became apparent the engine would have to be shut down in an attempt to break the stalls. At this point the flight was approximately 1190 miles west of Hawaii and 460 miles southeast of Midway Island, over the Pacific. Captain Laman continued in the glide, deployed the RAT and stopcocked the throttle. The compressor stalls cleared and an immediate airstart was accomplished. By this time, Captain Laman had descended through 10,000 feet and as the engine accelerated, fluctuations in fuel flow and rpm became apparent. The decision was made to let the engine run in manual fuel and the flight was turned toward Midway Island. A slow climb back to FL200 was initiated utilizing minimum throttle movement. When Midway approach control could be reached a straight-in precautionary landing pattern to Runway 06 was requested. Captain Laman completed an uneventful straight-in landing at Henderson Field approximately one hour after engine restart. Post flight investigation revealed internal engine damage and fuel control components out of adjustment which caused the engine compressor stalls and prevented subsequent clearance without engine shutdown. The decisive action, calm attitude and exceptional skill of Captain Laman averted the possible loss of a valuable combat aircraft. WELL DONE! ★

ARMED FORCES WEEK MAY 8-15