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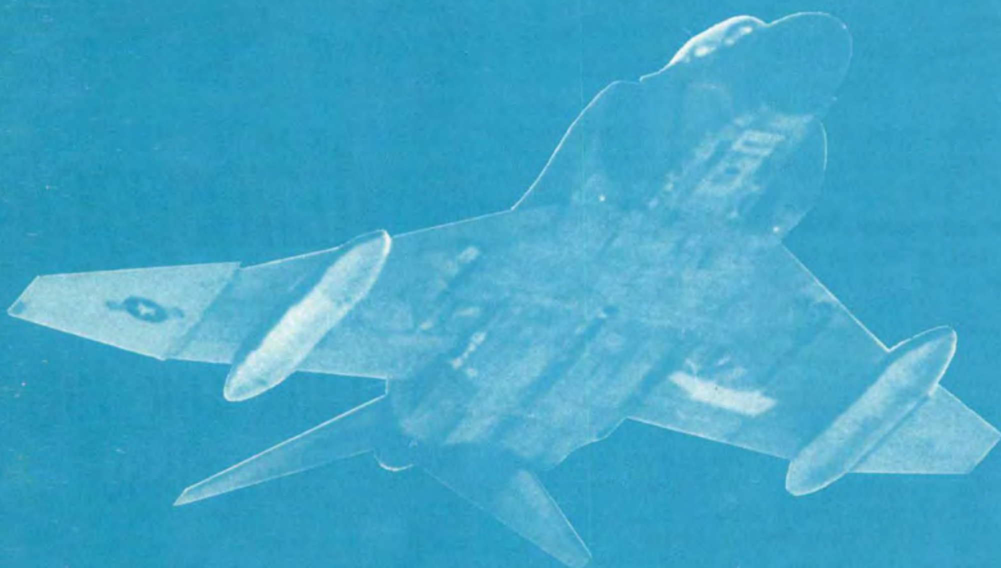
Aerospace SAFETY

FOR AIRCREWS, MAINTENANCE & SUPPORT TECHNICIANS



44 phantoms

Aerospace SAFETY

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MAY 1970 AFRP 62-1 Volume 26 Number 5

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SOME CHANGES

ARE BEING MADE

IN **Aerospace SAFETY**

LOOK FOR THE JUNE ISSUE

WITH

- **NEW FEATURES**
- **NEW LOOK**

AND

- **MORE PAGES**

F-86? SABRELINER? NO!

IT'S A T-39

Maj Ray D. Rittenhouse, Directorate of Aerospace Safety

Two fighter pilots were watching a T-39 on its takeoff roll and their conversation went like this: "Isn't that just purty, takes off short and hot just like our old 86s."

"Yeah, and they land like 'em too. Great airplane, similar in many ways; why, look at that wing, it's our Sabre all over again."

A clear case of mistaken identity.

Here's another case. The other day a pilot started the T-39's flaps down at 210 KIAS. The instructor in the right seat immediately stopped the flaps and asked a simple question: "What is the maximum allowable airspeed with the flaps extended?"

"Sure I know the flight manual says 180," was the reply, "but, the *Sabreliner* can go 225 with 60 per cent flaps — same airplane, you know." Well, North American reps say they can modify the T-39 flap actuating system to *Sabreliner* standards; however, until then the limit is 180 KIAS.

How about this one? The thickness of the T-39 fuselage skin was trimmed down to give us a lighter airplane. Would you believe the skin is some thirty thousandths of an inch thick while the *Sabreliner* skin remains at fifty thousandths? This leads up to the limiting mach. *Sabreliner* pilots can run up to .82 mach, but until we, among other things, figure some way to glue a *Sabreliner's* vertical stabilizer on our bird, we're going to follow the T-39 handbook and limit the mach to .77.

The word steadily spreads that the T-39 is nothing but a *Sabreliner* or modified F-86. Some pilots actually believe that the T-39 was manufactured with an F-86 wing, and that consequently, it can be subjected to jet-fighter type maneuvers and G-forces. Among these believers could be some of the aircrews flying T-39s who perform 360-degree overhead maneuvers in the landing pattern; if they rack the airplane hard, they can exceed the G-limit. This fighter-type maneuver in itself is not harmful to wing or fuselage IF the G-limitations are observed.

The T-39 and F-86 wings do look alike in profile, but that's where the similarity ends. The T-39 wing and fuselage are designed to sustain the loading conditions experienced by a transport-type airplane, not the violent maneuvers of a fighter type. The amount of material needed in the wing structure to sustain the loads imposed by high G maneuvers just does not exist in the T-39 wing, and if it were subjected to greater than the recommended G-loads, the wing as well as the fuselage could fail.

It is always good advice to know the airplane you are flying, to watch the accelerometer, and to observe all limitations spelled out in the Dash One. These include limiting mach .77, or 350 KIAS, prohibited maneuvers and maximum allowable airspeeds for lowering the gear and flaps, 180 KIAS.

The point of all this is very simple. The T-39 may look like, feel like and fly like something else but it's still a T-39. The little bird is going to be around for a long time and it's getting a lot of hours on it. The fleet is averaging approximately 8000 hours per copy. Several birds have exceeded 10,000 hours and the engineers tell us it's a 15,000 hour airframe.

The operating limitations spelled out in the Dash One are directive by nature. Let's not lose a bird just because it looks like a *Sabreliner* and flies like a *Sabre*. ★

Lt Col Raymond L. Krasovich
Directorate of Aerospace Safety

44 PHANTOMS

that's the number of USA[F]

F-4 out-of-control accidents have been a thorn in the commander's side since 1965, and the situation has not shown a great deal of improvement over the years. Of course, when you use a big, heavy, high performance, multi-missioned aircraft with an infinite number of configurations in a tactical fighter role—as the old heads say, "You gotta expect trouble!"

Well, that is probably true to some degree. Some aircraft accidents are bound to occur until we've taken care of all the cause factors. But surely not forty-four F-4s! That's right, forty-four USAF F-4s have been lost in out-of-control accidents (pilot factor, not including other cause factors) since the aircraft has been in service. When you think about it, that comes to a pretty respectable strike force.

The problem has existed throughout the life of the airplane. It really reared its ugly head in 1967 when the Air Force lost 16 F-4s in out-of-control mishaps. These losses triggered a Directorate of Aerospace Safety study in an effort to cut down this unacceptable loss rate. The study culminated in a briefing to the Chief of Staff in 1968 and the subsequent formation of a General Officers' Review Group. This group, consisting of general officers representing all commands involved with the F-4, first met in September of 1968. It reviewed the problem in depth and made recommendations toward a solution. The users, fixers, testers, designers and buyers were all represented. After viewing the problem from all angles, the group determined from test data that the aerodynamic stall warning of the F-4 was inadequate, not well defined, and aggravated by certain external store configurations in combination with CG location.

At the same time, the using commands began to take a close look at their training programs. They began to place more emphasis on aircraft handling qualities. Weapon delivery procedures were modified to insure that delivery patterns stayed within a safe operational envelope. Defensive and offensive combat maneuvering programs were revised. More training time was devoted to aircraft handling, including a learn-to-fly phase prior to the tactics application.

Flight Manual descriptions of stall characteristics and general handling qualities were revised to reflect the latest test and operational data. All of this was supplemented by various command messages and correspondence, which at times must have appeared to the hapless jock as an unending avalanche of paper.

Investigation of ways to improve the natural stall warning characteristics included more wind tunnel testing and investigation of such gadgets as stall strips, different tails, strakes, fences, and a number of other aerodynamic fixes. None of the fixes which showed promise were practical, such as turning the entire tail assembly upside down.

One interesting fact that was discovered in the tunnel was that directional stability deteriorated from a positive to a negative value at about 24 units angle of attack (AOA). This is seen from the cockpit during an approach to a stall as nose slicing. Again, there was no practical way to eliminate this phenomenon.

After considering all of this information, it was obvious that a major redesign would be the only way to improve the natural stall characteristics of the airplane. Efforts were then directed toward development of artificial stall warning devices, along with a deep stall flight test program with an instrumented F-4E. The artificial devices which looked most effective were a stick shaker with a pitch rate input, installation of a rear

F-4s lost in out-of-control accidents

cockpit AOA indicator, a new AOA presentation and relocation of the front cockpit instrument, and the aural stall warning system.

After considerable effort, the stick shaker was discarded since its operation was not compatible with the stick force transducers.

An extensive look was taken at a new AOA indicator as well as several different locations for the standard gage. Neither of these fixes had the desired pilot seeability so the efforts were curtailed. Along these lines, the present AOA indexer lights have been modified to operate continuously. This proved to be an effective visual presentation of AOA. AOA instruments for the rear cockpit are being procured and installation is underway. The aural tone warning system has been installed in production aircraft since August 1969 and kits for the remaining aircraft are being issued.

The deep stall test program got underway in December 1969 and is examining thoroughly the ragged edges of the F-4 flight envelope. Various external stores and CG locations are being tested. This program should give us a better idea of exactly what phenomena are encountered as well as the effectiveness of the present out-of-control procedures.

Now that you are filled in on what has taken place, you are probably wondering if all the effort is justified. First, let's look at the record.

The problem started in 1965 when we lost two F-4s to out-of-control accidents. The picture since then, comparing out-of-control accidents with total major F-4 accidents, is presented below.

YEAR	LOSS OF CONTROL	TOTAL MAJOR	PER CENT
1965	2	15	13.3
1966	6	31	19.4
1967	16	67	23.9
1968	7	50	14.0
1969	11	41	26.7
1970 (Jan)	2	5	40.0

In 1968, for some unexplained reason, the number of loss-of-control accidents dropped. However, this trend was short-lived and things were back to normal in 1969.

These accidents were examined in detail to see if any common set of circumstances was responsible for the losses. Thus far, there has been very little commonality. Aircraft external loads, CG location, entry conditions, all varied considerably. So did the model: F-4Cs, Ds and Es, and the RF-4 have all bit the dust due to loss of control.

Where have these accidents been happening? Here is a breakdown by phase of flight.

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Join-ups	4
Other	3
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Now, let's take a close look at the accidents in each phase of flight where losses have occurred.

TRAFFIC PATTERN

The traffic pattern accidents occurred during the pitchout for landing. The airspeed at the break was reported as 280-300 KCAS and the altitude about 1500 feet AGL. As the pattern progressed, airspeed bled off. Angle of attack increased to aircraft buffet and lateral instability. Finally adverse yaw caused by use of aileron to control bank angles led to the loss of control. Ejection results were poor. The low altitude usually precludes recovery attempts, and crew survival from such situations depends on a timely ejection.

44 PHANTOMS

a significant factor in these losses is that in these 44 bashes the flight manual out-of-control procedure was not used once!

TAKEOFF

Two takeoff accidents occurred when the landing gear failed to retract and the aircraft commander became so engrossed in the gear problem he let the airspeed decay to the point where the F-4 stalled, control was lost and the crew ejected. The other two accidents resulted during attempted no-flap takeoffs. In both cases over-rotation caused the aircraft to become airborne in a stalled condition, and control was lost.

A crewmember survived one of these crashes and was able to relate the sequence of events. The F-4 exhibited all of the classic stall characteristics — buffet, wing rock, pedal shaker and nose slicing, before the rear seater ejected. In addition, the aircraft commander was aware of the over rotation hazard involved. He expressed confidence in his ability to fly out of such a condition if he should have to, since he had seen a film of this being done at Edwards AFB during the test program. There were some big differences, however; in addition to a big bag of luck, the F-4 at Edwards was clean while this particular one had three full external tanks!

ASYMMETRICAL LOADS

Aircraft lost due to asymmetrical loads include three that had an outboard external tank fail to feed. One entered a rolling spiral from which the aircraft commander could not recover. The second also entered a rolling spiral when the AC initiated a climbing turn into the heavy tank. As the airspeed decreased, lateral control was lost and the aircraft entered a diving, rolling spiral. The aircraft commander was unable to regain control and the crew was forced to eject. Another F-4 crew entered the pattern and pitched out into a full tank. The AC lost lateral control and again low altitude prevented recovery or escape.

As all you F-4 drivers know, this business of one external tank failing to feed is an insidious trap. There is no good way to really know when both externals are dry. Timing their feed time, checking panel lights, checking aileron trim, and rig checks, are all methods that are being used to determine if both 370s are empty.

Another aircraft was lost when the aircraft commander initiated a go-around with 1800 pounds of unexpended ordnance on an outboard station. He retracted the gear and flaps and started a brisk turn into the heavy wing. He lost control and the aircraft crashed. The remaining F-4 was lost when both generators dropped off the line on takeoff. The gear could not be retracted and the flaps blew up to a trail position. The aircraft commander proceeded to the jettison area to get rid of the external load. He allowed the airspeed to drop below 200 KCAS during the jettison attempt — only one outboard tank released. With airspeed this low, lateral control and then the aircraft were lost.

The Dash One states that the F-4 can be flown with asymmetrical loads of up to one full outboard drop tank, and it can — but not at low airspeed and high angle of attack. To date, incident reports indicate that one F-4 has been successfully recovered from a spin with one full drop. Another successful, but hairy, recovery was made in the traffic pattern. Airspeed and common sense will keep you out of this coffin corner.

ACM/ACT

Aircraft lost in ACM/ACT were obviously involved in maximum performance flying. It is of considerable interest to note that of 44 loss-of-control accidents, only six have been in the ACM/ACT phase. That is, these aircraft were engaged in air combat maneuvering in flights of two or more and were maneuvering against each other.

These accidents are examples of classic out-of-control conditions. The aircraft were being flown in the area of moderate buffet (max performance regime) and in some cases the effort to squeeze out that last one-half G put the F-4 over the brink during hard turns, low speed-high AOA maneuvering, or rudder reversals. When you are walking the tight rope in this situation anything but smooth, coordinated control inputs is going to put you in never-never land. The ease with which the F-4 can be flown into a stalled condition, compounded in some cases by the misapplication of recovery controls ultimately led to loss of control.

GROUND ATTACK

Losses during the ground attack maneuvering phase are beginning to look like a trend. Eight F-4s have been lost here including all the fighter models, the C, D, and E. Two aircraft were lost when they were inadvertently stalled during weapon delivery recoveries. All indications are that the pass started out badly and the aircraft commander elected to press on in hopes of salvaging it. In both cases, low altitude precluded recovery or crew escape.

Control was lost on two other aircraft during roll-in for rocket passes. Again, it appears the aircraft commanders set up poor patterns and in attempting to correct, flew themselves into a stalled condition. From the normal roll-in altitude of about 7000 AGL, very little time is available for recovery or crew escape. Recovery at these altitudes depends on instant recognition of the problem and immediate corrective action.

Two F-4s were lost during roll-ins to simulated weapon delivery passes from pop-up maneuvers. In both cases, the aircraft were flying in the Nr 2 position. In one accident, the Nr 2 aircraft crossed from the left wing to the right wing, while the leader was in a slight right turn during the pop-up. The leader initiated a left roll-in followed by his wingman. The Nr 2 man was seen to rock, snap to the right, enter a spin and crash. Ejections were too late. The other accident in this category was similar except that the roll-in altitude and airspeed appeared slightly lower than desired.

One aircraft was lost when the aircraft commander stalled rolling in for a strafe run. He overshot the roll-in to final and didn't have his weapon control switches set up for the event. Preoccupation with the switches probably led to the overshoot which led to the stall. The remaining aircraft was lost after the F-4 flew approximately 500 feet to the left of the target. The AC initiated re-attack by pulling up to the right to about 5000 feet AGL and continuing a hard descending right turn toward the target. The aircraft stalled, snapped, and crashed near the target.

In almost every one of these accidents, the aircraft commander tried to salvage a pass after he'd made a mistake. The lesson is pretty straightforward — set it up right or break it off and try again. After all, it's only practice.

MANEUVERING FLIGHT

In maneuvering flight, a category that includes all the cats and dogs type accidents, we lost 10 F-4s. They look like this:

- Stalled in a hard turn during a sidewinder re-attack at low altitude.
- Lost control during intrail acrobatics.
- Stalled performing a split-S.
- Lost control during a simulated SAM break.
- Spun while maneuvering to avoid other aircraft.
- Lost control during an inverted flight maneuver.
- Spun out of a confidence maneuver during IP upgrading.
- Spun out doing a roll around the leader for spacing.
- Two aircraft spun out during high-AOA basic flight maneuvers.

JOIN-UPS

Four aircraft were lost during join-ups. One, the rear seater was flying and he used top rudder to kill his overtake speed. The F-4 snapped and he lost it. Due to the low altitude, only one crewmember escaped. Another loss occurred when a join-up attempt ended in a near head-on pass. The aircraft commander tried a high side yo-yo and spun out. The other two were lost due to excessive AOA during rolling join-up attempts.

NON-MANEUVERING FLIGHT

In this category one aircraft entered a spin after refueling when the aircraft commander overcorrected in pitch, induced a violent, longitudinal oscillation and subsequently lost control. Another aircraft was lost in the GCA pattern when the aircraft commander lowered the gear but elected not to lower flaps because he did not want the trim change during the base leg turn. He let airspeed decay until the F-4 stalled. The last F-4 bit the dirt when the aircraft commander could not control a nose rise, lost control and the crew ejected.

There you have the story — the

44 PHANTOMS

big picture. Forty-four F-4s have gone to the melting pot due to loss of control. **A significant factor in these losses is that in these 44 bashes, the flight manual out-of-control procedure was not used once!**

Most of the aircraft commanders' actions during these accidents were to go first to the spin recovery control positions. If the F-4 was not in a steady state spin at that time, it was shortly thereafter. The misapplication of control drove the airplane into a steady state spin. Spin recoveries are possible from this condition, but experience has shown that for the average pilot the probability is low. Aircraft commanders in deep trouble used the drag chute only nine times in recovery attempts. Four of the chutes streamed due to late deployment, two were deployed too low for recovery, and three separated from the aircraft due to undetermined causes.

In all cases the drag chute was used as a last resort and not in the sequence established in the flight manual. The effectiveness of the drag chute is drastically reduced once a steady state spin develops. As the new flight manual states: USE THE OUT-OF-CONTROL PROCEDURE BEFORE USING THE SPIN PROCEDURES. Coming home minus the drag chute and facing the wrath of the Wing Commander is like nothing compared to the storm generated when you walk in from the smoking hole.

In 28 of the accidents, the sequence of events leading to the loss started below 10,000 AGL. This low altitude does limit recovery time, and it is also the flight manual eject altitude. Recoveries have been made below 10,000 but only because instant recognition of the problem and positive control applications by the AC saved the day.

In addition, a few incident reports are available to document the effectiveness of the flight manual out-of-control procedures. Bar talk, usually considered the fighter pilot's confessional, tends to confirm the effectiveness of these procedures when they are immediately and correctly applied.

Don't sit back and say it can't happen to you. Pilot experience in these accidents has varied from new heads with two hours in the F-4 to highly qualified drivers with over 1100 hours in the airplane.

One of the most often repeated statements from the out-of-control accidents is, "I knew I couldn't be stalled because I had 300 knots when I entered the maneuver." The F-4, like every other airplane, stalls at a given AOA. The AOA can be driven to the stall point very easily. Entry airspeed doesn't determine when the airplane will stall.

Most F-4 jocks swear by the airplane and say that it's the most stable, honest fighter they have ever flown. Fortunately, that is true for the majority of pilots. However, sad to say, there are still 44 reasons why some improved stall warning is needed.

Remember, the F-4 can safely be flown to its maximum performance by a knowledgeable, well-trained fighter pilot. If you are lucky enough to be herding an F-4 around the sky, make sure you know the operational limits of the airplane. A good place to start is the Dash One, Section Six. Read it and believe it. A number of films showing the F-4 doing its thing are available. Ask your friendly Safety Officer to show them periodically. There are many publications available on high AOA flying — dig them out and read them. If you don't understand, ask some questions.

Above all, whatever you do, don't become Number 45! ★

AT PRESSTIME, NUMBER 45 HAD OCCURRED. DON'T BECOME NUMBER 46!

Ed.

THE I.P.I.S. APPROACH

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

HOLDING PATTERNS

Q When do I hold in the published holding pattern?

A Always, unless specifically instructed otherwise. With the advent of published holding patterns on enroute charts, there is apparently some confusion about when to use them. In an attempt to clarify holding, the following is a review of correct procedures.

Let's first consider procedures to be used with normal air to ground communications. Prior to arriving at your clearance limit fix (destination or enroute) the controller should give you holding instructions if a delay is anticipated. If the holding pattern is not published, the controller will issue "cleared to (fix), hold (direction)." If the holding pattern is not published, the controller will issue general holding instructions or, upon the pilot's request, detailed holding instructions. General instructions contain: (1) direction of holding from the fix; (2) holding fix; (3) radial, course, bearing, etc., on which to hold; (4) outbound leg length if DME is to be used; and (5) direction of turns if left turns are required. Detailed holding contains the same items except that the outbound leg must be given in either miles or minutes and direction of turn must be given.

Now, still assuming communications are normal, what happens if the controller does not give holding instructions? The answer is quite simple: If there is a holding pattern published, enter it!! This does not include missed approach holding patterns. If there is more than one holding pattern published (it's possible), take your choice. If there is no holding pattern published, you should hold in a standard pattern on the course by which you approached the fix. THESE PROCEDURES APPLY TO BOTH ENROUTE AND DESTINATION CLEARANCE LIMIT FIXES.

The next point of confusion seems to be, "what about holding procedures with inoperative communications?" The answer again is quite simple — no change. DOD FLIP Enroute, IFR Supplement still states that the published holding pattern will be used. If none is published, hold on the side of the final approach course to the fix on which the procedure turn is prescribed. At this point, a cry of anguish can usually be heard. "What if there is neither a holding pattern nor procedure turn published?" Or, "What if I'm using a JAL procedure where there are no procedure turns shown and there's no published holding pattern?" At this point the pilot will have to use his best judgment. A procedural change has been suggested which reads as follows: "Hold in a standard pattern at the initial approach fix on any course convenient to the subsequent accomplishment of the approach." We think it's a good method.

SID

Q When I list a SID on the DD-175, what do I put in the "TO" block?

A If the published SID terminates at a fix other than one in the route structure you intend to fly, you should put that fix in the TO block and the first entry in the route of flight would be to an enroute facility. If the SID has a published transition to an enroute facility, you may list the enroute facility in the TO block. The pilot should bear in mind that the filed route of flight, including the SID, should provide a complete route of flight for use in the event of communications failure.

ATTENTION, HELICOPTER PILOTS!!

The IPIS hopes to eventually expand to include an Instrument Instructor Course for helicopter jocks. We now have a fully qualified helicopter pilot assigned, so you have a direct point of contact in the IPIS. We hope your response to this will be cards and letters with helicopter instrument-related questions.

CHECK THE MARCH IPIS

Two corrections:

- Touchdown zone elevation is the highest elevation in the first **3000** feet of the runway. (Not 300!)
- Civil precision radar approach controllers are not required to inform USAF and USN aircraft when they reach decision height as military GCA operators are. ★

understanding AND using ground effect

Capt Bert A. Smith, American Airlines

Because of the relatively long period of time that they spend in ground effect, large aircraft lend themselves to a technique of utilizing this effect to cushion the touchdown. Unfortunately, the aerodynamic phenomenon of ground effect is generally misunderstood. What follows is not intended as a definitive explanation of all the causes and results of ground effect, but it should clear up some of the misconceptions.

In order to understand the changes that take place when an airplane flies in proximity to the ground, a review of the development of lift by a wing is in order. Nothing need be said here as to why a wing creates a pressure differential between its upper and lower surfaces, and that the results of this difference is lift. However, another result of this pressure difference is the wingtip vortex. It is this vortex that must be examined in order to understand ground effect.

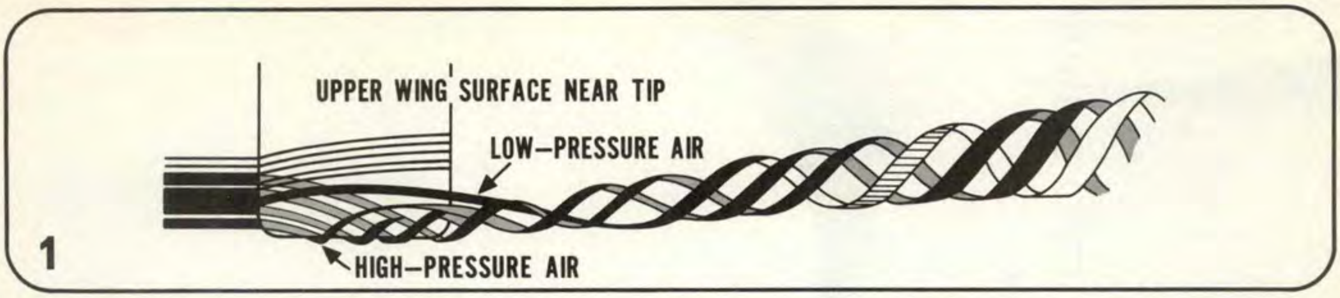
Tip vortex develops because the higher pressure under the wing tries to flow toward the lower pressure on the upper surface, the path of least resistance being via the wingtip. This flow, when coupled with the remote free stream, produces the vortex. This much is obvious. What is not obvious, however, is the profound effect that this phenomenon has on the development of lift by a wing.

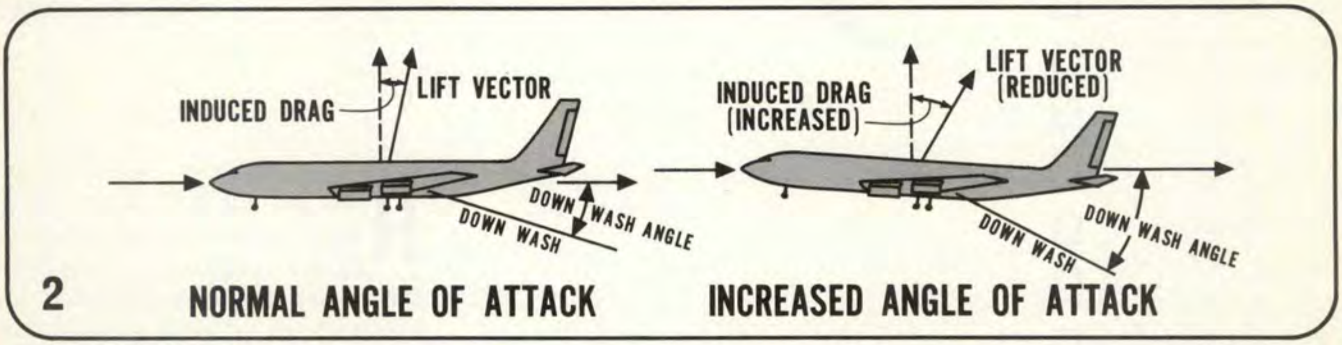
Simply stated, the tip vortex, when coupled with what is called the bound vortex, (the flow from the leading edge to the trailing edge over the curved upper surface) induces a downwash aft of the wing. The net result is that the relative wind in the vicinity of the wing is angled slightly downward. Since lift is perpendicular to the relative wind, a component of lift is always angled aft. This aft inclination of the lift vector will produce a certain amount of drag. This type of drag is called induced drag. The greater the angle of attack the wing is operating at, i.e., the slower the speed, the more the induced drag.

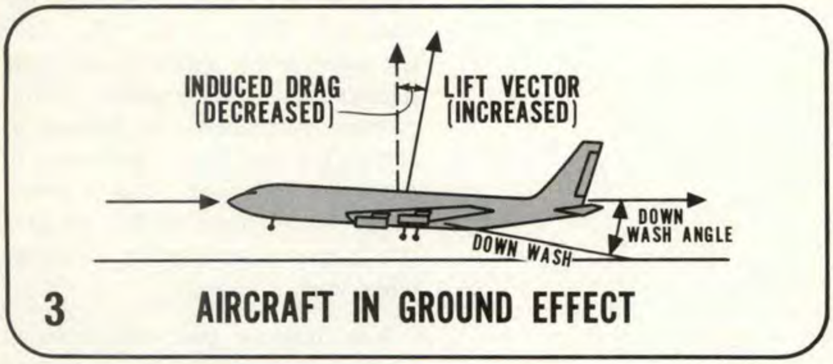
As the airplane nears the ground during the landing approach, the tip vortices begin to shrink, since the ground will not allow vertical components of flow. As the tip vortices shrink, the induced downwash angle lessens, the induced angle of attack decreases, and therefore, the induced drag becomes less. The net effect is an increase in lift.

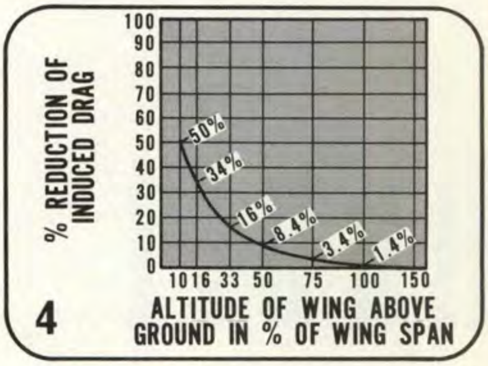
The wing may be said to be operating in ground effect when the height of the wing above the ground equals its span. The reduction in drag at that height is, however, quite small, about one and one-half per cent. When the altitude reaches a height equal to one-fourth the span, however, the reduction in induced drag is on the order of 24 per cent. At one-tenth span height, the reduction reaches about 48 per cent.

Another result of coming into proximity to the ground is a nose down pitching moment. This is due to the decrease in downwash over the horizontal stabilizer, since again, the ground prevents vertical components of flow. Because of the high position of the horizontal stabilizer, T tail aircraft show less of this effect.









The results of the above phenomena are experienced by the pilot in a classical ground effect situation as first, a mild pitch-down as the airplane nears the runway, and then, if the descent rate is not excessive, a cushioning that produces a gentle touchdown. The airplane will undergo ground effect during every landing. However, whether or not the increase in lift is enough to cushion the landing depends on the airspeed-descent rate combination. Ideally, the airplane should be in a steady-state condition during the approach, so that as the threshold is reached, no thrust, airspeed, or descent rate excesses or deficiencies are present. The pilot then need only make what is usually a slight adjustment in the flight-path angle to insure that the descent rate is not excessive for the airspeed being flown, and the increase in lift from ground effect will cushion the touchdown.

Utilizing the ground effect for landing is easiest when still air conditions for the approach and touchdown are present. The airplane can be controlled more precisely, and the lack of gusts makes its response from the threshold to landing more predictable. Gusts just before touchdown can upset the balance of forces acting on the airplane. An increase in wind increases the airspeed, which intensifies the ground effect. This will slow or stop the descent-rate prematurely, and usually leaves the airplane a bit high. A decrease in wind decreases the airspeed. Some lift is momentarily lost, and the descent rate tends to increase. Obviously, unless immediate corrective action is taken, a "firm" landing will ensue. Ground effect can be utilized in gusty cases, but the pilot must exercise tight control over the airplane, and be alert to correct airspeed and descent rate excursions as they occur. ★

(Reprinted from Air Canada *Grapevine*)

habit pattern transference

Lt Col R. D. Hansen, 58 Tac Ftr Tng Wg, Luke AFB, Arizona

Habit pattern transference is, I think, what killed an IP in a fighter accident last year. It is the person highly experienced in one mode of behavior who is most likely to be the victim of this phenomenon. The person who does not have firmly established habits doesn't have the problem. Habit pattern transference is defined as "i n a p p r o p r i a t e patterns of automatic behavior." This is pretty fancy terminology so let me give you some examples to illustrate what it is.

For those of you who have at least two family cars, one with power brakes and the other having standard push-hard brakes, if you have been used to driving the automobile with power brakes, then go back to the other one, you find that the brakes do not work very well because you are just tapping them with your toe. This will be even more noticeable when you go from the old car to the power brakes and throw everybody into the windshield because you are really shoving the brakes down and you don't need to. This is "inappropriate behavior."

Let's suppose that one of your cars has a floor shift and the other has a steering column shift. I happen to have this problem. The car I drive to work has a floor shift and the one I leave with my wife has the other type on the steering column. If I switch cars for some reason I find myself reaching down on the floor to shift the gears, when the gear shift is up on the steering column. This is "habit pattern interference."

We had an interesting example recently in the Wing Staff meeting. The Wing Commander was unavoidably delayed. At the time he normally arrived, another officer walked in and, everyone being primed to leap to their feet, we all stood up. This made the officer feel great, but the rest of us felt like clowns. This is "habit pattern interference."

How do we get habit pattern interference? First, you have to have a habit. The more ingrained the habit, the more likely you are to carry it over into some situation where it is not appropriate. Take the case of the well-trained pilot who learned always to hook up the gold key. Then he began using a different parachute that does not utilize the gold key but rather a cable the pilot plugs in. This is the problem we're talking about. The person has this habit. The more similar the situation, the more likely you are to transfer one habit to another. Now, if you usually drive your car to work but occasionally ride a bicycle to work, you are not likely to look for the gear shift lever on your bicycle, so you do not transfer under these circumstances because the situations are not similar enough.

One of the commonest examples you see is when someone catches his hand on something sharp or, say, a dog bites your hand. The sensible thing to do is to leave your hand in the dog's mouth, open his mouth and take your hand out. But the normal reaction is to jerk your hand back, and what do you do? Instead of getting a little puncture wound, you get a nice big gash in your hand. The habit is to pull back quickly when something bites you.

So, these are the two things to remember: The more ingrained the habit and the more similar the situation, the bigger problem habit transference is likely to be.

Distraction is another factor. I can certainly see where an IP could be distracted on a transition ride with a student because he is trying to watch what the student is doing. If the student does something inappropriate or the IP is afraid that he will at the time when the IP is hooking up, there is a good chance that he will hook up improperly.

Then there is fatigue. It will make you fall back on automatic behavior. The more tired you get, the less thinking you do, and the more you function automatically.

How can you prevent habit transference from biting you? One thing the Air Force encourages is the use of checklists. Now this is fine for slow, timed procedures, but you cannot ordinarily pull out

a checklist when you have an emergency ejection, so you must fall back on your automatic habits and, hopefully, you will have the right habit which you got through repeated training. This is why you go through egress procedures on the ground periodically — you are trying to develop a set of automatic habits so that you can get out without having to think, "What do I do next?"

If you switch procedures you have to unlearn what you previously learned and learn something new. Therefore, what you need to remember—and the whole point of this article—whenever you switch procedures where something you have learned to do automatically is inappropriate, be aware that habit pattern transference is a potential problem.

Think yourself through the new procedure and learn it better than you knew the last one, so that when the chips are down, and you have to perform automatically, you will perform in the proper way, *automatically*, and not go back to some old procedure which is no longer appropriate. ★

emergency EXIT ...THROUGH UPPER ESCAPE HATCHES B-52

Investigation following a B-52 landing accident revealed that the upper deck crewmembers experienced considerable difficulty in opening and lifting their respective escape hatches. It was further revealed that they did not follow the UPPER DECK CREWMEMBERS EMERGENCY EXIT INSTRUCTIONS provided in the emergency procedures section of the applicable flight manual.

A crewmember wouldn't think of making a flight without first mentally rehearsing each of the steps necessary for successful inflight ejection of his seat. But how much time is devoted to mentally rehearsing each of the steps necessary for a successful ground emergency exit? We all like to think that such emergencies only happen to the other fellow, but experience has proved that no one is totally immune. The best insurance is always to be prepared.

For those who have never opened and lifted an upper deck escape hatch, the following questions and answers, (and illustrations) should be of interest:

Q How far downward must the manual release handle be rotated to release the locking cam?

A Approximately 80 degrees.

Q Once the locking cam releases, is there danger of it locking again when you turn loose of the handle to push upward on the hatch?

A No. The hatch will settle when you let go of the handle, but once released, it can't lock again of its own accord.

Q On which side or end does the hatch pivot and to what area of the hatch should a manual upward force be applied for best efficiency?

● On B-52C — F airplanes, rotate handle forward out of stowage clips (approx. 90°).

● Then pull downward and inboard full length of travel (approx. 80°) until locking cams release.

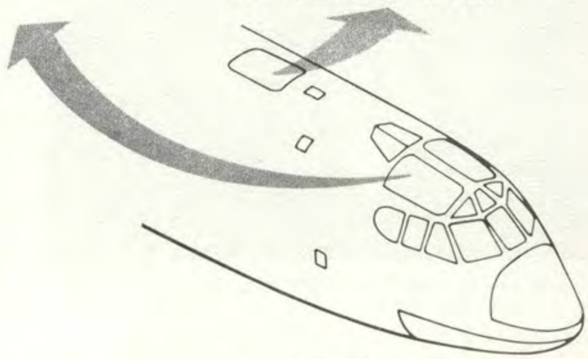
● Apply manual upward force on forward edge of hatch, rotating hatch upward and aft (approx. 95°) until it falls free of the airplane.

COPILOT'S HATCH (PILOT'S HATCH TYPICAL)

● Pull handle downward full length of travel (approx. 80°) until locking cams release.

● Apply manual upward force on forward edge of hatch, rotating hatch upward and aft (approx. 95°) until it falls free of the airplane.

EW OFFICERS HATCH



B-52C—F

A The hatch is hinged on the aft end and manual upward force must be applied on the forward end. The hatch weight, and the possibility of it sticking to the seal can make it nearly impossible for a man to apply enough force in any other area to lift the hatch.

Q What is the approximate weight of the hatch?

A Approximately 150 pounds. This requires a minimum of 75 pounds upward force at the forward edge.

Q How far must the hatch be rotated before it will fall free of the aircraft?

A Approximately 95 degrees.

Q When a ground emergency or crash landing makes manual removal of the hatch necessary, what is the correct procedure to follow?

A Refer to the emergency section of the applicable flight manual. Presently, the emergency exit procedure for upper deck crewmembers (P-CP-EW-G) is as follows:

UPPER DECK CREWMEMBERS (P-CP-EW-G)

1. Install armrest pins.
2. Unfasten safety belt.
3. Disconnect oxygen and interphone.
4. Remove parachute and survival kit by unfastening parachute leg and chest straps.
5. Stow control column (P-CP).
6. Stand facing aft.
7. Pull hatch release handle down and rotate full length of travel (approximately 80 degrees.)
8. Release hatch release handle.

CONTINUED ON NEXT PAGE

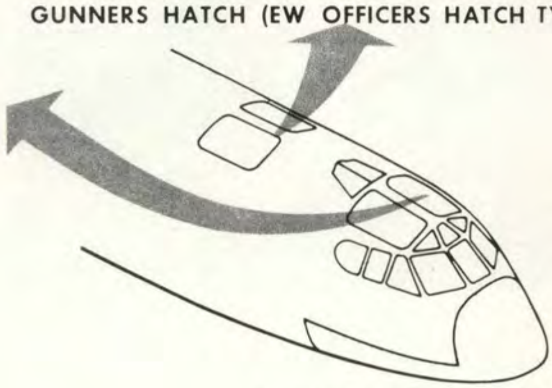
- On B-52G – H airplanes, rotate handle aft out of stowage clip (approx. 90°).

- Then pull downward and inboard full length of travel (approx. 80°) until locking cams release.
- Apply manual upward force on forward edge of hatch, rotating hatch upward and aft (approx. 95°) until it falls free of the airplane.

PILOT'S HATCH (COPILOT'S HATCH TYPICAL)

- Pull handle downward full length of travel (approx. 80°) until locking cams release.
- Apply manual upward force on forward edge of hatch, rotating hatch upward and aft (approx. 95°) until it falls free of the airplane.

GUNNERS HATCH (EW OFFICERS HATCH TYPICAL)



B-52G—H

EMERGENCY EXIT CONTINUED

NOTE

It is not necessary to hold the hatch release handle when removing the hatch. Although the hatch settles somewhat when the handle is released (because of hatch weight), the locking cam will not travel back past overcenter.

9. Push hatch upward and aft, stepping into seat while doing so. Continue pushing until hatch has rotated approximately 95 degrees and falls free of aircraft.

NOTE

As the hatch is rotated, the mechanical link connecting the hatch to the catapult safety pin-pull initiator will fire the initiator. Do not be alarmed; although the seat catapult is armed, it will not fire unless the firing trigger on the armrest is squeezed.

One B-52 base assures that its flight crewmembers are knowledgeable about upper deck escape hatch removals in the following manner: When maintenance requires removal of an escape hatch from a B-52, the flight crewmembers of that airplane are requested to make the removal.

The important thing is to know your emergency procedures so well that when the situation arises you can think clearly, act precisely, and exit quickly.

(Boeing Service News)

DURING a B-52 accident the gunner scrambled out of the aft section and found himself being hanged by his oxygen equipment. Fortunately he was able to support himself by his escape rope while he pulled the oxygen hose hard enough to break it and the nylon cord inside.

REX RILEY'S CROSS COUNTRY NOTES

CAMERAS

Talk about stacking the odds against yourself! Or deliberately distorting the world outside your cockpit — but let's start at the beginning.

Solo UPT student, returning from the practice area, buzzes his way down a river and winds up as part of a black smoking hole in the ground. Unhappily, it's an old story. But there's an unusual twist to this one that made me sit up and pay attention.

In this accident a strong possibility exists that the student was trying to take photographs while he was buzzing his way to that smoking hole. A hunter nearby saw the airplane at high speed about 500 feet above the river shortly before the crash. And the accident investigators found enough evidence in the wreckage to make it look like unauthorized, foolhardy and amateurish low-level photo recon.

Just imagine his distorted view of the terrain ahead, looking through a rangefinder! There's plenty to keep one pilot busy in the cockpit even if he doesn't violate the rules, flying at dangerously low altitude. Taking pictures from many times this pilot's height above the ground is tricky (you don't often get good pictures). And you tend to let aircraft control become secondary, violating a very basic rule.

I don't recommend the photography bit unless you have someone else along to handle the airplane while you do your thing with the camera. ★

THE

REX RILEY
Transient Services Awar

LORING AFB	Limestone, Me.
McCLELLAN AFB	Sacramento, Calif.
MAXWELL AFB	Montgomery, Ala.
HAMILTON AFB	Ignacio, Calif.
CHANUTE AFB	Rantoul, Ill.
SCOTT AFB	Belleville, Ill.
RAMEY AFB	Puerto Rico
McCHORD AFB	Tacoma, Wash.
MYRTLE BEACH AFB	Myrtle Beach, S.C.
EGLIN AFB	Valparaiso, Fla.
FORBES AFB	Topeka, Kans.
MATHER AFB	Sacramento, Calif.
LAJES FIELD	Azores
SHEPPARD AFB	Wichita Falls, Tex.
MARCH AFB	Riverside, Calif.
GRISSOM AFB	Peru, Ind.
PERRIN AFB	Sherman, Tex.
CANNON AFB	Clovis, N.M.
HICKAM AFB	Hawaii
LUKE AFB	Phoenix, Ariz.
RANDOLPH AFB	San Antonio, Tex.
ROBINS AFB	Warner Robins, Ga.
TINKER AFB	Oklahoma City, Okla.
WETHERSFIELD AB	England
HILL AFB	Ogden, Utah
YOKOTA AB	Japan
SEYMOUR JOHNSON AFB	Goldsboro, N.C.
ENGLAND AFB	Alexandria, La.
MISAWA AB	Japan
KADENA AB	Okinawa
ELMENDORF AFB	Alaska
PETERSON FIELD	Colorado Springs, Colo.
RAMSTEIN AB	Germany
SHAW AFB	Sumter, S.C.
WRIGHT-PATTERSON AFB	Dayton, Ohio
LITTLE ROCK AFB	Jacksonville, Ark.
TORREJON AB	Spain
TYNDALL AFB	Panama City, Fla.
OFFUTT AFB	Omaha, Nebr.
ITAZUKE AB	Japan
ANDREWS AFB	Washington, D.C.
McCONNELL AFB	Wichita, Kans.
NORTON AFB	San Bernardino, Calif.
BARKSDALE AFB	Shreveport, La.
HOMESTEAD AFB	Homestead, Fla.

AIRPLANES:

There's an old saying that "A squeaking wheel gets the grease." That explains why articles on FOD appear so frequently in safety publications. Ruined engines, blown tires, and jammed controls keep "squeaking" for more preventive "grease."

While foreign object damage covers quite a gamut, this article will address specifically the subject of tool control because that is probably our biggest controllable FOD problem. Dirt in hydraulic systems, objects on the runway that cause tires to blow out, are troublesome and expensive, but the chewing up of neglected tools by engines far surpasses any other FOD in terms of both hazard and cost.

What we're talking about is the human element — the greatest asset we have, when properly trained and supervised, and the most destructive when it is permitted to go uncontrolled and undisciplined. Any mechanic — pick one at random — has the capability of grounding an aircraft, perhaps permanently. All he has to do is leave a wrench in a jet engine intake, or a screwdriver in the flight controls. This doesn't take talent or smarts. It does take carelessness, poor planning or an I-don't-care attitude. These are qualities that the Air Force can do without.

If what has been said seems a bit tough, consider the fact that FOD costs us (you and me and every other American) millions of dollars a year, not to mention the loss of mission capability. Here's a forinstance.

Maintenance was being performed on an F-101 parked on a trim pad. After the Nr 1 engine splitter vane had been opened to allow access to some panels, it was decided to operationally check Nr 2. However, during the attempt to start Nr 2, Nr 1 was started. Nr 1 was shut down immediately upon reaching idle, but it had run long enough to swallow a bolt, two nuts and several washers. The man responsible said he had replaced the bolts and washers and had tightened the nuts finger tight.

There is plenty of guidance which, when followed, can prevent FOD from articles left in or around engine intakes. TO 00-20-5 requires a red cross entry in the AFTO 781A any time maintenance is per-

OR BICYCLES

formed in or around the intake. In addition, most units require a red cross for intake inspection at the completion of each flight and before each ground operation of an engine.

If the red cross is properly cleared there should not be any FOD, at least not of the type caused by tools and equipment left in or near the intake. To properly clear the red cross, the inspector must assure himself, beyond a shadow of a doubt, that the intake and surrounding area is free of any foreign objects. He cannot afford to take another man's word for it, regardless of what other tasks may demand his attention. He should be fully aware of the consequences if he signs off an intake as clear when it wasn't and subsequent FOD ruins the engine.

Many systems have been devised to beat the FOD problem by helping the mechanic control his tools. Check an article titled "Guys and Dollars" in the October 1960 issue of *Aerospace Maintenance Safety* — the safety office may have a copy. The article advocated use of an inventory card bolted inside tool boxes. Also in the same magazine, October 1968, was an item on a dial indicator mounted inside the box. A number of different check-off systems have been devised, along with tool counts, tool numbering, etc. But no matter how good the system, we keep getting back to the man who operates it. The responsibility is his and he can't escape it any more than the inspector can who signs off without a thorough inspection.

Suggestions have been made that when FOD can be proven to have been caused by negligence that the responsible persons be charged for the damage. From the education standpoint we do think that every person in a position to create FOD should have an appreciation of the cost of his actions.

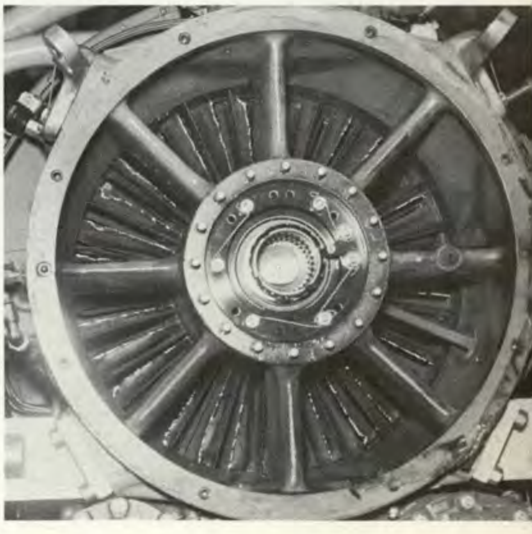
Money — the cost of repair or replacement — is one thing. But how about the possible cost in lives. How would you feel if you knew that it was your screwdriver that jammed the controls of a fighter and that the pilot lost his life when the bird crashed? Here's an example in which the pilot landed safely, but others haven't been so lucky.

During descent the pilot of an RF-84F discovered that only a fraction of right stick movement was available. He "pounded" the stick until he got approximately 20 per cent of aileron control from neutral. After declaring an emergency he landed. A six-inch screwdriver was found wedged in the aileron control stop area. No one has claimed the screwdriver.

Remember when you were a kid? You were probably a built-in FOD problem, although not of the consequence of the one you have on the flight line. All small boys love to work with dad's tools. This is a healthy thing, but you know how difficult it is to teach junior to put each and every tool back in its place. Men are supposed to be more responsible than small boys. And their jobs reflect this; small boys don't work on multi-million dollar airplanes. But sometimes men who do act like small boys when they leave tools lying around. Better they should be working on bicycles. ★

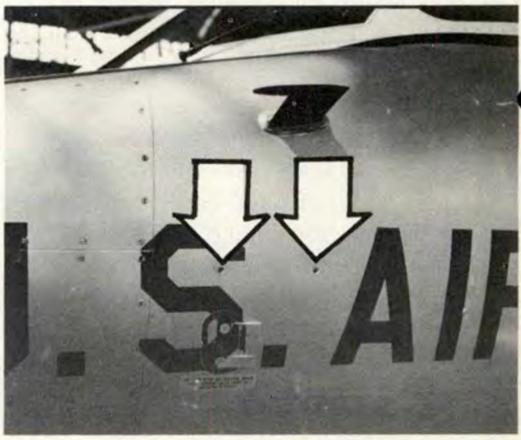
Who will lay claim to this screwdriver?

Would you like to pay the cost of repairing this engine?



Maj Edwin L. Marsh, Directorate of Aerospace Safety

T-39 what drains?



Two drains under pitot tube on either side of fuselage.

During climbout the T-39 pilot's airspeed indicator read 30 knots lower, and the altimeter 2000 feet lower, than the copilot's instruments. The alternate static system was selected and readings appeared normal. However, during the landing approach, with a chase plane, the pilot's airspeed still read low. A successful landing was made at the nearest VFR base.

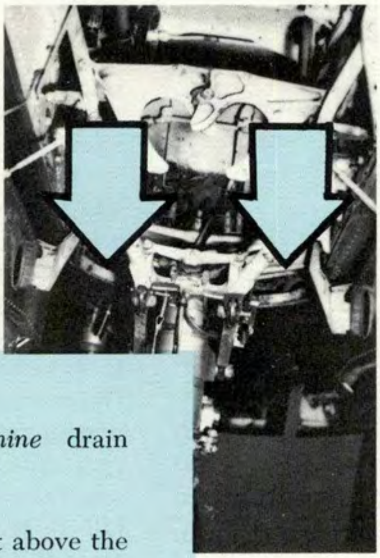
Maintenance personnel discovered that both the pilot's and copilot's static lines were ruptured because the two pitot static system drains located in the nose wheel well were not drained during preflight. When the aircraft was flown above the freezing level, the trapped water in the lines froze and ruptured both static lines.

The crew chief had properly opened the two drains on each side of the fuselage just below the pitot head, but he was not aware of the two drains in the nosewheel well. These two drain plugs, along with the identification placards, were painted over, making them difficult to locate.

Maintenance personnel responsible for draining moisture from T-39 pitot static systems should be aware of all nine drain locations. Since no common low point exists, the entire system should be drained during each postflight, preflight, phase inspection, and any other time deemed necessary, such as after heavy rains or aircraft washing. SMAMA is presently revising the Dash Six and all preflight, postflight, and phase inspection work cards to insure that draining is accomplished properly.

Note for Pilots: Since on occasion you may have to perform your own preflight, the following data are extracted for your use from TO 1T-39A-2-1:

"To drain pitot-static system re-


Two drains located one on either side of nose wheel well.

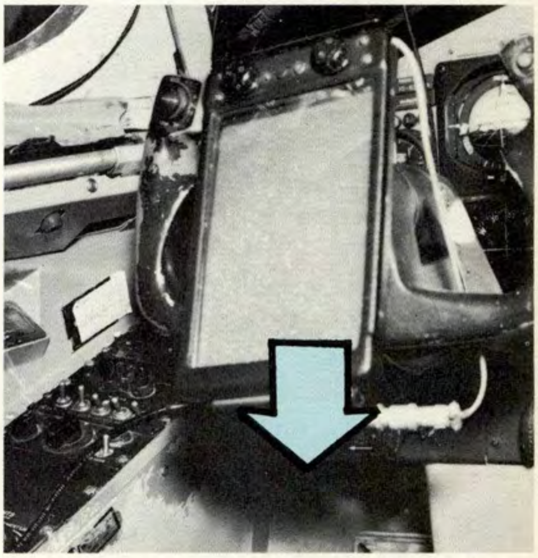
move the following *nine* drain plugs:

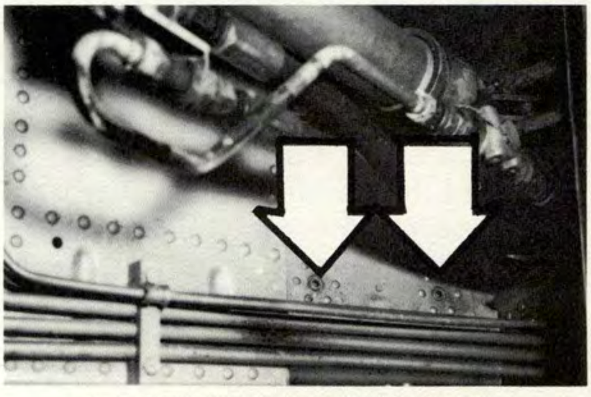
- One plug in cockpit above the pilot's left rudder pedal.

- Two plugs on each side of the fuselage just below the pitot head.

- Two plugs in the speed brake well, right hand fuselage station 185 (On T-39A 59-2871 and later airplanes).

- Two plugs in the nose wheel well, one on each side of the aft end." ★


One drain located left of pilot's left rudder pedal.


Two drains located in speed brake area.

experts talk about tho

R. D. Becker, SAAMA
Kelly AFB, Texas

CARBURETOR: "A sensitive device designed and calibrated to produce proper fuel/air ratio regardless of changes in RPM, altitude or temperature."

People who have had to change several carburetors have a different definition which would require several beeps if expressed in public. The prime objective of SAAMA, as far as carburetors are concerned, is to provide the best specifications and parts available to assure a quality product. Excluding some errors, which seem to occur regardless of repeated inspections, present carburetors should be good for four to five thousand hours of operation.

All carburetors now contain new style diaphragms that are less susceptible to rupturing. These new diaphragms are more flexible and temperature changes do not affect metering. R-2800 engine carburetors have had metal idle link bushings replaced by delrin bushings, eliminating the wave washer and two of the plain washers. Besides being easy to install, the delrin bushing has good wear characteristics and does not require lubrication. The only objection to this bushing is that it will bind if the nut on the through bolt is overtorqued. The nut must be screwed on by hand until it contacts the plain washer and then tightened one or two castellations to align the cotter pin hole. Mechanics can look for the delrin bushings to be installed in other carburetors on a phase-in basis.

Not long ago, Bendix and SAAMA engineers were asked to find out what type of grease and sealant would be best for use during carburetor overhaul. As a result, greases and sealants have been selected which will outlast the expected life of any carburetor.

From an operational standpoint, production of a serviceable carburetor determines 50 per cent of the metering performance to be realized on an installed engine. There are five major operations which must be accomplished correctly to achieve the remaining 50 per cent.

INSTALLING—When installing a carburetor be sure the hold down bolts/nuts are torqued to the values and in the sequence specified in the tech orders. This is extremely important, for although the body may appear to be a rigid piece of metal, it is not. There are several internal passages and in certain areas the walls are rather thin.

If the body is tightened at one end, the carburetor-to-case gasket will be compressed enough to raise the other end of the body. When the raised end is then tightened, the body will warp. Fuel flow variation of several hundred pounds can result. This has been verified by applying torque while observing fuel flow on carburetor test stands. A good rule to remember: always stagger-torque, starting in the center of the body and working outward.

BLEEDING — Even though carburetors employ dual vapor eliminators, all the air may not be expelled, especially during initial installation. The fuel chambers are filled with air before fuel under pressure enters them. Sometimes all the air will be forced out; when it isn't, trouble starts. Usually trapped air can be detected by fuel pressure fluctuation, but not in all cases. So bleed carburetors in accordance with the tech order.

IDLE ADJUSTMENT — Many publications and scholars of the old school believe the idle adjustment is effective only in the idle range and has no effect on carburetor operation at higher power settings. This is untrue, especially on larger engines. The R-4360 engine, for instance, has the idle valve modified to minimize idle effect at takeoff. On most engines the idle valve will remain in effect up to 2100-2200 rpm. Even though the size of the idle valve opening at speeds above idle RPM may be greater than the area of the jets, it will alter the pressure drop across the jets sufficiently to alter fuel flow. Tech order specifications for carburetor adjustment take these factors into account. Follow the book!

BOOST PUMP PRESSURE — High surge pressure resulting from rapid application of high boost has caused more carburetor internal failures than anything else. Years ago, the vapor eliminator floats were made of a rather thick stainless steel material. Unbelievably, high surge pressure could collapse these floats. This same pressure

se round engines

CARBURETORS

also warped the stainless steel support plates for large diaphragms, causing regulators to malfunction. Tests have shown that pressures up to 125 pounds can occur when high boost is applied rapidly. Plastic floats have replaced the metal ones and diaphragm support plates have been reinforced, but the poppet valve diaphragm cannot be beefed up to withstand these high surge pressures.

Flight crews and maintenance men must always switch to low boost and allow pressure to stabilize before going to high boost. If this simple procedure is followed there will be no damage to the carburetor.

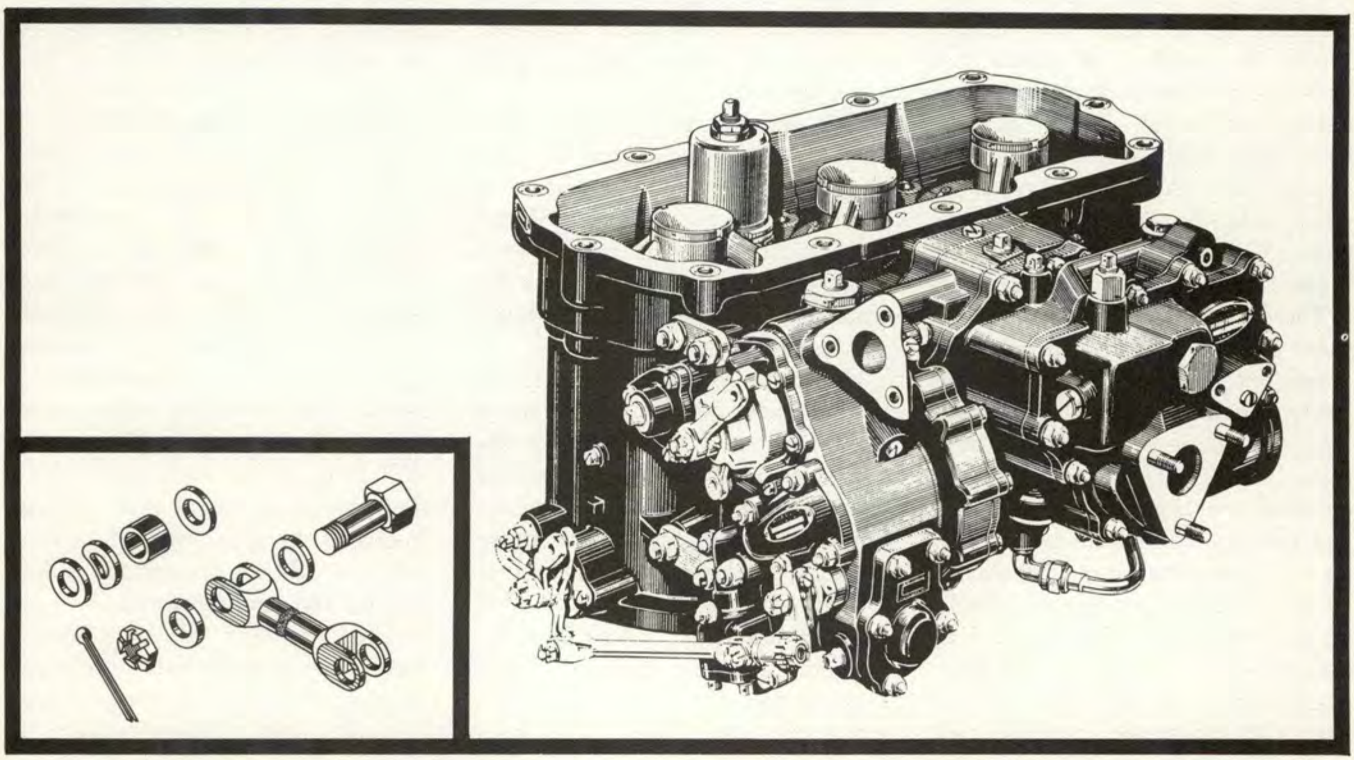
RAPID ACCELERATION — There are three types of acceleration pumps used on carburetors: One which charges and discharges with pressure changes below the throttle valve, one with a piston which discharges in proportion to throttle opening and rate of throttle movement, and one which discharges to a diaphragm causing the poppet valve to open. This last type is used in the R-2800 engine and all the pump pressure is exerted against a diaphragm having an exposure of one and three-eighths inches in diameter.

Years ago the material in this diaphragm was changed to reduce rupturing and the results have been excellent. But several EUR exhibits indicate that users are rupturing these diaphragms by rapid acceleration. During acceleration checks, the throttle should be advanced smoothly and evenly up to power check.

Carburetors are delicate instruments and must be treated as such. Treat them right and they won't let you down.

This concludes this series of articles on reciprocating engines and accessories. Our thanks to the various authors, all specialists at SAAMA. — Ed. ★

The metal wave washer and bushing have been replaced with a delrin bushing, making installation a lot simpler.



This improperly latched panel would come off in flight.

Loose airlocks are not always this easy to detect.

PANEL PROBLEMS

Anything that falls out of or off an aircraft in flight could mean that someone may be seriously hurt or killed, or that property could be damaged or destroyed. It could also mean that SOME MAINTENANCE MAN DIDN'T DO HIS JOB CORRECTLY.

The ball must have been pretty slippery last year because we dropped it at least 107 times. That's the number of panels reported lost in flight, and there may have been more. These ranged from gun bay doors to escape hatches and the reports read so much alike that they get monotonous: ". . . panel missing after flight. . . improperly installed."

There are a lot of reasons why a panel can be installed improperly (read not fastened, if you wish), but we've never heard of a good one. A common excuse goes something like this: The hydraulic shop repaired the flight control system and entered a red dash in the 781 for an operational and leak check. In the process a couple of panels on the vertical stabilizer were left unfastened because Transient Maintenance had to make a runup check. The hydraulic specialist and the TA chief verbally agreed that after the check TA would inspect the work area and fasten the panels.

You can guess what happened. The fasteners dropped down until they were flush with the surface, and the pilot and transient maintenance tech failed to catch the loose panel during the walkaround inspection. When the aircraft arrived at its first stop, one panel was missing and the other was hanging loose, out of position.

This was the result of poor communications. Maybe you've been bugged to death by that word, but that's the way it was: The 781 did not indicate that the panels were loose; the TA chief did not pass the word to his relief; the panels didn't get fastened.

One of the problems with panels is that they get bent or warped from wear and the fasteners become so badly worn they either won't fasten securely or they vibrate loose in flight. And of course there is the human factor in that sometimes someone is in a rush or careless and just doesn't get the fasteners properly secured. Some times a fastener is too tight and won't completely lock. This happens with overcenter cam locks and a little vibration causes them to let go.

There is really not much excuse for panels and doors falling off aircraft, and we can cut down on the number of incidents. For one thing, we can insist that a Red X be entered in the forms every time a panel is removed. Of course, the number of excuses for not making the entry will undoubtedly exceed the number of entries made — "lack of time," or "no one immediately available to clear the red X."

What will really solve the problem is each man taking pride in his w o r k a n d d o i n g it correctly, whether it is adjusting a valve, trimming an engine or simply fastening a panel. This includes supervisors who realize that supervisors have as many responsibilities as they do privileges; who supervise as closely as the job and the skill level of the men under them demand; who insist that persons qualified to sign off red crosses perform their inspections thoroughly and conscientiously.

Then perhaps the number of panels lost in flight will be reduced to where it is safe for the populace to walk about without helmets. ★

EXPLOSIVES SAFETY

ONE MAN — ONE ACT

Once in a while one man, performing one act, causes a mishap with no outside help. But usually it takes more than one unsafe act — a series of three, four or more — before the stage is set and the damage occurs. Each act in the series is usually a small error of commission or omission which alone would cause no harm. Like confirming a write-up in the 781 that says an aircraft has been dearmed; even if a cartridge is still in the breech of the centerline fuel tank jettison system, there are enough safety devices in the system to keep the cartridge from firing.

Well, don't be too sure. It was a series of omissions that recently caused a 600-gallon tank full of JP-4 to be slammed to the ramp from the belly of an F-4. First, the load crew that dearmed the bird neglected to remove the centerline cartridge. Then, after they left, the aircraft crew chief made an entry in the Form 781 to the effect that the aircraft had been dearmed, but he neglected to check the centerline station. Still later another load crew came along and loaded the Phantom for its next mission. Noting the "dearmed" entry in the Form, the load crew chief neglected to check the breech of the centerline station, too.

The number two man of the load crew was in the cockpit and had activated the armament override button. When power was applied to the aircraft, the tank went. It turned out that a micro safing switch in the centerline rack was shorted. But wait, even with that short and the armament override button, the circuit wasn't yet complete to the cartridge that wasn't supposed to be there. The troop in the cockpit inadvertently leaned against the external stores emergency release button on the panel!

No single one of the failures or unsafe acts could have caused this one alone. And, of course, had all of them occurred as they did, but the cartridge had not been installed. . . . . .

And purposeful attention to their checklists by everyone involved would have not allowed *any* of the unsafe acts in the series to occur.

UN-SAFE PIN

A FLIGHTLINE maintenance trainee was climbing out of the front cockpit of an F-4E recently, placing one hand on the canopy rail and the other on the top of the control stick. Imagine his surprise when the M-61 gun in the nose of the bird emitted a short roar and fired several rounds of 20mm training ammunition. They impacted 150 feet in front of the airplane and ricocheted off the ramp. Some went as far as 7000 feet!

Several violations of TO 11A-1-33 were involved:

- The gunfiring lead was not disconnected,
- The clearing sector holdback tool was not connected,
- The armament master switch was not in the safe position, and
- A qualified maintenance technician or weapons mechanic was not present while maintenance was being performed on a loaded aircraft.

That's bad enough. But the gun would not have fired if the gun safety pin had been correctly installed. It's possible to install this pin on the F-4E gun so that it appears all the way in, but is actually not holding the electrical safing switch depressed.

It's easy to check — just grasp the head of the safety pin and pull. If the pin dislodges with a firm pull, the gun's not safe. ★

MAINTENANCE briefs

F-100 • canopy caper

SHORTLY AFTER TAKEOFF, while making an afterburner climb to 25,000, an F-100 lost the aft canopy bubble. The mirror attached to the top of the aft canopy glass struck the rear seat pilot shattering his helmet visor. Fortunately, he had the visor down. He received a cut on the forehead and pieces of glass from the mirror in his eyes but no eye damage.

The student pilot in the front seat took over and made an uneventful landing. Investigation revealed the canopy glass retaining rods, P/N 243-31802-35, reference TO 1F-100F(1)-4, Fig. 92, Nr. 17, were not installed properly. Instead of through the glass retaining loops they passed outside of the loops, which allowed the aft canopy glass to separate from the canopy frame during climbout. This was the first flight after installation of the canopy which had just been received from an overhaul depot.

Maintenance bought this one because the faulty assembly was not discovered prior to installation.

INTRODUCING

MICRO FOD

unseen enemy of hydraulic fluid CONTAMINATION

F-100 • "lumpy" controls

AFTER ENGINE START, the F-100 pilot checked the flight controls and described them as "lumpy," not smooth in the fore and aft direction. But they smoothed out and he attempted to take off. At rotation stick force was extremely heavy as though the stick was binding on something, so he aborted. The aircraft was returned to the ramp and Maintenance dug into it to find out what was wrong. They found that the lower half of the control stick torque tube was inbedded in ice.

When hydraulic pressure is first

applied to the flight controls during start, the controls move to a predetermined position. This apparently broke up the ice and allowed free movement. The vibration and G forces during the takeoff roll caused some of the pieces to move and again restrict the flight control torque tube. There are no cockpit drains in the floor channel in the immediate torque tube area. This unit has added a check for water, ice and other FOD to the preflight checklist. The question is, how did that much water get there in the first place?

B-52 • priming for an accident

DURING AN ATTEMPT to defuel a B-52 with an F-6 defueling unit, positioned about 20 feet from the aircraft, with a fire truck standing by, the F-6 pump could not be started. Using a two gallon plastic bucket containing JP-4, the refueling unit operator attempted to siphon fuel from the bucket in an effort to prime the pump. When this method proved unsuccessful, the unit operator sent a helper to the fuel cell dock for a funnel.

In the interim the bucket of JP-4 fuel was placed on the pavement next to the F-6 and the operator stood on the metal lid covering the battery compartment. His weight caused the lid to sag onto the battery terminals, thus completing an electrical circuit. The bucket of fuel was immediately ignited by either sparks or pieces of molten metal. The operator jumped down and drove the refueling unit away from the fire while the foam truck moved into position and extinguished the fire.

(Adapted from 8th AF (SAC) Safety Bulletin)

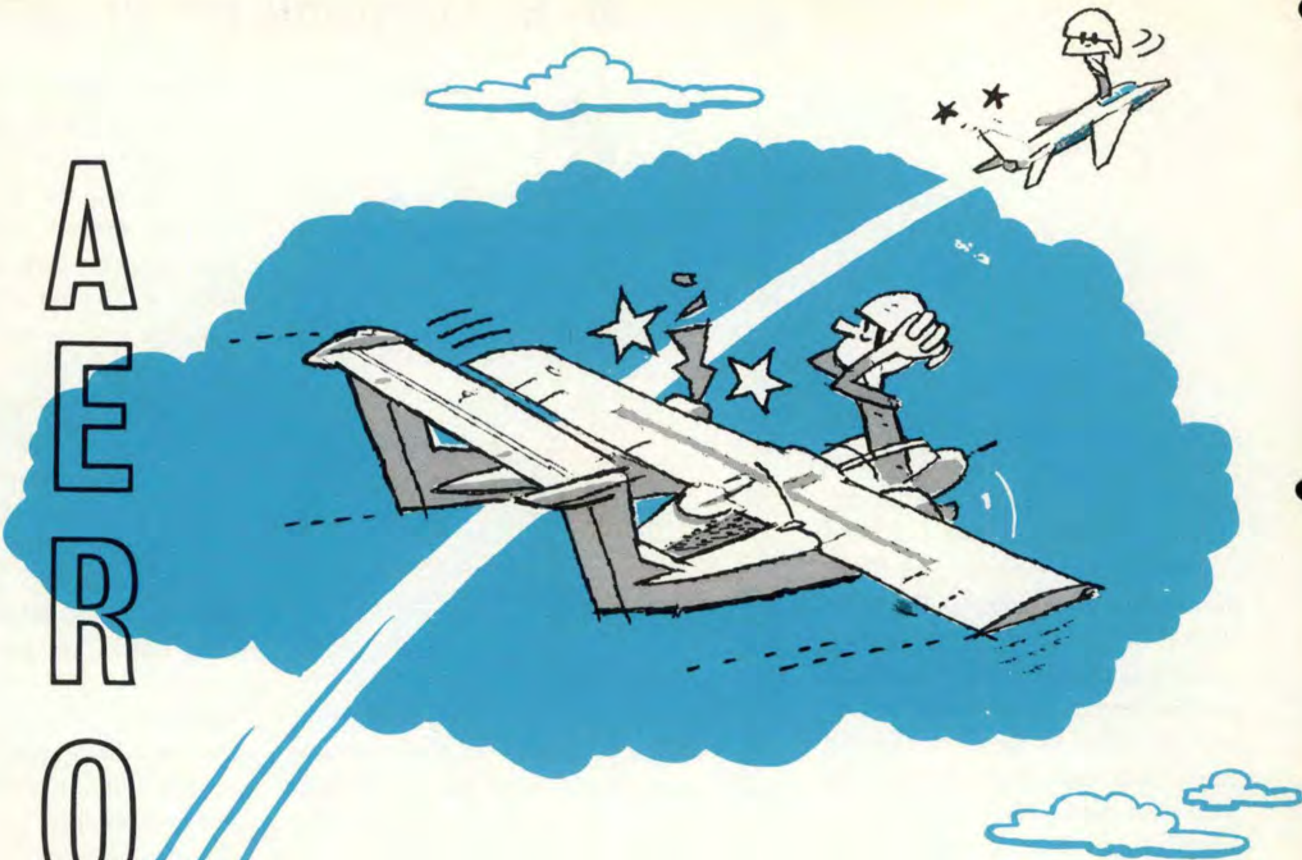
T-38 • cotter pins are cheap insurance

AFTER A TOUCH AND GO landing, as the pilot turned to the crosswind leg, he noticed a rolling tendency and heavy left wing condition. The situation deteriorated until full right stick and rudder would not maintain wings-level flight. The pilot transmitted his difficulties and ejected while the aircraft was rolling out of control. He landed uninjured, but the aircraft was destroyed.

This aircraft was lost because the cotter pin for the control bolt connecting the right wing aileron servo valve to the push rod was not installed, or was improperly installed. This allowed the nut to come off and the bolt to come out. The uncontrollable servo valve then caused the actuator to drive the right aileron to the full down position and keep it there, resulting in complete loss of aileron control.

To avoid ever making such a mistake as that made by the man who did the job that led to this accident, remember: If you perform maintenance on any control linkage, make the proper red cross entry in the forms. After you have completed the work to your satisfaction, have a qualified inspector inspect the work and clear the forms. ★

AEROBITS



HOW CLOSE? The FAC, in an OV-10 with a combat photographer in the back seat, was controlling a flight of two F-100s, his third for the day. He cleared the flight for random passes with each pilot to give his run-in direction, then flew from north to south, marking the target and advising the fighters to hit his smoke. He then began a left turn around the target.

The flight leader made the first pass; then the wingman called in from the west while the FAC was south of the target, heading east. The FAC saw the wingman coming from the northwest and cleared him hot, advising that he would have the FAC at 12 o'clock when he came off target. As the wingman continued his run-in the FAC again advised that he would be at 12 o'clock when the fighter came off the target. As Wing pulled off, the FAC repeated the advisory. Although both the FAC and the photographer heard acknowledgment, neither Lead nor his wingman recalls hearing the FAC's transmission.

As he came off the target, the wingman rolled left, which the FAC thought would be a left break. However, the wingman said later that he just turned to check his bombs in his mirror, then rolled back erect. When he did this the FAC called 12 o'clock, ". . . look out," and pulled back on the stick. The wingman saw the FAC and pushed over, passing under the OV-10. The trailing edge of the fiberglass fairing on top the F-100 vertical stabilizer struck one blade of the Nr 2 prop on the OV-10.

TWEET-SLIDE. There's more than one way to get the gear horn to stop blowing, as one unhappy T-37 IP learned not long ago. Arriving at destination on a cross-country flight, the student made a VOR touch and go. Then the IP took it and requested a closed pattern for another touch and go. Level on downwind, he reduced power and extended the boards. He put the gear handle down and lowered flaps as he started to turn back toward the runway. Strong wind down the runway called for more power and the IP pushed the throttles forward on a high final. Then he continued the briefing he was giving his student on landing over the barrier cable and the next pattern they would fly.

When he reduced power in the flare, the horn sounded. It was too late to take the Tweet around. They found the gear handle in the full down position after they slid to a stop and the dust had settled. But the best guess is that it was not all the way down before touchdown since the gear did not come out of the well, and the horn didn't sound because of the high power setting on final.

Now, about the gear position indicators — —

PHANTOM WHOOPEE. The F-4 student, with his instructor playing GIB, had gone through a series of chandelles and lazy eights. Then, with tanks dry, they completed a normal stab aug rig check. The ball centered with ailerons neutral. Their advanced maneuvering practice went without incident, but when they got into their first confidence maneuver, a high angle of attack rudder roll, heartbeat and respiration rate increased dramatically.

Starting with about thirty degrees of pitch, they initiated the roll as airspeed bled through 200 KCAS. One-quarter of the way through the roll they had 17 units AOA. When they were three-quarters of the way around, roll rate increased rapidly. At one and one-quarter roll the bird snap-reversed.

Although the IP attempted to obtain five to ten units, there was no apparent response to his control input. He ordered the student to deploy the chute as the nose came through the horizon, wings vertical at about 110 knots. Recovery was as advertised.

On the ground and breathing normally again, the two learned that trim pots in the autopilot control amplifier were out of adjustment. With roll aug engaged in flight the right aileron drooped one and one-half inches.

The 1 Nov 69 change to the F-4 Dash One warns about the possibility of adverse yaw when you attempt rudder reversals with roll aug engaged, producing a cross-control or pro-spin condition. Joint Manual 55-154 says to disengage the roll aug before engaging in ACT or other high angle of attack maneuvers. But the training manual for the course of instruction in which these two were engaged left roll aug optional, saying it "may" be disengaged.

Sounds like a good idea to turn off roll aug before you start high AOA maneuvers—and don't forget to turn it back on again when you're finished.

Toots

Dear Toots

It's time to spotlight another problem area that has been around a long time and represents a great hazard to personnel and equipment. Several years ago an excellent Liquid Oxygen System Tester, P/N TTU-162/E, was issued to most units possessing aircraft with liquid oxygen systems. It was designed to test liquid oxygen converters in a bench test environment after repair. However, adequate directives for the environment where it was to be used still have not been published. Directives exist on how to use it, but none explain how to service a bench test setup when all other directives prohibit servicing aircraft within 50 feet of any structure. No directive is explicit on test room construction, type of lighting (explosion proof?), type of ventilation, or the room's location in regard to other activities. It's a safe bet that, in the absence of proper standards, a lot of our test facilities are unsafe. How about helping to obtain clear-cut directives for establishing a test facility of this type?

SARGE

Dear Sarge

According to the experts at OCAMA, the LOX converter field tester, P/N TTU-162/E was designed for flexibility and will perform efficiently indoors or out. The tester is small, self-contained, compact and enclosed in a carrying case. The tester will operate as well in the back of a pickup as on a workbench. The only facility required is an area meeting the requirements of TOs 15X-1-1 and 32D2-10-46-1 (more detailed reference in para 2), a space for the tester and converter to sit in a level upright position where the converter can remain undisturbed for a two-hour stabilization period and a rack to hold the required 80 feet of one-half inch OD tubing. The authorized field level repair consists of bench testing and replacing component assemblies. There is a minimum of exposure of internal parts; therefore, the environmental requirements are less stringent than for an overhaul facility.

The use of good shop practices and observance of the precautions and instructions contained in Section V, TO 15X-1-1, 20 June 65 changed 1 December 69 and paragraph 3-4 and 4-2, TO 32D2-10-46-1, 1 February 64 will provide a satisfactory environment for testing with the TTU-162/E tester. Converters to be tested may be filled in any area approved by ground safety for the handling and use of liquid oxygen.

The TTU-162/E tester was purposely designed to be usable in a less stringent environment than that required for depot overhaul of oxygen equipment. Field level bench testing and the replacement of malfunctioning components would not be economically feasible if an elaborate facility was required at each installation.

Toots

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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.

Major

Floyd Dadisman, Jr.

44th Tactical Fighter Squadron
APO San Francisco 96288

On 16 June 1969, Major Dadisman was flying lead in an F-105F on a combat mission in Southeast Asia. At level-off, after leaving the target, a fuel check showed Lead with 6500 pounds. While Nr 2 was joining up and checking Lead for battle damage, fuel continued to decrease alarmingly, reaching 5000 pounds when the flight was still 80 miles inside hostile airspace. Knowing that, with the rate of fuel loss, he might not make friendly territory, Major Dadisman called GCI for a tanker to be vectored toward him. When the fuel was down to 3500 pounds, a rumbling explosion was felt and the engine flamed out. With emergency fuel selected, Major Dadisman got a relight but the engine would run only one or two minutes before flaming out again. Maximum speed that could be maintained was 320 knots at full military power. Fuel quantity was diminishing rapidly; meanwhile, Major Dadisman was being vectored around numerous thunderstorms toward the tanker. Since he did not have sufficient power to overtake the tanker, it orbited in a clear area so that Major Dadisman could use a cutoff angle for joinup. At hookup Major Dadisman's fuel was down to 1000 pounds. The tanker began towing the F-105, so Major Dadisman was able to throttle back, which kept the engine from flaming out. The tanker towed the fighter to within 40 miles of an alternate, where he dropped off with 11,000 pounds of fuel at 14,000 feet. As soon as power was advanced the engine flamed out, but could be restarted at 85 per cent RPM. From the dropoff point to landing, several flameouts and restarts occurred and 5000 pounds of fuel was consumed. A precautionary landing pattern was established and with continuous use of the airstart button, a successful landing was made.

Subsequent engine inspection revealed an afterburner fuel regulator valve frozen open. This prevented afterburner operation while permitting both afterburner and normal/emergency fuel scheduling, and excessive fuel consumption without an increase in power. In addition, this condition reduced the total fuel pressure available to the normal/emergency fuel control units, further limiting power available to about 85 per cent despite maximum thrust settings. Moisture in the main fuel shutoff valve cannon plug caused that valve to intermittently close, resulting in multiple engine flameouts. Major Dadisman's professional knowledge of the aircraft systems and outstanding flying skill during a serious emergency preserved a valuable aircraft and possibly saved the crew. WELL DONE! ★

RADIO OUT ?

SQUAWK

CODE

7600

THE FAA CONTROLLER'S HANDBOOK NOW CONTAINS SPECIFIC PROCEDURES TO BE USED WHEN RADIO FAILURE OCCURS AND YOU SET YOUR TRANSPONDER TO 7600. **(CHECK THE FLIP IFR SUPPLEMENT)**