AEROSPACE

SAFETY

UNITED STATES AIR FORCE

JUNE 1965

AEROSPACE SAFETY

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FALLOUT

I'VE GOT IT!

Recently I read the article "Double Your Proficiency Flying Time" by Col. Robert D. Curtis (April issue, page 25), and decided to try out the recommendations.

Immediately after lift-off, I called out from my hooded position in the rear cockpit, "I've got it!"

"The hell you have," came the voice from the Navy Captain in the front seat.

What do I do now, Colonel Curtis?

CDR Donald M. Layton, USN
USN Postgraduate School
Monterey, California

Punt?

ARE YOU A FORGETTER?

Congratulations to CMSgt Al Pitts, of Andrews AFB Transient Maintenance, for his excellent "from the shoulder" article that appeared in AEROSPACE SAFETY (March) titled "The Other Side." It is my opinion that more articles should appear in AEROSPACE SAFETY or AEROSPACE MAINTENANCE SAFETY to bring to the forefront what should be considered normal expectations of Transient Services. Any means necessary to arrive at a more complete understanding between aircrews and the Transient Services at their RON bases should be readily accepted and encouraged. I believe articles in this area should be treated with the idea of achieving this better understanding, rather than a source of complaints column. Too frequently we are invaded by the men from space who, indifferent to healthy maintenance standards, also add vexation by bringing some malignancy on the AFTO Form 781A that was incurable at the home base, in the hopes that some sympathetic soul might diagnose their case and provide a remedy. Many times the impatient jockey feels that "a minimum of time" precedent should be set on his particular air vehicle, and that the other birds on the air patch are merely decoys, and require no attention.

Then too, there are those who are used to operating at their home station with all facilities and equipment available that are required for their particular aircraft, and feel that they should be accorded the same treatment. I really don't believe that the average pilot realizes that the required facilities cannot be obtained on a short order basis. Also, in many cases, maintenance can be performed on these aircraft only because some personnel in certain skill levels are still around who were programmed in on the basis of a particular type of aircraft being assigned to the unit.

The entire subject of fewer transient services being available, as more restricted manpower controls become effective, has been thoroughly covered in a TIG Brief (28 Aug. 64). I still do not feel that this message has been received.

I have in mind a recent occurrence at my own base, where a jet aircraft arrived and the airman who was servicing it was instructed by the pilot not to open the canopy, as the aircraft was equipped with catapult seats. The pilot then left, and while fuel servicing was started the airman noted fuel spewing from

continued on page 28

THE ENEMY WITHIN

One of the most formidable military air forces in the world was partially knocked out of action last year. We, the U.S. Air Force, get credit for this "victory." We crippled a combat air force, together with much of its support air arm and many of its trained personnel. Just to give you an idea, here's a partial box score:

170 Single-engine fighters
39 Twin-engine fighters
39 Bombers

Bear in mind, this is only a partial tally. "Kills" were also recorded on trainers, cargo aircraft, helicopters, missiles, miscellaneous ground vehicles and support equipment. "Victories" were achieved both in the air and on the ground.

As could be expected, destruction of a force of this magnitude was costly. Regrettably, these victories resulted in losses of our own. Our dollar cost alone ran about a million dollars a day. Our combat capability was reduced an amount equivalent to that of the "enemy."

The ironic aspect of this situation — none of it was intentional, every bit was accidental!

I have not altered the facts. I merely reversed the normal outlook in an effort to call attention more dramatically to the tremendous Air Force loss, through accidents, during 1964.

1964 is history. There is little we can do about it, so let's concern ourselves with 1965. The outlook is encouraging. I am keenly aware of the concern of the Air Council, Air Staff and the commanders of the major commands. There can be no question that accident prevention is receiving top level backing. All the using commands, the supporting commands and industry are teamed in an effort to solve some of our most difficult problems. Recently an Air Force-Industry team visited all F-100 bases in this country and Europe. Aerospace safety project officers and engineers, an AMA representative, and a pilot and two engineers from North American made up the team. Their job, in essence, was to talk to as many pilots and maintenance personnel as possible, discuss past F-100 accidents, explain some of the F-100 problems we have been having, answer questions and suggest techniques and procedures which can make accidents less likely. Believe me, they were out also to observe and pick up any clues that might be used to make the training and tactical employment of this aircraft safer.

Here's another example of top level command concern for safety. Because of a series of unexplained C-133 accidents, the fleet essentially was grounded. Two aircraft were turned over to AFSC for extensive flight tests. Concurrently, other selected agencies were reviewing in detail prior difficulties experienced with this aircraft. It will fly again, and be safer and more reliable.

But, while these are problems receiving priority attention, we cannot neglect our normal routine precautionary measures. Let me cite a case to show what can happen if we do. An F-104 pilot, scheduled for a gunnery mission, decided to abort when warning lights came on during the takeoff roll. He retarded the throttle and pulled the drag chute handle. No chute. At first he thought he would be able to retain his external stores and still be able to stop. Then, approaching the end of the runway, he realized he was going too fast. He extended the tailhook and made a successful BAK-9 barrier engagement. The fighter stopped in 50 feet. No damage. This was merely an incident. But, let me stress the fact that often the only difference between an incident and a serious accident is degree. The reason the drag chute failed to deploy was quite simple — it had not been installed. The crew chief had failed to do his job. He had failed to perform a proper preflight but the pilot would have caught it had he made a proper walkaround inspection. All the high level interest in the world cannot eliminate or assume responsibility for carelessness of this sort.

Think about one more statistic — 911. This is the number of Air Force officers and airmen killed last year by accidents. As I pointed out earlier, there *is* tremendous team effort to clear up major trouble areas. This effort will continue. But we can never defeat our enemy within unless we wipe out carelessness and insist on professionalism at all levels in our own ranks. If we are to have a more favorable box score in 1965, this is one irrefutable requisite.

Jay T. Robbins

JAY T. ROBBINS
Brigadier General, USAF
Director of Aerospace Safety

Early in 1965, in an effort to reduce the number of F-100 aircraft accidents, a special briefing team visited all ZI and USAFE bases using this airplane. Members of this team came from the Directorate of Aerospace Safety, North American Aviation and the Sacramento Air Materiel Area. The three articles which follow were adapted from presentations by members of this team.

Save A Hundred

By Lt Col Eugene P. (Gus) Sonnenberg
Directorate of Aerospace Safety

During my tour in the Directorate of Aerospace Safety, I hope to achieve a personal safety goal. I want to save one F-100 and one pilot who might otherwise be lost in an accident. This may seem modest for four years work, but remember, this saving comes to a million dollars and pays my salary for almost 70 years.

I hope to make some progress toward this goal by showing you fighter pilots how some F-100 accidents and incidents occurred and by doing so, alert you to areas that are very worthy of caution. Incidentally, if there are some pilots present who fly other than the F-100 I invite you to stick around; some of the suggestions apply across the board to all fighters.

First, a quick look at the F-100 record:

MAJOR ACCIDENTS

1962	65
1963	52
1964	47

What causes accidents?

Pilots cause some of them, usually because they exceed their limitations or those of the aircraft, or because they are inadequately prepared for an emergency.

About the Author Lt Col Eugene P. (Gus) Sonnenberg, F-100 project officer, has had outstanding careers both as a Naval aviator and Air Force pilot.

As a WWII Navy dive bomber pilot, he had an impressive record in sinking enemy ships and destroying aircraft both in the air and on the ground.

As an Air Force pilot during the Korean conflict he flew 100 close air support missions in Republic F-84's. He subsequently became an Air Force experimental test pilot, test flying the F-84F, F-86H, F-100, F-104 and F-107, also French and Italian fighter planes. He won the Thompson Trophy Race in 1954 to set a 100 km. closed course record in a North American F-86H Sabrejet.

Pilot fatalities in the F-100 are somewhat higher than the USAF rate, which is about 2.0. What follows has been said many times but bears repeating:

- Rehearse your ejection procedures on the simulator and do this while wearing *all* of your flying equipment, especially your gloves. Practice timing so you will know exactly how much time it takes YOU to eject.
- Know your personal equipment. Knowing how to release the chute is *vital* for ejecting over water or in high winds.
- Select exact limits for specific emergencies and stick with them. For example: No more airstarts after 3000, EJECT! Uncontrolled flight at 10,000, EJECT!

Flight control malfunctions and uncontrolled flight conditions such as spins are insidious – spins because the pilot may believe his aircraft is just about ready to recover and he will stay with it too long, trying. With a flight control malfunction, warning lights normally DO NOT COME ON. Nor are there any other danger signals. It is only rarely that the malfunction of the flight control system has a warning light or instrument danger signal, since most malfunctions are mechanical. Personal experience, during a horizontal stabilator disconnect, convinced me that a pilot has a tendency to delay ejection far too long while experimenting – perhaps even momentarily disregarding altitude. For years, when I pulled the stick back the nose always came up. Now I was getting no result but I kept moving the stick fore and aft and trimmed. I didn't get out right away. Had I been at a lower altitude, I'm sure this would have been fatal.

Materiel failure is another major accident cause. In the same breath I want to add that maintenance error enters here; it is most difficult to determine, from accident debris, whether a component failed because it exceeded design limitations or from improper installation or adjustment. I have been making a very strong appeal to the maintenance people and point out that the moments they steal from a task can cause a pilot's death.

From an analysis of F-100 accident and incident reports, all of which come across my desk, the doors that will most likely lead to accident prevention in the F-100 are plainly marked in big black letters: FLIGHT CONTROL MAINTENANCE and PILOT FACTOR. In the three-year period ending in 1964 there was a total of 53 accidents that were traced to or suspected to be caused by malfunctions of the flight controls or to pilot factor. Let's break these into common groupings.

Five pitch-up accidents on takeoff. In four of the accidents we lost the pilots. In the fifth, both pilots ejected from an F and were available to give valuable testimony to the accident board. From them we learned what happened. As the pilot pulled back on the stick the nose came up prematurely, as though the pilot in the rear seat had pulled the stick back and was holding it. The pilot pushed forward but by that time the aircraft had pitched up to about 150 feet. He couldn't regain control. Both pilots ejected successfully. The exact malfunction in the flight control system was never pinpointed; however, had the pilots not escaped, very likely this accident could have been given a most probable cause tag of pilot factor since it looked exactly the same as others that have happened. This type accident can result from a malfunction, also from a pilots' pulling his aircraft off prematurely.

We have had five pitch-up accidents on base leg and on the turn to final for landing. In one the pilot punched out successfully and reported that the control reactions were similar to pitch-up on takeoff. The stick came back in his lap and at 150 knots he went out.

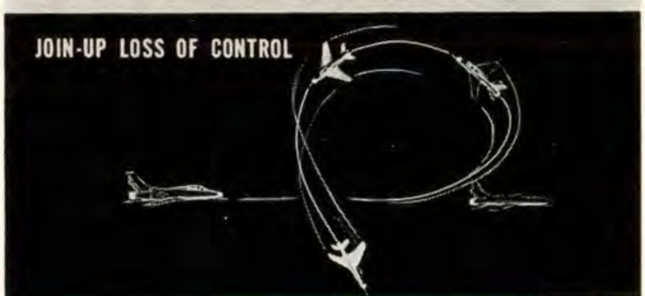
Earlier a similar case occurred but the pilot felt that he was regaining control. He brought the bird in. Investigation of this incident revealed many minor discrepancies in the flight control system but none to definitely isolate the cause. This incident was incompletely investigated – had a thorough analysis of the aircraft been made, possibly a cause factor could have been isolated.

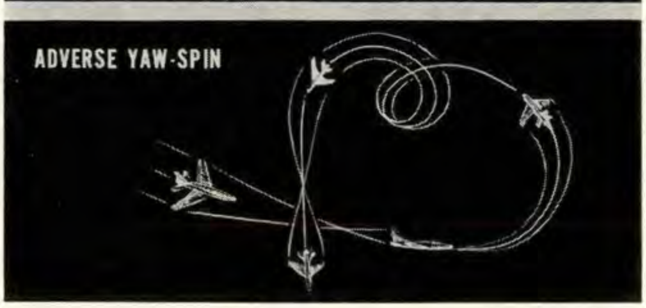
The next group we classify as join-up loss of control. Three recent accidents of this type followed the same pattern. Approach to the formation was being made from the rear and the aircraft went into a barrel roll type maneuver, culminating in loss of control. No pilots have recovered from these accidents. However, two years ago an incident of this type was traced to a faulty engage switch in the autopilot system which permitted the autopilot to take over momentarily.

Another category we classify as pull-up off target. This type accident involves passing over the target, initiating the climb then getting a rapid pitch-up. This can be caused by a malfunction of flight controls, of course, and also by pulling too hard and turning too soon, getting a very high angle of attack and stalling the bird. A definite cause factor for this type of accident has never been established.

Pitch-roll on the gunnery range is another accident category. Normally, this type is attributed to pilot factor. The maneuver itself is relatively simple, permits error, and yet we have lost three airplanes in the turn from base to final in the last three years, and we've lost two in the final turn to the high angle delivery.

The most puzzling of these is the loss of control during turn to base leg for strafing or napalm delivery.





I believe this is a pilot factor-adverse yaw situation. I flew the gunnery pattern several times not long ago and found pilots were normally pulling as much as 4G in this turn. If you pull slightly more than 4G in this turn, throw in some trailing winds and have a heavily loaded bird, you can get into trouble. Just remember, if you are overshooting the turn to final, don't try to salvage the bad pass. To determine all the unsafe parameters in the gunnery patterns, North American Aviation is going to be asked to evaluate the pattern speeds with various common loads.

In the past 10 years we have lost more than 50 F-100's due to spin and adverse yaw. The majority of these accidents have occurred during Air Combat Maneuvers (ACM). These losses should be inducement enough for us to respect anything which might lead to this type flight condition. Even relatively minor flight control discrepancies must not be treated lightly. You must report all of these discrepancies and the corrective action taken. At one base I observed an autopilot check that was — well, I'll call it a little strange. Since the autopilot wasn't to be used, the bird was accepted. It should have been turned down. Further, report and repair those aircraft that exhibit out-of-rig flying characteristics.

There's another category, hard to evaluate exactly, but certainly suspect over the years, and that's the accident that stems from pressing the target. Pilots working for good scores can be tempted to press a little too close, then not always get out. There have been some adjustments made in weapons delivery techniques and we believe that problem has been solved, insofar as technique is concerned. So much for the accidents.

Here is something else I believe to be of great significance. During the past three years we have had 158 flight control incidents reported. These included all manner of gyrations, including pitch-down, pitch-up, roll, yaw — and all were due to flight control or autopilot malfunctions. In many cases these incidents would have been accidents had they occurred at low altitude or had it not been for the skill of the pilots in handling the emergencies.

To isolate a flight control problem, if one exists, North American Aviation has a contract to instrument and flight test four F-100's. These airplanes will be analyzed from nose to tail, component by component, to include all the bits and pieces of the flight control autopilot system. They are to determine how much deterioration we have had during the past 10 years. Also, as a part of this test, we are going to run flight tests and try to duplicate the various malfunctions we have experienced: bent bungees, sticky slats, runaway trim. We want to find out how much latitude a pilot has when these emergencies occur.

In the meantime, one thing all pilots can do is to make detailed write-ups of all discrepancies, particularly flight control discrepancies. Often a pilot's write-up at the conclusion of a flight is known to be well merited, but no deviation from normal can be detected by maintenance personnel. If this happens, and if the maintenance people have completed the SMAMA flight control checklist, then call SMAMA for help. In cases of this kind, a team from North American Aviation, SMAMA and the Directorate of Aerospace Safety will respond whenever and wherever possible.

No stone is being left unturned by Aerospace Safety, North American Aviation or SMAMA to ferret out a problem in the control system if it exists, in an effort to make your flying safer. My suggestions are:

- Don't exceed your limits.
- Don't exceed the airplane's limits.
- Report, accurately, all discrepancies.
- If you still have problems, don't just live with them — call for help.
- When you are faced with an ejection situation due to a major flight control malfunction, such as a disconnect, don't hesitate. BAIL OUT! (And about the bailout: decide ahead of time what your altitude limits are and when they are reached — if things aren't under control, "Sayonara, G.I.") ★

F-100 Flight Control System

By Kenneth Pratt
Sacramento Air Materiel Area

Mr. Pratt is F-100 Supervisory Maintenance Support officer, Sacramento Air Materiel Area. Many of his comments apply to other aircraft as well as the '100. Mr. Pratt has been associated with the F-100 since it was first selected for the Air Force inventory and is considered one of the most knowledgeable men in the maintenance and engineering fields.

The importance of thorough preflight inspections cannot be over-emphasized. These checks should not be made unduly time-consuming, but must be complete since each step is intended to check a different feature of system operation. Most pilots and maintenance people who have been in the business a long time realize that the little things can make the difference between success and failure. For example, *reading* a gage instead of just glancing at it to see if everything is in the green; bleeding the air from the hydraulic system instead of merely adding more fluid.

Our experience indicates that a fertile area for improvement may be during the after-start checks. These checks involve the interpretation of various important indications. Know your systems and you will recognize a sick bird. The important thing to remember is that a thorough knowledge of the system and a few extra seconds spent during the preflight may prevent serious trouble during the flight.

When you have an inflight malfunction, the postflight inspection is where the pilot and maintenance team effort should start. Prior to engine shutdown is the best time for a pilot to explain or demonstrate the exact nature of an unusual discrepancy. Quite often the demonstration of a defect will provide motivation to the maintenance team. Such motivation might otherwise be lacking if the defect is not apparent during a later check.

The debriefing must also be a team effort and pilots should be afforded a debriefing that includes a member of each affected specialist branch. This will assure that the program is understood, and that all pertinent factors are recorded.

Pilot write-ups have been the subject of much criticism. Some of this is undoubtedly warranted, but frequently there can be more than one meaning attached to the same words by different individuals. Therefore, the responsibility for usable form entries must again be a team effort. The elimination of vague or ambiguous phrases and inadequate descriptions can only be accomplished through coordinated effort by both pilots and maintenance personnel.

TESTS PROGRAMMED

A program was recently contracted to North American Aviation to evaluate the condition of the F-100 flight control systems. Four aircraft will be used in the investigation: two D's, one F and one C. The airplanes will first be instrumented and flown to obtain basic performance data. Systems test will then be conducted and will include an evaluation, using a stick force recorder. The new recorder charts will then be compared to original factory recordings to determine the extent of system deterioration. There will also be new tooling developed to measure free play between the stick or rudder pedals and the control surfaces, and free play limits will be established.

When all components have been renewed, or checked OK, the aircraft will again be ground-checked and flight tested. The results of this investigation will then be applied to our F-100 heavy maintenance program and should enable the flight control systems to adequately perform throughout their extended service life.

A malfunction simulation phase will also be included in the investigation for the purpose of evaluating the effects of various types of failures. It is hoped that this phase of the investigation may shed some light on recent accidents that have apparently involved failures of an unknown nature in the flight control systems.

In conclusion, 1964 was the safest F-100 year. 1965 is up to YOU! ★

Be An Old Smoothie

By Robert A. (Bob) Hoover
Manager, Customer Relations
L.A. Division
North American Aviation, Inc.

Mr. Hoover is one of the foremost aerial maneuver demonstration pilots. He has specialized in exhibiting maximum performance capability of F-86 and F-100 aircraft. A WWII fighter pilot, Mr. Hoover is a graduate of both Air Force and Navy test pilot schools.

I can remember when the measure of a pilot's skill was how tight he could crank the bird around the traffic pattern. When he became sharp enough he would peel up right from the deck, holding the maximum number of G and not touching the throttle until ready to clear the runway.

We lost a lot of pilots with that technique. Of course, we had the excuse that we could get it on the ground if the engine quit. I don't think we ever lost many airplanes due to engine failures at this stage of the mission, but we sure lost a lot due to this exacting traffic pattern.

We began to wisen up when we moved into the century series aircraft. Our wing loadings were much higher than we had ever experienced and because of the swept wing we encountered high angle of attack problems not evident with earlier aircraft.

The patterns you are now flying are the result of a lot of research. From what I have observed, pilots

now try to fly the traffic pattern with controlled speeds. You simply can't get too good at flying traffic patterns. Flying the airspeed accurately and really sticking with it will consistently put you on the touchdown point at the right airspeed. It's worth recalling that, for each additional 10 knots of airspeed on touchdown you can expect another 1000 feet of ground roll. For my part, it's comforting to come into a 7000-foot runway when you know you've got speed control and know you can consistently hit that touchdown point. You need your utmost skill going for you when it's a dark rainy night with a 7000-foot runway and you wonder if this might be the time the drag chute fails.

It's important to control airspeed throughout the traffic pattern, especially when we consider that as we crank the bird into a bank the stalling speed goes up. True, we learned this a long time ago, but let's consider another input — G's. I've flown with pilots who pull a bit more G than I like to see in the traffic patterns. Once you tighten the turn, the stalling speed runs way up and the recommended pattern speeds are no longer acceptable.

The speeds that are recommended are based on holding approximately one G flight. I am sure that some of our past accidents can be attributed to this problem of pulling excessive G. The exact same problem exists in the gunnery pattern. With abrupt excessive G you can go right through all the stall warning signals to an accelerated stall condition.

Let me explain some of the basics of what happens to a high performance airplane like the F-100 when you try to exceed its stable flight design limits. We'll start with adverse yaw. Any airplane that has ailerons is subject to adverse yaw. When you start a turn the nose has a tendency to move opposite to the direction of desired turn. Turn on your gunsight, align it with a spot on the horizon and start a turn—you'll see what I mean. When are you most likely to encounter adverse yaw? When flying at slow speeds and high angles of attack and pulling G, as in the traffic pattern or at high altitudes during ACM.

There is no need to fear adverse yaw, or any other abnormal flight situation. I think this is a most honest airplane. When we tested it originally I couldn't get it to go out of control. I really worked and worked. It was weeks before I could set up a condition that would make the airplane do something it didn't want to do in the first place. I stalled the airplane in every possible attitude: straight up, slid it backwards on its tail, racked it into tight turns, and attempted to enter spins. All I had to do to stop it from whatever condition I had forced it into was to neutralize the controls and the bird would weather vane itself out and start flying again. That's in your flight handbook.

For spin recovery there is a certain technique, but before you apply this technique, you ought to really know whether you are spinning or not. You can tell. Just let go of the controls and if the airplane is definitely rotating then you know you are starting in to a spin. Also, always check your airspeed. Airspeed will be pretty slow if you are spinning. If you've got plenty of airspeed you are in a spiral. Neutralize controls and the bird will fly right out. If you are in a spiral but think you are in a spin and use spin recovery technique—stick all the way back, rudder opposite the rotation and aileron with—all you are going to do is force the airplane to continue the spiral.

So-o-o-o, the procedure is: check the airspeed to determine whether you are spinning or spiraling. If spiraling, neutralize; if spinning, use the handbook procedure. You'll be out in approximately two turns.

In the early days of the F-100 we considered clap-trapping the bird with warning devices—stick shakers, and the like—but we decided, after evaluation by company and Air Force pilots, that such devices are not needed. When the wingtips stall and the nose wants to drop — RELAX! Neutralize the controls and you'll be flying again, altitude permitting, of course. Bear in mind that your ailerons are the most effective controls. Don't try to force the bird on through with use of ailerons. If you are pulling through a maneuver and she starts to protest, don't use ailerons—use rudder and let it come right on through. It's just amazing how the airplane will always end up pointed downhill and building up airspeed if you just stay off the ailerons.

In all my tests of the F-100 I found one uncontrollable condition —the flat spin. At a high angle of attack I got the airspeed down to about 110 knots, then, stick all the way back, I slammed in full cross control—right rudder and left aileron. On that particular occasion I was able to get the airplane into a flat spin. I had to hold this control configuration for three turns for the test requirements and when I went through the recovery technique I couldn't recover. I used every technique we thought might help, including an attempt to light the burner, but was unsuccessful and I had to leave it 22 turns later. Of course, that time we were still experimenting with the best techniques for recovery.

Let's sum up spin recovery—just in case you should manage to force the plane into one. Do as the book says, and I stress this, no matter what type of spin you are in: stick back, ailerons with and opposite rudder. Don't think of anything else. Sit there and hold that. Also, remember never to play with any uncontrollable situation below 10,000 feet. Eject!

In conclusion, I have spent considerable time discussing the worst situation you might be able to get into in the F-100. If you fly it like it should be flown, don't suck it in abruptly in the pattern, don't slam the controls around—especially aileron, don't try to force it through a maneuver when it's protesting, you'll have no trouble.

Every time I fly I have the personal goal of trying to do a little bit better. I try to keep that ball in the center at all times. I know that the smoother I can handle the controls the more performance I can expect. I can fly it faster, or slower, or more precisely through an intricate maneuver. If you want to get the most out of your F-100, or any other airplane for that matter, be an old smoothie. ★

WHO'S IN CHARGE HERE?

Lt Col James S. Keel, Directorate of Aerospace Safety

The title for this story was taken from an excellent article published in a recent issue of a major air command safety magazine. Many accidents and near accidents were cited, all pointing to one conclusion: An aircrew is "a bunch of guys with different skills driving an airplane." But the hooker is, "LED BY ONE MAN WHO IS IN CHARGE." The obvious inference is that, what can be a "bunch" driving the machine, can become, with proper leadership, a well-coordinated group, highly trained and motivated for their profession, working under the command of one man toward a common goal.

The goal for the transport mission of the Air Force is moving the airplane with passengers or cargo from point to point. But here is another hooker. *The key to success is doing the job without busting someone or something.*

A recent minor accident involving a four-engine transport is an example of how a compound emergency resulted in a breakdown of command and control.

The aircraft, with crew of nine and three passengers, departed a Pacific island base for the West Coast with approximately 23,000 pounds of cargo which consisted of 463L aluminum pallets and nets. At 9000 feet, shortly after passing ETP, with the second engineer at the panel and the aircraft commander in the left seat, a zero ampere-zero volt condition was noted on Nr 3 generator. Since an overheat condition was not indicated, the aircraft commander directed a physical check of the generator.

In consideration for the lesser experience of the second engineer, the first engineer elected to check the generator. He proceeded through the right wing crawlway to the Nr 3 nacelle where he found the generator loose and wobbling erratically. The decision was to remove the generator, which necessitated engine shutdown. This operation consumed slightly over an hour. (For those not familiar with this frequent requirement, it's cold, it's dark, the noise level is tremendous because of wind blast, space is confining. When flight engineers are directed to remove generators during flight, they undoubtedly reflect on the attempts that have been made over the past 14 years to design and install a flight-deck-operated generator disconnect device—one that would eliminate the difficult task of going through the crawlway to the nacelle and physically removing the generator to prevent fire.)

After the failed generator was removed, the engine was restarted and the first engineer went back to the flight deck. While climbing the crew ladder, he noticed a momentary loss of cabin lights with immediate recovery to full intensity. Meanwhile, anticipating a complete loss of electrical power, the second engineer, at the panel, without coordinating with the aircraft commander, split the bus, started the GTU and brought it on the line. This caused loss of essential bus operation for about 30 seconds. The effect was complete loss of pilot's instrumentation and lighting, necessitating use of flashlights. Immediately thereafter, a zero ampere-zero volt condition was noted for the Nr 2 generator. Another check by the first engineer, this time to the left wing and Nr 2 nacelle. He found the same condition — the generator loose and wobbling erratically. Identical problem—identical decision!

Number 2 engine was shut down for generator removal. The fire control lever was used for engine shutdown, but instead of the prop going to full feather, it began windmilling counter-clockwise. The second engineer could not stop the windmill by using the manual prop control, and the first engineer returned to the flight deck to assist. Just as he arrived at the panel, Nr 3 engine surged to 2600 rpm with zero torque and zero fuel flow indicated. The first engineer traded seats with the second engineer. The aircraft commander called for METO power on one and four and directed that efforts be continued to restart either two or three. As altitude could not be maintained on two engines, descent was begun and Airways was contacted for intercept. Airspeed was reduced to 130 knots, 10 degrees of flaps were lowered, and the aircraft commander directed the loadmaster to jettison cargo.

The elevator platform with about 5500 pounds of cargo, including 44 pounds of registered mail, was immediately jettisoned. Altitude at this time was 8000 feet. The cargo hoists could not be used because of the possibility of overloading the aircraft electrical system, therefore, all aircrew members (except the aircraft commander, first engineer and navigator) and passengers manually dropped cargo on the closed elevator doors. The load was then salvoed by opening and closing the doors. On the third salvo, a piece of cargo lodged against the rear elevator bulkhead and was held flat in this position by the slipstream. This caused a speed brake effect with light to moderate aircraft buffeting. Attempts to dislodge the piece of cargo were unsuccessful until another piece was dropped which caused both to fall free. These pieces struck and caused extensive damage to the area behind the bulkhead. The dislodged piece rolled beneath the right underside of the aircraft, narrowly missing the right stabilizer, but causing numerous tears in the aircraft skin.

While the cargo was being jettisoned, the first engineer made several unsuccessful attempts to restart Nr 3 engine; the propeller was finally feathered to reduce drag. He then discovered the fire control lever for the Nr 2 engine in the aft position which had prevented the second engineer from previously feathering the Nr 2 propeller with manual control. Consequently, by placing the fire control lever in the off position, prop control was regained for Nr 2 and it was restarted and placed back in normal operation. Altitude at this time was 5300 feet. Since the aircraft was on three engines instead of two and altitude and airspeed could be maintained, the aircraft commander directed the loadmaster to cease jettisoning. This was relayed by the second engineer who was now on interphone in the cargo compartment. Due to the noise level he was unable to get the message to the loadmaster, so he resorted to a hand signal, indicating a cutting motion across his throat. The loadmaster interpreted this as a ditching signal and began ditching preparations. Continued efforts by the second engineer led to correct interpretation by the loadmaster and jettisoning was discontinued. By this time, about 12,000 pounds of cargo had been jettisoned. Nr 3 engine was then restarted, and, with the aircraft again on four engines, climb was made to 7000 feet. Airspeed was maintained at 160 knots to prevent further damage to the aircraft structure; successful intercept was made and the aircraft continued to an uneventful landing at its destination.

Significant findings by the investigating board were:

- The primary cause was attributed to the second engineer who did not follow his engine failure checklist, which in turn compounded the emergency and delayed engine restart at a critical time.
- There were many contributing causes assessed; primarily, the aircraft commander did not insure that the engine failure check list had been completed, information on jettisoning is not adequate in the Dash Nine T.O., and maintenance inspection of generator mount bolt torque is not sufficient to provide timely detection of failed or failing generator studs.

The *simple* lesson to be learned from this accident is quite obvious. The second engineer failed to complete his engine failure check list after he used the fire control lever to shut down the Nr 2 engine. Repositioning the lever to the off position is an item on the checklist; such action was an absolute necessity in this instance since the corresponding prop selector on the manual prop control quadrant is automatically disengaged until the fire control lever is returned to its normal off position.

But, what about the *complex* lesson? What about the distraction factor when the scanner advised that the Nr 2 prop was windmilling backwards, which caused the engineer to divert his attention from the checklist? What made him attempt to control the counter-rotating prop with an inoperative control which he had de-energized with the fire control lever? Was his training a factor? Was his lack of experience a factor? These certainly enter the picture. Regardless, the emergency was compounded at this point. Why didn't the aircraft commander insure that the checklist had been completed? What caused the Nr 3 engine to surge and quit?

First, it is rather obvious that, during the sequence of events that led to this accident, the man driving the machine had his hands full. He, too, was most assuredly in a situation that was distracting to say the least. Secondly, the board found that just prior to the time Nr 3 surged, fuel transfer was in progress. Moreover, carburetor icing could not be ruled out as a possibility. But the reason for zero fuel pressure, which caused Nr 3 to quit, could not be determined.

In conclusion, the investigation of this accident brought out that positive overall crew control and coordination were deficient. There were times when the aircraft commander could not obtain information and/or was not aware of events as they developed.

Returning to the title of this episode, "Who's In Charge Here?" put yourself in the left seat, at the panel, or out in the nacelle during this particular mission. With the advantage of "Monday Quarterbacking," could this happen to you? Could you have prevented it? Would you have fared as well? Or, would the next day's headlines read:

"LARGE MILITARY TRANSPORT DOWN AT SEA – 12 ABOARD–NO SURVIVORS!" ★

Those Shifty Flows of Fuel

An expert from MOAMA explains unscheduled fuel flow shifts in the F-105 and what really happens when "emergency fuel" is selected.

By Ross J. Lindsey, Equipment Specialist, F-105 Tech Services Br., MOAMA, Brookley AFB, Ala

Unscheduled shifts in fuel flow and lack of throttle response, as every pilot and maintenance man knows, are about as welcome as the German Measles on the eve of a wedding. Shift magnitude can vary in intensity from a gentle rocking chair effect to a kick in the posterior that would do credit to a Missouri Mule, and range from little or no indication on engine support instruments to clocking of fuel flow indicator, rapid loss of exhaust gas temperature, engine pressure ratio, RPM unwinding, and in some cases complete engine flameout.

There are several possible causes for symptoms of unscheduled fuel flow shifts, some of which are improper maintenance, power lever management, fuel management, gun fire, aircraft fuel system malfunction, J.C. maneuvers, etc. However, comment will be restricted to events directly related to the fuel control.

In early 1963 a joint Air Force-Industry F-105 Flameout Team was formed to gain on-site knowledge of reported engine fuel control malfunctions. The first efforts of this team were in USAFE during January 1963 to investigate repeated instances of inflight unscheduled fuel flow shifts. By improvising test equipment, a condition could be induced which caused fueling through both normal and emergency systems of the fuel control in an intermittent random frequency during block test operation of the engine. Shuttling of the fuel transfer valve resulted in fuel flow fluctuation of up to 2500 pph, compressor discharge pressure fluctuation of up to 2.5 psi, small fluctuation of EGT and approximately 10 per cent fluctuation in N-2 compressor speed. Engine instability was very similar in nature and magnitude to that experienced in flight. Reducing replacement interval of the fuel control servo filters materially aided in a sharp reduction of reported inflight unscheduled fuel flow shifts.

TEST PROGRAM

Of more lasting significance, team findings emphasized the requirement for a full scale engine test program. Subsequent engine contractor tests demonstrated that air ingestion, fuel flow interruptions at the fuel pump inlet, or excessive pressure drop across the servo filter, could cause the servo filter bypass valve to open, permitting trapped dirt particles from the filter chamber to enter and contaminate the computing (normal) system of the fuel control. It was further demonstrated that these dirt particles could cause hung starts, lack of throttle response and unscheduled fuel flow shifts similar to those reported. Of considerable significance is that, although several fuel controls returned for investigation did not repeat the reported malfunction on the test bench, they did display evidence of foreign object contamination in the computing side of the fuel control. Consequently, the engine contractors' development efforts were directed toward providing a fuel control more tolerant of fuel system contamination. Work in the fuel control program has produced specific revisions to the control to provide a measure of tolerance to contamination. Changes consist of improved servo system structures, redesigned lever and linkage systems, internal stand pipes and improved filtration. The combined programs have culminated in "Project Slow Stop," the current F-105/J75 fuel control exchange program.

While scheduled modifications will vastly improve one of the more reliable fuel controls on one century series aircraft, let there be little doubt regarding design changes as a panacea for unscheduled fuel flow shifts. Like certain aspects of life, the possibility of an unscheduled fuel flow shift will remain.

EMERGENCY SYSTEM

Recent accidents and incidents have focused attention on reluctance of some pilots to use the emergency fuel control system. One major accident and pilot fatality was charged to lack of throttle response and Dash One deficiency in that the Flight Manual did not, at that time, provide information on procedures to be accomplished with a "hung RPM" condition. Repeated instances have occurred wherein an unscheduled fuel flow shift has been experienced, and selection of emergency fuel system resulted in normal operation; then the pilot elected to again select normal fuel system and experienced a second unscheduled fuel flow shift. Perhaps a lack of understanding of fuel control operation has contributed to reluctance to use the emergency fuel control system.

The F-105/J75 fuel control unit incorporates both the normal and emergency fuel control systems. During normal operation there are five signal inputs consisting of N-2 compressor speed, power lever angle (throttle position), burner can pressure, compressor inlet temperature and pressure. These signals are received by the normal (computing) side of the fuel control and, as a function of various servo positions, regulate fuel flow to the engine combustion chambers, relieving the pilot of responsibility for closely monitoring engine support instruments. The normal side of the fuel control also adjusts fuel flow for altitude changes for a given throttle setting, schedules fuel flow to protect the engine from overspeed, overtemperature conditions and compressor stalls during rapid acceleration and decelerations. As with all relatively sophisticated, close-tolerance mechanisms, the computing side of the fuel control is very susceptible to contamination and reacts in a manner that results in hung starts, unscheduled fuel flow shifts, lack of throttle response and overfueling. Hence, the emergency (preferably alternate) fuel control system. During operation in the emergency system, the normal side of the fuel control is inoperative and fuel flow is metered by the throttle valve which is mechanically linked to the throttle. Since the emergency system does not offer the automatic overspeed, overtemperature, flameout and compressor stall prevention features of the normal (computing) side of the fuel control, reasonable precaution should be exercised during throttle manipulation when operating in the emergency system.

The writer hesitates to comment on matters of a psychological nature; however, the impact of the word EMERGENCY may well be a major cause in creating reluctance toward use of this system. Possibly, if the systems were labelled NORMAL and ALTERNATE or AUTOMATIC and MANUAL, pilots of fighter aircraft would more readily use the secondary system.

There is one known condition causing slight fuel flow surges that should not be considered an abnormality. Pressurizing and dump valve discharge flow is unstable in the 3000 to 4000 pph flow range, as a result of secondary fuel cutting in and out. The exact fuel flow at which fluctuation occurs varies from one aircraft-engine combination to another. However, for a given installation fluctuation will occur only over a relatively small flow range, requiring only slight throttle movement for elimination.

Our story? In the unlikely event that unscheduled fuel flow shift, flameout, lack of throttle response or overfueling are experienced and selection of emergency fuel system results in normal engine operation, leave it there. The place for trouble shooting, investigation and evaluation is on terra firma or during special flight test programs. ★

Air Force Secretary Eugene M. Zuckert congratulates Maj William R. Wood, of the Military Air Transport Service for achieving a phenomenal individual safety record of 20,000 accident-free flying hours. Major Wood, who is assigned to MATS 1405th Aeromedical Transport Wing, Scott AFB, Ill., has flown more than 19 different types of aircraft without an accident since his first Air Force flight in 1942. General Howell M. Estes, Jr., (left), MATS Commander participated in the ceremony.

The PRECISION

Every pilot is familiar with the two types of precision approaches: Precision Approach Radar (PAR) and ILS. They are designed to enable a pilot to fly his aircraft to within close proximity of the runway and permit landing during minimal weather conditions. Since PAR provides an approach path for alignment and descent of an aircraft on final approach to a runway, exact guidance information is essential in both the vertical and horizontal planes. Basically, PAR serves the same purpose as an ILS, except the guidance information is presented to the pilot through aural instead of visual means.

The similarity between PAR and ILS does not end there. The PAR scope (military) has a logarithmic presentation which gives more expansion and supposedly more accuracy as the aircraft gets closer to the runway. The ILS does the same – increases in accuracy closer to the runway. For example, a one dot displacement of the glide slope indicator at one mile from touchdown represents approximately 100 feet above/below glide path! Our PAR indicators present the same accuracy on the scope as the ILS cross pointers do to the pilot in the cockpit.

We are now approaching the sole purpose of this article. What does accuracy mean to you as a pilot, instructor pilot, or stan/eval pilot? How would you use accurate information on a PAR approach? For example, suppose you were told, "150 FEET BELOW GLIDE PATH, ADJUST RATE OF DESCENT, FOUR MILES FROM TOUCHDOWN." Using this example, what adjustment would you make on the attitude gyro? What is your position in relation to the lower safe limit?

First, we will start with accuracy using the PAR indicator. The PAR controller can detect a plus or minus 20 feet deviation in the elevation scan. Immediately, we must throw out the 5, 10, and 15 feet deviations from glide path, especially when those deviations are more than one mile from touchdown. Azimuth deviations from the PAR "on course" can be recognized at approximately plus or minus 50 feet at best. Second, we will look at the ILS. Remember, a deviation the width of your ILS slope indicator needle at four miles would be approximately plus or minus 20 feet. A course deviation of one dot left or right at four miles from touchdown could place you at least 600 feet from the ILS "on course."

Flying the PAR final approach should be almost identical to the procedures for the ILS. Corrections for glide path and course deviations should become smaller as you near the runway. If you should receive a call of 200 feet above or below glide path at five miles from touchdown how would you make the correction to return to the glide slope? The instrument flying manual (AFM 51-37) does not give a quantitative answer. I think your corrections should be basically as stated on pages 8-3 and 8-4 in AFM 51-37. If you are 200 feet off the glide slope at five miles, your pitch attitude change should not exceed a 400 feet per minute vertical velocity change. I believe most pilots would have a tendency to overcorrect the first few times they receive a 200-foot deviation from glide slope. If a 200-foot deviation at five miles was called on a PAR approach, a pilot performing his annual instrument check would probably fail. On an ILS approach he would pass, even though the deviation from

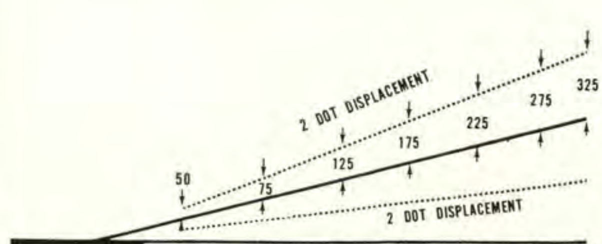
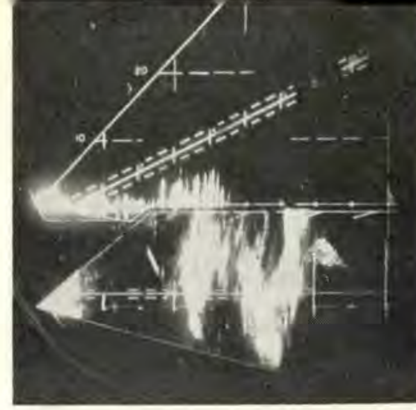


FIG. 1

Fig. 1 shows the two-dot displacement from ILS glide slope —these distances coincide with the PAR elevation safety zone limits. Fig. 2 shows one-dot azimuth displacement. Fig. 3 diagrams the PAR azimuth safety zone.

APPROACH



By Capt Bernard F. Albers, 1866 Facility Checking Flight, Scott AFB, Illinois

glide slope may be the same 200 feet at five miles. (Reference pages 33 and 43 of AFM 60-33 for an example.)

Look at this another way. You are three miles from touchdown on the front course of a good ILS system, your glide slope indicator is on the top dot in the ID-249. How far below glide slope are you? In addition, your course deviation indicator is one dot to the right. How far left of course are you? Answers can only be approximate; however, you are at least 150 feet below glide path and 500 feet left of course. Given this same position on a PAR approach you should have received "IF RUNWAY NOT IN SIGHT, CLIMB IMMEDIATELY AND MAINTAIN . . . " The missed approach instructions would be issued because you are at or have exceeded the PAR lower elevation limits and you are approaching the azimuth safety limits! Suppose this had been a check ride, executing an ILS you were within the grading limits; if on PAR you have exceeded vertical limits three times the allowable distance.

It is important that you, as a pilot, understand the information given to you during these precision approaches. First, we'll cover the PAR and ILS elevation information presentation. A two dot displacement on your ILS glide slope indicator will give the approximate deviations in feet from the glide slope as shown in Fig. 1. The two dot ILS deviations are the same as the PAR elevation safety zone limits. Second, the azimuth information with a 10,000-foot runway using a one dot displacement is approximately as shown in Fig. 2. The PAR azimuth safety zone is shown in Fig. 3. If you exceed the azimuth safety zone limits the radar controller must issue missed approach instructions.

Now as to *why* this article was written. This is the quickest way to tell you that our military air traffic controllers are trying to call deviations from *glide slope* and *on course* more accurately. As we approach the realization of this goal, we will be calling larger deviations more exactly, especially from glide slope. The larger deviations from glide slope, especially those over 50 feet, will require many changes in grading criteria by stan/eval personnel. The deviations will also require some changes in mental calculations by the pilot! Changes in aircraft pitch attitude should remain small.

Why should we change our present technique and insist on greater accuracy? First, it is not possible for a controller to accurately detect 5- and 10-foot deviations. More likely, such deviations range from 20 to 40 feet and should be called as such. Second, there are some pilots who fly aircraft with final approach speeds of about 200 knots. If they are to make the best use of a wet runway during low ceilings and visibility, a plus 25 feet at one half mile can mean up to 1500 feet less usable runway because of an extended touchdown point.

Third, accurate deviations given to the pilot beyond three miles from touchdown will better enable him to determine the best rate of descent in order for him to maintain the glide slope.

This review and analysis of the precision approach and improvement in our technique is one of the continuing steps taken by AFCS to improve the service to you, the users. ★

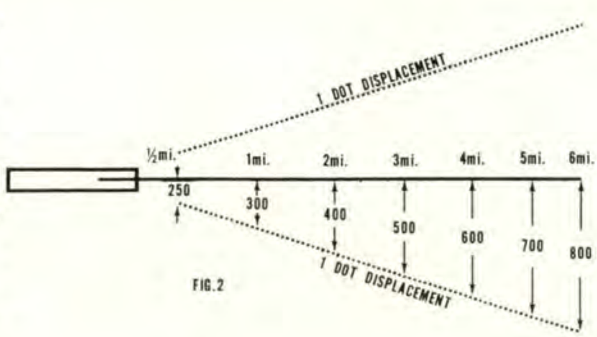


FIG.2

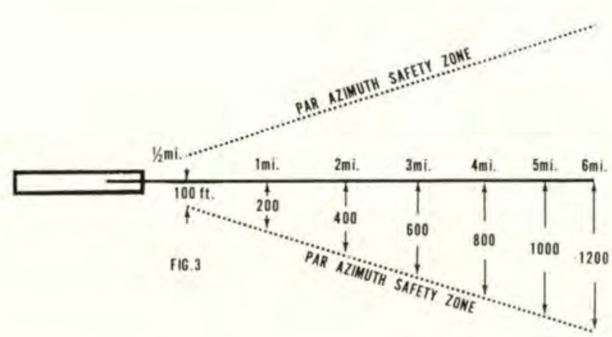


FIG.3

MISSILE
SAFETY AWARDS

Missile Safety Plaques have been awarded to the following Air Force organizations for outstanding safety achievement during 1964.

ADC	• **1 Fighter Wing, Selfridge AFB, Michigan**
	• **46 Air Defense Missile Squadron, McGuire AFB, New Jersey**
AFSC	• **6595 Aerospace Test Wing, Vandenberg AFB, California**
PACAF	• **41 Air Division, APO San Francisco 96328**
	• **18 Tactical Fighter Wing, APO San Francisco 96239**
SAC	• **351 Strategic Missile Wing, Whiteman AFB, Missouri**
	• **308 Strategic Missile Wing, Little Rock AFB, Arkansas**
TAC	• **4510 Combat Crew Training Wing, Luke AFB, Arizona**
	• **4520 Combat Crew Training Wing, Nellis AFB, Nevada**
USAFE	• **38 Tactical Missile Wing, APO New York 09130**
	• **49 Tactical Fighter Wing, APO New York 09123**
ANG	• **148 Fighter Group, Duluth Intl Airport, Duluth, Minnesota**

Missilanea

MY ACHING RAIL — In this time and age if you have an aching back, you are among the elite. However, with aching rails you just have trouble, as recently experienced by an F-101 armament crew in the process of downloading an AIM-4C. As the launcher rails were extended, the aft fitting assembly P/N 33-73652-1, on the left-hand outboard launcher broke. This caused the rear end of the launcher rail to drop and the forward portion to rise. The nose of the missile struck the aircraft. The infrared dome of the guidance unit was cracked and the leading edge of a fin was dented. Inspection of the broken aft fitting assembly revealed that part of the assembly was missing. This caused an overstress on the remainder of the assembly.

Suspected Cause Factor: The launcher rail that failed had recently been frequently extended with WSEMS aboard during high-speed flight.

Action: An inspection is presently being made of all launcher fitting assemblies within this squadron. As man and equipment age, both require frequent and closer inspection. With equipment, technical orders and checklists provide the frequency; *you* the Doctor must provide the thoroughness.

Just think what an aching back the airplane would have had if this rail became loose in the slipstream!

Lt Col M. L. Chardi
Directorate of Aerospace Safety

TECH DATA — AGAIN! The AFTO 22 system, tech data conferences, and the applied interest of many individuals have gone a long way toward improving the quality of missile weapon system tech data. But, regardless of its degree of perfection, the tech data cannot serve us if we don't use it properly.

Recently, a team of contractor and depot maintenance personnel was connecting a rather expensive piece of missile guidance equipment to a power source at a missile site. Power was necessary to provide heat while the unit was removed from the missile. Although this was not a normal or usual maintenance task for them, none of the team members had thought to bring along the applicable tech data. Instead, they called back to the contractor's office at the base for guidance. In relaying instructions over the telephone something was lost, consequently the connection was improperly made. The work was done in the presence of both the job supervisor and a maintenance inspector and signed off. Less than three hours later, it was found that the guidance unit had been severely damaged.

Constant admonition on the use of Tech Data had either failed to reach the right people or had fallen on deaf ears. This incident proves again, if such proof is necessary, that maintenance people, whether they are "blue suiters," depot, or contractor personnel, must have tech data available, be familiar with the procedures to be followed, and follow them to the letter. Nothing less is acceptable.

Major K. H. Hinchman
Directorate of Aerospace Safety

ATLAS-TITAN DEACTIVATION. The fact that missiles have been removed and are now in storage, and the fact that the cryogenics have been offloaded or boiled off does not mean that the silo is now safe and that safety precautions are unnecessary.

We must continue to apply sound safety practice. Every supervisor must understand that safety is still an important aspect of his job of silo maintenance. Some of his people may not be missile trained or silo familiar. Yet, these people will perform required maintenance and monitor silo preservation. Those concerned with now empty silos must become intimately acquainted with the "hole in the ground," locate the pitfalls, and establish procedures for entry that leave no doubt as to the safe way.

Possible areas of attention could be residual gases, diesel fuels, gases under pressure for diesel starts, deterioration of still used electrical connections, elevators that are not used daily, atmospherics in areas not entered on a daily basis, emergency exiting in event of power loss while in tne empty silo, protruding metal after equipment removal, sewer gases from latrines that are not being used or from sumps that are not being drained, etc. The list may be lengthy and cover items not contained in existing technical data.

Even though major hazards have been removed from the silos, subtle pitfalls may remain which, combined with personnel not familiar with the new configuration of the silo, can breed accidents. ★

Lt Col C. N. Mozley
Directorate of Aerospace Safety

System Safety—a dramatic new concept that grew out of Air Force mishap experience—will drastically change the course of system management both for the Air Force and its contractors. The author explains the need for, and the principles of, this new concept, AEROSPACE SAFETY recommends the article for reading by Air Force personnel at all levels.

SYSTEM SAFETY

By W. L. Irvine, Ballistic Systems Division, AFSC, Norton AFB

In December 1960, at Vandenberg AFB, a low order explosion (or deflagration) and fire completely destroyed a $45 million missile launch test site. The cause of this disaster was a relatively small component of the missile system: the hydraulic control valve on the missile elevator system failed, primarily because it was not strong enough to do the job expected of it.

The contractors concerned had some doubts about these valves, since there had been minor troubles with them previously, so they had worked out a correction which involved increasing the weight of the elevator counterweights. However, because it would take nine days to acquire and install the additional weights, the decision was made to go ahead with a scheduled test operation. This was a trade-off between safety and time — and obviously the wrong decision was made.

The forces involved in this catastrophe can be judged by the fact that the entire crib structure inside the silo was blown entirely free of the silo. Perhaps even more impressive: A forty-ton piece of equipment was found 1200 feet away from the missile installation.

In another accident, the leaf of a silo closure door, which weighs more than 100 tons, fell while undergoing operational tests. The cause was again a hydraulic valve. Investigation showed that the piston in the valve had not been built in accordance with the approved plan.

During the past several years considerable publicity has attended accidents in which four Atlas F launch facilities were destroyed. In each case the loss of these facilities was due to the failure of relatively small components within the total system.

The accidents described might indicate our interest is only in the prevention of catastrophic events. This must not be the case; we are concerned with all items affecting safety.

There are many locations in missile installations where high pressure tubing has been installed with little or no protection. In one case, an unprotected 2500 psi line terminates adjacent to a door frequently used by personnel.

But the real classic of all the minor design deficiencies which have come to our attention was a combination safety shower and eyewash at a northern missile site. In order to operate the eyewash, a man, who might already be blinded by acid, had to put his head in the eyewash bowl and then turn the water valve on with his right foot. The only problem was that the foot-operated valve was about four feet to his rear and higher than his waist. As an additional feature, if a man did happen to hit the valve, he got a full shower from overhead as well as getting his eyes washed out. However, the problem became academic in winter because the whole system froze.

These few examples illustrate the need for a new safety concept. Such a concept is now in existence; it is known as *System Safety*.

DEFINITIONS

Because of the many factors to be considered, any definition of system safety is complicated, therefore considerable explanation is required along with a bare definition. Basically system safety can be said to be "the use of management, scientific and engineering criteria, principles and techniques in all applicable disciplines throughout all phases of system development to secure the highest possible degree of safety within the constraints of time, cost and operational effectiveness."

Now for those explanations: The primary objective of system safety is to reduce the hazardous consequences of equipment operation. It involves the systematic use of analytical techniques, scientific data, design criteria, engineering principles, evaluation procedures, management skills, and experience reporting and recording systems. Because the goal of system safety is prevention rather than correction, particular attention is given to early engineering design and procedural analysis.

Basically, the following four statements summarize system safety as a discipline:

1. System safety is a distinct technical management discipline with its particular and unique body of specialized knowledge.

2. System safety is an integral and deliberate design objective of the Air Force, which cannot be left to chance or benevolent research and development.

3. System safety is a blanket discipline touching on many related fields and, within its own frame of reference, transcending all of them.

4. System safety is a coordinate discipline at all levels of technical effort requiring continual trade-offs between hazard elimination and optimal mission support or effectiveness.

Now let's discuss the why and how of system safety. In the past, system safety was procured as an inherent consideration in each contract, and no contractor ever deliberately designed an unsafe system. But no place, either in the Air Force or the contractor's organization, was there any system or method to insure that safety was considered throughout the development phase.

SAFETY MIL SPEC

In order to correct this weakness, the Ballistic Systems Division, AFSC, prepared BSD Exhibit 62-41 in April 1962. It has since been revised, the last time in July 1963. During this period the Directorate of Aerospace Safety, DTIG, observed the operation of the systems safety engineering principles contained in BSD Exhibit 62-41. Approving these actions, they undertook to write a military specification to make the practice Air Force-wide. From their draft finally emerged Military Specification MIL-S 38130 published 30 September 1963. It provides safety inputs in development of all new Air Force systems.

The title of MIL-S 38130 is "General Requirements for Safety Engineering of Systems and Associated Subsystems and Equipment." The stated purpose is "to achieve a comprehensive system safety engineering effort, integrated with the system design, development, manufacture, test, checkout, and, as applicable, construction/installation/activation/operational efforts." The means to accomplish are specified: "establish and pursue an active system safety engineering plan for the systems and associated subsystems and equipment." This means that the System Safety Engineering Plan (SSEP) is the important basic document which will be used throughout systems development.

The plan is acquired by informing the contractor in the Request for Proposal that he must provide a preliminary system safety engineering plan as part of his proposal. This preliminary plan will be considered with all other items in making the contract award.

Each associate contractor will have a system safety engineering plan for his subsystem and the integrating contractor will have a system safety engineering plan to cover the entire system.

When completed the plan will include, first, responsibility. It will identify within the contractor's organization the focal point for his safety engineerng efforts. It will detail the functions of this group, the authority they have within the company, and their interrelationships with other departments.

A second section will detail the program sequence. This will include milestones for planning, design, test programs, and operation.

A third section will list safety requirements and design criteria which will be used in system development.

A fourth section encompasses some of the most important activities to be detailed under the system safety engineering plan. These are subsystems safety analyses.

SUBSYSTEMS COVERED

First, we will cover those to be performed by the associate and/or subcontractors. These analyses will define and identify hazards. Failure mode and malfunction effects analyses will be made and hazards will be identified according to a four part code. These safety hazard classifications are:

SAFE which means that mechanical failure or personnel error cannot result in damage or injury.

MARGINAL which means that mechanical failure or personnel error will degrade the system but can be counteracted without damage or injury.

CRITICAL which means that mechanical failure or personnel error will degrade the system and result in abort, damage or injury.

CATASTROPHIC which means that mechanical failure or personnel error will cause permanent damage and severe injury.

Another section of the system safety engineering plan will describe procedures for post-analysis actions. These will tell how catastrophic hazards will be eliminated and how critical hazards will be minimized. Four guides are provided for this purpose. The first is to design for minimum hazard. This is the best, most practical and cheapest method. Where the best possible design cannot minimize the hazard, safety devices may be provided which will prevent damage or injury. The third guide is to install warning devices — lights and bells and other signals to indicate when a hazard exists. Finally there are special operating procedures. This is obviously the weakest method because it places dependence on people doing what they are supposed to do when they are supposed to do it.

In addition to the subsystem analyses, system safety engineering analyses will be required from the prime integrating contractors. These will include systems integration analyses which will define interfaces and identify problem areas. These must be continuously kept up-to-date as subsystems may be changed in the course of development. System failure mode analyses will be made of the entire system. This will define all possible modes of failure including the effects of personnel error. Operational safety analyses will be made. These will determine safety requirements of personnel, procedures and equipment to be used during maintenance, support, testing and training. From the operational analyses, emergency backout procedures will be developed to assure safe egress, safe escape routes, and rescue procedures.

ELIMINATES DUPLICATE EFFORTS

MIL-S 38130 also requires that prime, associate, and subcontractors will not duplicate efforts, tasks, analyses, etc. Joint proposals must contain the action agencies for the various tasks and those portions of the specification to be applied to subcontractors. In particular, systems safety efforts defined in other contract requirements will not be charged against this specification. Of course, any deviations from the approved plan must be agreed to by the procuring agency, and MIL-S 38130 may be applied to modernization and updating programs as well as complete system development programs.

The implementation of MIL-S 38130 obviously depends to a great extent on the contractor's safety engineering organization. The safety program director must have access to top level supervision within his company, and he must be continuously informed of all actions taken or proposed. Many of the largest aerospace development firms have completely reorganized their safety engineering staffs to carry out these principles.

USAF RESPONSIBILITIES

Of equal importance to the contractor is the safety organization within the Air Force procuring agency. The System Program Division of AFSC and the System Support AMA must have adequately manned safety offices to assure that system safety engineering efforts performed by the contractor are not lost within the Air Force itself. This could happen due to Configuration Control Board (CCB) actions or contract changes not coordinated through safety engineering. The Air Force safety offices must exchange information with all project officers in the organization, e.g., quality control, reliability, tech data, ordnance, test nuclear safety, and CCB's.

One of the most important functions of a SPO safety office is to organize and chair a System Safety Group (SSG) in accordance with AFR 58-4. Membership of the SSG may include representatives of the staff safety office of the development organization, site activation task force (SATAF), the Directorate of Aerospace Safety, the AMA concerned, the using command, technical development contractors and, of course, the associate and integrating contractors.

Tasks of the SSG include:

• Review safety specifications and requirements;

• Exercise surveillance over all safety activities at test and operational sites; design criteria, functions and interfaces; hazard and catastrophe analyses;

• Act as advisor to engineering groups and boards;

• Recommend to the CCB safety priority on proposed or actual changes. SSG's will be continued throughout the life of the system by the Logistics Command AMA.

Whenever a program involves nuclear components, the System Program Director should designate a nuclear safety officer within the safety office. This officer will insure that all the weapon system contractors are aware of the DOD nuclear safety standards defined in AFR 122-2 as well as other pertinent nuclear safety documents. He will also insure that basic design safety principles, such as isolation of energy sources and fail/safe components, are recognized and incorporated in the weapon system. Nuclear safety analyses to insure maximum design safety should be performed at frequent intervals throughout the design phase.

System safety has become a rapidly developing field. A recent development is a requirement from General Bernard A. Schriever, Commander, AFSC, to produce a system safety management manual. This manual will specifically define the system safety effort associated with the Systems Command administered mainstream effort during the program conceptual, definition and acquisition phases of the system life cycle. In addition, the task force established by General Schriever will revise and update MIL-S 38130 to relate more closely with the procedures in AFSCM's 375-1, 375-4, 375-5 and 310-1.

In summary, system safety is relatively new and is becoming increasingly important in the development of Air Force systems. The few examples cited in this article demonstrate why system safety is necessary and various regulations, specifications, manuals, and exhibits exist or are being prepared that will implement system safety into all Air Force systems. ★

Simply Pull The Ring And....

By SSgt Robert E. Brock,
USAF-Ret., PE Section, Norton AFB

The new J-1 parachute release is basically the same as the old model all aircrews are familiar with, except that a loop of cable replaces the pushbuttons. Users cussed and discussed the old model because it was often difficult to release. This was particularly true when the user was wearing gloves, wasn't wearing gloves (in cold weather), was confused, or just not very sure about the operation of the mechanism.

Now before the cussing gets too strong about the new release: You may find it hard to operate. It was designed to operate very simply—just reach up and pull the safety cover down, then slip one or two fingers in the loop and pull. So you pull and nothing happens. What next? Panic?

If the release doesn't open on the first pull, and it may not, pull again, sharply. If it still doesn't open, reach over with the other hand, hook a couple more fingers in the ring and pull again—hard.

Chances are yours will work all right. But a few will require a good healthy jerk. Don't be dainty. PULL!

The reason for this is the newness of the equipment. The releases we've found most difficult to operate are on the newly manufactured chest type harness, but it's the same release that is on other types. Personal Equipment people are using a lubricant and working the releases during each routine inspection in an effort to wear off the newness so that the equipment will work easily when you need it most.

Suggestion: If you haven't received training in how to use the quick release, visit your PE shop. It's much better to learn how to unstick one here than to struggle with a sticky release while being dragged through cactus by a 25-knot wind. ★

J-1 parachute release is designed for one-finger operation. Just pull down the guard, grab cable with one finger, and pull.

Some releases may be hard to pull. Don't wait. Use both hands, and jerk hard!

New release is simple and quick. Nevertheless, why not visit the PE shop and have the fellas give you a thorough briefing, then try it a few times yourself.

IT CAN HAPPEN to YOU

By Maj William T. Smith Directorate of Aerospace Safety

Be honest now, are *you* one of those people who believes accidents happen to the other guys? Don't be afraid to speak up. I'm sure you are not alone. I believed this for a long time. In fact, I believed it up until my present assignment. I know better now; accidents can happen to me—or you!

I had been in the Directorate of Aerospace Safety but a short time when I saw the light. I am one of those responsible for reviewing many of the aircraft accident reports that arrive daily. Even though I now have "religion," I am appalled at the number and many types of accidents and incidents that occur. The ways in which accidents occur are literally beyond my imagination.

But, threaded through many of these reports, is a common condition. Much of the time those involved failed to adequately cope with unusual situations. And the recommendations to prevent recurrence can generally be resolved to one basic essential—pilots and other aircrewmen must mentally condition themselves to the idea that an emergency *can* happen to them. Then, with this mental stimulus, if they learn the SOP's for normal situations, they will be better able to handle the emergencies.

Now, let's consider panic. There is no doubt that panic is an important factor during an emergency. Consider the pilot's attitude during a check ride. There we anticipate practice emergencies and concentrate on procedures knowing full well that we are in a simulated situation and no great hazard exists. All effort is directed toward handling the emergency promptly and effectively. But during a real emergency, panic or anxiety might reach a level where judgment is impaired and the pilot's response to the situation is imprudent. It is not possible to predict a pilot's reaction to an actual inflight emergency. However, thorough training and self discipline tend to have a leveling influence on our actions at such times. If every pilot, as he lined up on the active, anticipated an emergency condition on takeoff, he would be mentally conditioned and alert, and certainly more capable of handling the situation. For example, if I lose No. 4 engine on liftoff, what will I do? Have I briefed the copilot and engineer adequately to preclude confusion and panic in the cockpit when time is precious? At the risk of being redundant, the point being emphasized is that it is necessary for pilots to recognize the possibility of an emergency occurring during any phase of flight.

The aircraft Dash One describes procedures for handling most of the emergencies that can reasonably be expected to occur. But it is impractical to write this handbook to cover every conceivable malfunction that may occur and which may be complicated by failure of other systems or subsystems. Furthermore, it would be impossible to commit to memory all the procedures considered necessary to handle these emergencies. However, knowledge of the fundamental emergency procedures and a comprehension of how the aircraft's basic systems operate should provide the pilot with the information necessary to make intelligent decisions in coping with most emergencies.

There are many methods of improving pilot proficiency and knowledge of emergency procedures. Here are some training aids I have observed.

- Place typewritten Dash One bold face items prominently inside of latrine doors with a plain cover sheet listing the type of emergency.
- Discuss an emergency-for-the-

day at mission briefings or scheduling meetings.

• Display bold face items on a bulletin board in the briefing room.

• Hand out questions on aircraft emergency procedures at monthly flying safety meetings.

These suggestions should help provide some of the motivation essential to a successful safety program.

One of the unfortunate facts about safety is that it is not self-perpetuating. On the contrary, experience indicates that organizations with good safety records frequently tend to take things for granted. They become *complacent* (there's that word again) and accidents occur.

As examples of the types of situations of which I speak, here are a few of the more unusual accidents and incidents which have occurred in recent months. Read on and you will see why we, in Flight Safety, are justifiably appalled by some of these. As an incentive you might ask yourself what would *you* have done under the same circumstances.

While on a GCA approach with an ILS backup, the pilot of a B-52

crossed the threshold at 50 feet and 138 KIAS. Best flare speed was computed to be 131 knots. The pilot queried the copilot on whether they could land OK and received a conditional affirmative reply "yes, if the aircraft is landed immediately." After the aircraft had floated approximately 4000 feet, the pilot applied power for a go-around. The co-pilot, thinking that the pilot was reaching for the air brakes, deployed the drag chute and the aircraft contacted the runway at the 7000-foot marker and bounced. During the ensuing confusion, the pilot chopped the throttles but the copilot, thinking they were still on the go-around, simultaneously jettisoned the drag chute. The aircraft finally came to rest well beyond the overrun. Fortunately no one was injured and the aircraft drop tank and pod suffered only superficial damage. However, a ruptured fuel cell could have resulted in a fire with extensive damage and loss of life. We know that pilots occasionally find themselves in a compromising or unforgiving situation such as this with excessive air speed on final approach; however, proper crew coordination and pre-established and understood procedures probably could have prevented this incident.

A flight of B-57's had just completed a mission and returned to home base. Two aircraft broke off from the lead element and con-

tacted GCA for a series of practice approaches. On the second approach the wingman noticed a strange odor in the cockpit which he thought to be alcohol or ether. Although he was on 100 per cent oxygen at the time, this pilot detected the odor because his mask was leaking around the bridge of his nose. Two GCA's were completed successfully and the flight leader called for a channel change to tower frequency. Traffic pattern entry and the break were normal. The pungent odor was still apparent so the pilot tightened his mask and made a long base leg. He stated that gear and flap extension seemed extremely slow. A gear check was called on the final, but jet wash from the lead aircraft precluded continuation of the approach so a go-around was initiated.

The aircraft was cleaned up and the pilot noted at this time that his breathing was labored and his side vision was gone. He also experienced a skin-tingling sensation. On the second approach, the pilot does not recall extending the gear, but at this point the oxygen mask was rechecked and pressure oxygen selected. An improvement in vision was noted on final and the landing was accomplished without further incident. After turning off the active, the pilot stopped the aircraft, climbed out and immediately experienced the dry heaves. It is doubtful if this pilot could have made a successful landing if another go-around had been necessary. Moreover, if pressure oxygen had not been selected he would probably have lost consciousness. The preliminary stages of an individual approaching unconsciousness were already evident, e.g., seeing stars, grogginess and weak feeling. After a few minutes of breathing 100 per cent oxygen at the hospital the pilot stated he felt normal. A thorough examination of the cockpit revealed a leaking hand fire extinguisher (CB type).

Due to continued emphasis by responsible personnel, disparities in manifested weights and actual weights are relatively infrequent, but they still occur. Therefore, those flying transport type aircraft should continue to take a skeptical look at cargo weights and the cal-

culated aircraft CG before each flight. The extremes in this area were realized recently during a major airlift operation.

The means of weighing vehicles was not available prior to air shipment so the shippers estimated the weights, and, where a doubt existed, weights were padded by an amount which was considered adequate beyond a doubt. Unfortunately, these people were not aware of the fact that errors of this type could create serious aircraft weight and balance problems.

Errors in overestimating the weights varied up to approximately 235 lbs—which in itself is not too significant, but, conversely, a serious situation occurred when the weight on one vehicle was underestimated by 24,230 lbs. Admittedly, the 24,230 lbs is the extreme case but errors of 3000 to 4000 lbs were quite common with several in the 13,000 to 17,000 lbs category.

Administrative action has been taken to preclude recurrence of this type error but it's the old story of Murphy's Law, and no amount of paperwork can prevent all stupidity or carelessness. You as Aircraft Commander are responsible for all factors which affect safety of flight so to quote our friend the flight surgeon, "watch your weight!"

A flight of F-4C aircraft was on a cross country at FL 340. While circumnavigating a thunderstorm, the flight passed between two cells and a lightning bolt passed horizontally beneath the lead aircraft. Almost immediately Nr 2 aircraft experienced a flameout of the left engine and simultaneously Nr 3 aircraft a flameout of the right engine. Both pilots were successful at airstarts and the aircraft continued on to their home base. No damage was sustained by either aircraft. It is suspected that the lightning caused atmospheric phenomena that temporarily interrupted airflow to the outboard engines of the wingmen in the flight. Although an effort was made to stay clear of the thunderstorm, the route of flight necessitated flying in close proximity to some cells resulting in a temporary emergency. Unless military necessity dictates otherwise, the 180-degree turn is still recommended as the best accident preventive action by pilots encountering thunderstorm activity.

These examples should serve to illustrate the diversified and unusual types of incidents occurring daily. Any one of them could have resulted in a fatality. We in Flight Safety hope that a fatal accident in your squadron isn't the type of motivation that you as a crewmember require to be safety conscious.

Knowing that it *can* happen to you should serve as an incentive to see that it doesn't." ★

TO ERR IS HUMAN

By Col James F. Risher, Jr., Chief, Ground Safety Division

Pilots with thousands of hours in the air have landed with gear neatly retracted. Mechanics, crew chiefs, missile technicians, all have committed errors that belied their training and the checklists that were available to them. Young fighter pilots, men capable of hacking a 200 foot ceiling in the world's fastest and most sophisticated aircraft, have "lost control" of their sports cars on the highway and "failed to negotiate the curve." Welders and machinists have lost eyes and fingers after years of skillful job performance by simply neglecting to use protective devices. Such illustrations of puzzling human errors could become an endless list.

We must remember that the people who made these mistakes, ludicrous or tragic, depending upon the results, performed these or similar acts the correct way many, many times. Here we can take note in passing of a famous line, Murphy's Law, that "if it can happen, it will happen."

For us in the safety business, the more commonplace error assumes prime significance. There is no assured correlation between degree of error and magnitude of consequences. In our times, some of man's errors of action and reaction result only in momentary embarrassment, while others of similar nature have far more serious consequences. Simple human actions—flipping the wrong switch, missing one item on a printed page—may result in no more than "OOPS!" and correction of error in some situations, or a multi-million dollar accident in others.

Furthermore, while man's capacity for error has not increased, his opportunity has increased astronomically in our mechanized times. Even more significant is the fact that our present day environment provides penalties for mistakes which simply did not exist until recent times. Not too many years ago it would have been literally impossible for a maintenance technician on the flight line to strike from the Air Force's and the nation's assets some $8,000,000 by a single act of human error. Yet this was done when one item was omitted in a tech order procedure and a strategic bomber was destroyed by fire on the ground. Normally, a moment of hesitation or indecision should not incur a significant penalty. Yet for the fighter pilot faced with a decision on ejection from his crippled aircraft, this may be the moment, the single second, that costs his life. Then there is the faulty valve, the washer, the small connecting device, far back and obscure in the aircraft or missile which may be the subject of an Unsatisfactory Report, or the cause of a catastrophic accident. For it was not until recent times that engineers, designers, and manufacturers could, through faulty design or omission, breed system deficiencies in weapons and machines which, though obscure and small in themselves, may have colossal effects in costs of corrective action, or even more, accident potential.

Whether we think of the missile technician readying a space shot, the pilot of a modern jet transport, the aircraft maintenance specialist working over multi-million dollar equipment, the designer or engineer over the drawing board or in the test chamber, or even the average driver behind 300 horsepower on the freeway, we are thinking of

people who have enormous potential for costly and tragic human error. Conversely, we are thinking of people who can and do make their individual contributions to our complicated, highly intricate way of life by efficient, enlightened, safe performce of their normal tasks, day after day.

We safety people like the routine day. We abhor the wail of sirens. We hate accident investigations. We prefer incidents to accidents and little accidents to big ones. So we press on, as best we can, toward our twofold goal: First, reduction of the probability of human error and, second, reduction or elimination of harmful results when errors occur.

The tools of our safety trade are many and varied. They change to suit the time and the need. New ones come and old ones go, or are reshaped. But all are designed to lessen the error factor, increase the forgiveness factor, or both. Standard operating procedures; checklists; protective devices and clothing (seat belts, helmets, flying gear); survival equipment; warning signs; personnel screening, mental and physical tests; evaluation; surveys; control and supervision of work areas; safety distances; design criteria and specifications; training; management; motivation; —these are a few of our tools.

Our title is, of course, the first part of a classic sentence which has been quoted throughout the civilized world for decades past. If we are ever called upon to justify our programs and our tools in the fewest possible words, perhaps we, too, should borrow Victor's Hugo's time-burnished line and say simply "TO ERR IS HUMAN, TO FORGIVE DIVINE." ★

". . . while man's capability for error has not increased, his opportunity has increased astronomically in our mechanized times."

THE IPIS APPROACH

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

Q. **If I am flying a B-52 at the emergency safe altitude on the FLIP Terminal Chart (8000 feet) and Approach Control clears me to the outer marker to *hold*, would I use one minute legs as FLIP, Section II says, or one-and-a-half minute legs as AFM 51-37 says? Would I be doing a procedure turn or a holding entry? *(Captain Art Laehr, Glasgow AFB, Montana.)***

A. One minute legs. You will be flying a holding entry. AFM 51-37 contains instructions for accomplishing *procedure turns* which are maneuvers completely separate and distinct from holding pattern procedures. It does not contain instructions for holding. If Approach Control cleared you to the outer marker to *hold*, you would fly the holding pattern in accordance with the procedures outlined in FLIP, Section II.

POINT TO PONDER

Here is a good method to determine a heading to fly when proceeding direct from one DME fix to another. This procedure can be of real value when administering flight checks, flying on instrument proficiency flights, or when cleared by ATC to proceed direct from one DME fix to another. We'll start by drawing a diagram showing a simple situation (Fig. 1). Assume that you are 40 miles south of the TACAN station and wish to go to the 20 NM DME fix on the 090 radial. If we draw our diagram to the proper proportions, it's fairly simple to see by "eye-balling" that the no-wind heading to the fix will be about 030°.

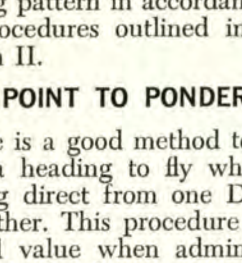


figure 1

The procedure we are going to suggest is nothing more than mentally drawing a diagram such as this on any compass card in the cockpit.

When you draw the diagram, there are three rules to keep in mind:

1. The center of the compass card will represent the TACAN station.
2. The greater the two distances (your range or the fix distance) will be represented by the outer edge of the compass card.
3. Your aircraft position will be somewhere along the line from the center of the card and the tail of the bearing pointer. (Opposite the head if the bearing pointer has no tail.)

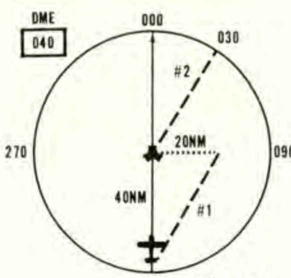


figure 2

Now, look at figure 2 and we will see how this works using the same problem as above. The greater of the distances is your range (40 miles), so the compass card will be 40 miles in *radius*. Your aircraft position is at the tail of the bearing pointer. Now, find the desired radial (090) and go out that line 20 miles from the station (halfway from center). Line 1 represents your flight path to the DME fix. To find what the no-wind heading will be, you simply slide this line parallel so that it passes through the center of the compass card (line Nr 2). You then read your no-wind heading to the fix where line Nr 2 intersects the edge of the compass card (030°).

If both distances are equal, you use the same procedure, except that both distances are represented by the edge of the compass card. The final situation you could encounter is when your range is less than the DME fix distance. The procedure remains the same, but now the radius of the compass card will be equal to the DME fix distance, and the proportions must be reversed. This is shown in figure 3.

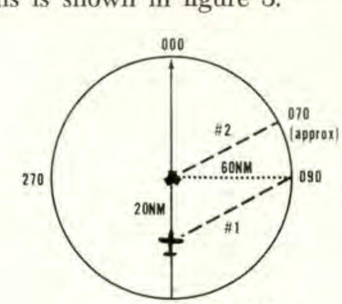


figure 3

In this situation you are 20 miles south of the TACAN station and wish to go to the 60 NM DME fix on the 090 Radial. Since the radius of the card is 60 miles, you find your aircraft position 20 miles from the station (one-third of the way out from the center of the card). Line Nr 1 is again your flight path and line Nr 2 is the parallel line to find the no-wind heading.

There is one final capability of the procedure that should be pointed out. Since you have set your diagram up to proportion, you can also find your approximate distance to the fix. For example, in figure Nr 2, the radius of the compass card is 40 miles. Your flight path line (line Nr 1) is slightly longer than the radius of the card. Therefore, you can see that your distance to the fix is approximately 45 miles.

Clearances to proceed direct to a DME fix are becoming more of an everyday occurrence. Being able to use this procedure can save you and the controller time and trouble. Remember, radar is not always available. We suggest that you spend some time in the simulator or on a practice ride using this method. Perhaps you can increase your capability as an instrument pilot. ★

FAA ADVISORIES

FEDERAL AVIATION AGENCY · UNITED STATES OF AMERICA

By Bob Terneuzen
FAA Liaison Officer
Directorate of Aerospace Safety

AUTOMATIC TERMINAL INFORMATION SERVICE (ATIS). The Federal Aviation Agency conducted operational tests at San Francisco, Chicago O'Hare and New York Kennedy Airports to determine the feasibility of automatically broadcasting routine non-control information in the terminal area. The tests concluded that ATIS provided relief to the problem of frequency channel congestion, provided the controller more time for solving traffic problems and permitted the pilot to obtain the information at times when cockpit duties were least pressing and to listen to as many repeat broadcasts as he might desire.

ATIS is the continuous broadcast of recorded non-control information in high activity terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information.

ATIS messages contain routine information such as ceiling, visibility, wind, altimeter setting, instrument approach and runways in use, and an identifying code word.

Example: "THIS IS WASHINGTON NATIONAL AIRPORT INFORMATION BRAVO. CEILING MEASURED TWO THOUSAND, OVERCAST, VISIBILITY SIX, SMOKE. WIND ONE SIX ZERO DEGREES AT FIVE. ALTIMETER TWO NINER NINER TWO. VOR RUNWAY ONE FIVE APPROACH IN USE. LANDING RUNWAY ONE EIGHT. DEPARTURES ON RUNWAY ONE FIVE. NOTAM, GEORGETOWN RADIO BEACON OUT OF SERVICE UNTIL FURTHER NOTICE. INFORM WASHINGTON APPROACH OR GROUND CONTROL ON INITIAL CONTACT THAT YOU HAVE RECEIVED INFORMATION BRAVO."

Messages are automatically broadcast on the voice channel of a TVOR/VOR/VORTAC located on or near the airport, or on a discrete VHF control tower frequency. The messages are updated as necessary to keep the information current and will normally not exceed 30 seconds in length.

Pilots hearing the broadcast inform the tower or approach controller on initial contact that they have received the information by repeating the code word appended to the message, thus obviating the need for the terminal controller to issue the information. Example: ". . . I HAVE RECEIVED INFORMATION BRAVO."

Terminal controllers issue pertinent information to pilots who do not acknowledge receipt of the ATIS message or who acknowledge receipt by a code word which differs from that assigned to the current message.

Each ATIS message will be identified by a specific phonetic code. The first recording of each day will be coded ALPHA. Subsequent updated messages will be assigned succeeding alphabet codes (BRAVO, CHARLIE, etc.); thus, the same alphabet code will not be used again until all code letters in the alphabet have been used sequentially.

A new recording will be made when there is a:

a. Regular hourly weather report issued that differs from the previous broadcast.

b. Special weather report issued.

c. Change in the type of instrument approach.

d. Change in takeoff or landing runways.

e. Change in other information of the previous broadcast.

IMPLEMENTATION — Initially, ATIS is being established at the following FAA tower airports:

Boston	Kansas City Municipal
New York Kennedy	St. Louis
Washington National	Chicago O'Hare
Atlanta	Denver
Miami	Van Nuys
Houston	Los Angeles
Dallas Love Field	San Francisco

A national program has been developed to provide ATIS at approximately 60 locations by the end of 1965.

A listing of locations currently providing ATIS, hours of operation and frequencies of voice outlets is contained in the Airman's Information Manual.

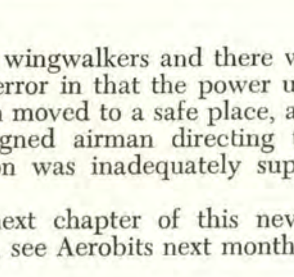
PILOT PARTICIPATION — The success and effectiveness of ATIS is largely dependent upon cooperation and participation of airspace users. Although participation is voluntary, pilots are urged to cooperate in the ATIS program since it relieves frequency congestion on approach control, ground control and local control channels. ★

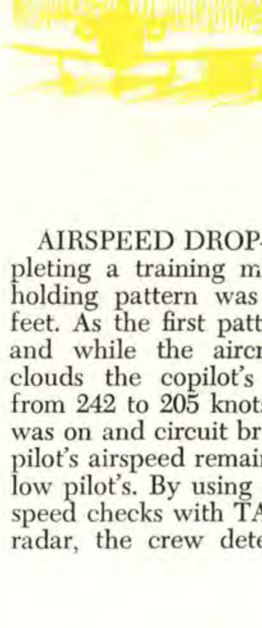
Aerobits

TAXIDENT—What happened can be told very simply: A T-39 with an IP in the left seat taxied into an MD-3 power unit. The MD-3 being the more durable, the aircraft wing received a tear about four inches deep. Cost to fix was estimated at 50 manhours. The causes were routine for this type incident: the pilot wasn't using wingwalkers and there was supervisory error in that the power unit had not been moved to a safe place, and a newly-assigned airman directing the taxi operation was inadequately supervised.

For the next chapter of this never-ending story, see Aerobits next month.

AIRSPEED DROP—C-135. After completing a training mission the TACAN holding pattern was entered at 25,000 feet. As the first pattern was completed and while the aircraft was in cirrus clouds the copilot's airspeed dropped from 242 to 205 knots. Pitot heat switch was on and circuit breakers were in. Copilot's airspeed remained 37-40 knots below pilot's. By using charts and ground-speed checks with TACAN and airborne radar, the crew determined the pilot's airspeed indicator to be most accurate. With a 500-foot ceiling, the decision was made to divert from the midwest base to an east coast base with better weather. Nearing the new destination the aircraft broke into the clear and almost immediately the copilot's airspeed began to increase. Within five to 10 minutes it agreed with the pilot's. Postflight inspection revealed the right pitot tube heater to be inoperative.





EGT HANG-UP – OVERTEMP? An F-104G pilot complained of an EGT hang-up at an indicated 640°C on a pre-takeoff throttle burst check. The engine was ground-checked and although it checked out OK, the temperature amplifier was changed as an "educated" precautionary measure. Subsequent engine operation was normal and shortly thereafter this engine ran out its PE inspection interval and was replaced.

Later, another pilot, in the same aircraft, encountered a temperature hang-up at 640°C after coming out of AB. An emergency was declared and landing was made without further incident. The pilot could give no information concerning the behavior of other engine instruments. Since the engine had been changed shortly before, the EGT gage was considered suspect and subsequently changed. Engine operation has since been normal.

Meanwhile, during a new engine installation ground runup on another ship, the EGT was seen to peak at 640°C and hang-up while the throttle was retracted to idle. RPM, fuel flow and nozzle position followed the throttle. Jarring the instrument panel brought the EGT gage needle back to normal. This was repeated several times with the same results. The instrument was removed and rejected to overhaul.

The experiences related above are probably not isolated cases. Be alert for this type of problem and observe the other engine instruments when an apparent over-temperature is encountered. This could substantially reduce trouble-shooting manhours and unnecessary parts replacement.

From a Field Report by
W. A. Kerr, General Electric

SPOTS—If you think your eyes are playing tricks on you as you come down final and try to blink away those big yellow spots on the runway, don't panic! The spots are for real — they're aviation yellow, ten feet in diameter and centered 30 feet apart. Their function is to mark the location of BAK 6, 9 and 12 barrier pendant cables. The cable location will be marked when it crosses an operational portion of a runway, including cables on the approach side of a displaced threshold when the pavement is used for aircraft movements. Internally lighted signs the size of runway distance markers and featuring a yellow disc will also mark the location.

HOW TO GO OUT OF BUSINESS FAST—To paraphrase the last sentence of a message concerning an Aero Club incident: The .... Aero Club will be closed and the aircraft will be disposed of in accordance with . . .

Here's what immediately preceded this action: A T-34 was being ferried from a private field to the Air Force base. On preflight the pilot found that the left brake was not operating so he had a licensed FAA mechanic bleed the brake. It then appeared to operate satisfactorily so the pilot took off. After landing at the air base he found that the left brake was again flat, so he pumped it a few times and it came up to normal. As he taxied down a slight incline near the transient alert building, he applied brakes and the left brake again failed and the right brake locked causing the aircraft to turn into a concrete curbing which damaged the nose gear and prop.

Prior to this mishap another T-34 owned by this club was lost in a major accident. Other factors having bearing included lack of participation by club members and lack of adequate active duty personnel to properly supervise and monitor the club activities.

THOSE TINY TIME CAPSULES — Awhile back a young troop was having that "ache-all-over" feeling and he evidently wasn't satisfied with the assistance he was getting from the flight surgeon. His wife said she had just the thing to make him feel like a million. (A million what she didn't say.) Young troop started taking his wife's tiny time capsules and after being on them for a short time, he did indeed begin to feel wonderful.

Meanwhile, back at the base, young troop was scheduled to fly wing in a two-shipper. Down with the pills, on with the G-suit. Takeoff and the first few minutes of the flight were OK. After being airborne about 15 minutes, things started to happen.

The wingman didn't like his position so he started to move in. Lead didn't like the new position so he told the wingman to move out. Lead called the wingman to move back in. Full AB and CHARGE. Leader pulled up just in time as Number 2 went smoking through the spot that Lead had just vacated. The same thing was repeated a few more times.

For the next few minutes the two pilots engaged in one of the most heroic air battles since WWI. Lead tried to outrun Number 2 but he had the slower bird. After trying all of the old tricks and inventing some new ones, Lead got on Number 2's tail. Lead, in a high pitched voice, convinced Number 2 to just fly straight and level, then return to home base. The wingman was a little reluctant to break off the fun but the leader was more reluctant to be airborne with him. An uneventful landing was made by both aircraft except the leader was now ten pounds lighter.

Turned out those tiny time capsules the wingman was taking contained belladonna. Belladonna (beautiful lady) is known in medical circles as a mydriatic, a drug used to dilate pupils of the eyes. After the wingman swallowed his pills, he had to get pretty close to the leader to be able to see him!

PLEASE leave medications to the Flight Surgeon and the washing of dirty socks to the wife.

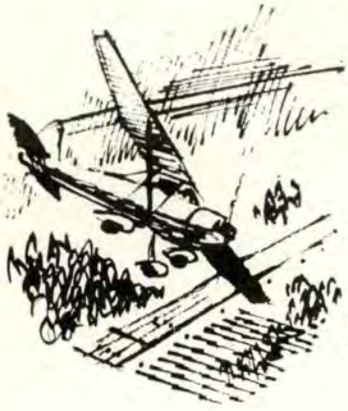
(From ATC's Approach to Safety)

Aerobits

AERO CLUB AWARDS—Forty-nine Air Force aero clubs received Federal Aviation Agency flight safety certificates for operating during 1964 without accident or incident. Major command representatives accepted the awards for the 40 recipient clubs which are based in the ZI during ceremonies at the FAA's Washington headquarters. The nine overseas clubs received their certificates by mail.

The awards were indicative of improved aero club safety since just under one-half of the 108 clubs were recipients. During 1964 the clubs flew 177,658 hours.

The following clubs received certificates:



ADC—	Adair Air Force Station
	Hancock Field
	Kingsley Field
	Otis AFB
	Oxnard AFB
	Perrin AFB
	Richards-Gebaur AFB
	Stewart AFB
	Tyndall AFB
AFLC—	Griffiss AFB
	Kelly AFB
	Olmsted AFB
	Tinker AFB
AFSC—	6594th Aerospace Test Wg
	Arnold Air Force Station
	Kirtland AFB
	Patrick AFB
	Space Systems Division
ATC—	Craig AFB
	Lowry AFB
	Randolph AFB
	Moody AFB
	Webb AFB
AU—	Maxwell-Gunter AFB
MATS—	Charleston AFB
	Scott AFB
	McGuire AFB
SAC—	Beale AFB
	Ellsworth AFB
	Lincoln AFB
	Vandenberg AFB
	Bunker Hill AFB
	Larson AFB
	Schilling AFB
	Whiteman AFB
CONAC—	Davis Field
	Minneapolis-St. Paul Int'l Airport
	Dobbins AFB
TAC—	Seymour Johnson AFB
USAFA—	USAF Academy
PACAF—	Clark Air Base
	Misawa Air Base
USAFE—	Bitburg Air Base
	Laon Air Base
	Wheelus Air Base
	Bentwood Air Base
	Freising Air Base
	Toul Rosieres Air Base
USAFSC—	Albrook AFB

A NEW RADAR that will enable forecasters to know current cloud structure and changes above a station has been installed by Air Weather Service at L. G. Hanscom Field, Mass. The first operational piece of weather equipment produced under the 4331 Weather Observing and Forecasting System, the TPQ-11 Radar Cloud Detecting Unit will be installed at 43 Air Force bases.

Pilot reports have been the only accurate source of information on clouds above the lower layers. The new equipment detects, displays and records the top and bottom heights and density profiles of clouds and precipitation directly above the installation from 500 to 60,000 feet. ★

FALLOUT continued

the dump valve at the trailing edge of the wing. He immediately discontinued the fueling operation, checked the cockpit, and found the fuel dump valve switch in the "open" position. Of course the pilot had forgotten to reposition the switch to the "off" position after landing.

This same airman was involved in another incident on the same day, where his alertness in detecting a potential fire hazard in an MD-3 unit possibly saved an aircraft. Although both actions are expected of a five level airman, nevertheless it is a real pleasure when we can report that his actions did prevent possible serious incidents or accidents. I feel that suitable recognition could be accorded our more or less forgotten personnel in the Transient Alert functions. I would like to offer the name of A1C James T. Mosley for recognition in your magazine.

Consider the plight of the maintenance man! The majority of the transient maintenance personnel who do make mistakes are not willfully negligent, or indifferent, neither are they completely lacking in their skills. Whenever peculiar situations arise, rain or shine, snow or blow, the transient maintenance man is there to help you, and oftentimes all he is looking for is a kind word, just as assurance or reassurance that he is "doing a fine job."

SMSgt Walter A. Zardecki
Base Acft Maint Division
Olmsted AFB, Pa.

☆ U. S. GOVERNMENT PRINTING OFFICE 1965 751-218/9

WELL DONE

Major
CHARLES A. SAMS

Captain
CLIFFORD W. LANDIS

123 FIGHTER INTERCEPTOR SQUADRON, OREGON ANG, PORTLAND, ORE.

Major Sams was the pilot and Captain Landis the radar interceptor officer on a cross-country flight from Portland, Ore. to McClellan AFB, Calif. in an F-89. While they were descending to 7000 feet, Sacramento Approach Control informed them that there was a lost aircraft in their area and asked if they had enough fuel to make a search. Since they had nearly 8000 pounds of fuel remaining they agreed to do so. The lost aircraft, a single engine Swift, was approximately 60 miles northeast of Sacramento, heading due west, and was thought to be at about 12,000 feet.

Sacramento Approach Control vectored the F-89 into a tail position about five miles from the Swift and cleared them to climb to 11,500 feet. They entered the clouds at 8000 feet and climbed to 11,500 feet. At a range of two miles, Captain Landis picked up his target on radar, but it was very high on the scope. Major Sams slowed the F-89 to 130 knots with gear and flaps down. Upon getting radar contact with the Swift he lit both afterburners and established a climb at 125 knots to 18,000 feet. At about 200 yards range, visual contact was made with the Swift which was holding steady at 270 degrees bearing with an airspeed of 90 knots. Major Sams waggled the wings of the F-89 as he went by but the pilot of the Swift did not see the fighter and visual contact was lost. Sacramento Approach Control again vectored the F-89 into a tail position and again an actual weather intercept was made at 125 to 130 knots, minimum control speed. This time the F-89 passed closer to the Swift and the pilot saw the F-89. Major Sams turned to a heading of 310 degrees leading to an area where he knew the weather was broken to scattered. The Swift started to follow but the pilot lost sight of the F-89 in the clouds. Successive intercepts were made in the same fashion until, all told, six radar intercepts were accomplished, all at minimum control speed, before the Swift was guided to an area of clear weather conditions.

In the meantime Sacramento Approach Control had vectored a Navy U3A into the area to pick up the Swift and escort it to Sacramento. Once the F-89 got the Swift into clear weather and began a descent, Approach Control joined the U3A with the Swift and it was escorted to Sacramento Municipal Airport.

A civilian light aircraft was saved from possible destruction and the pilot's life was probably saved by the persistence and professionalism demonstrated by Major Sams and Captain Landis in conjunction with Sacramento Approach Control. WELL DONE! ★

CITATION FOR THE AWARD OF THE 1964

Daedalian

FLYING SAFETY TROPHY

SAC

STRATEGIC AIR COMMAND

The Daedalian Flying Safety Trophy is awarded to the Strategic Air Command for having the most effective aircraft accident prevention program of all major air commands for calendar year 1964. During the period of this award, the Strategic Air Command established the lowest accident rate in its history. The well defined and effective Strategic Air Command accident prevention program proved itself in the successful completion of thousands of sorties flown in special exercises and the unique strategic mission. During this period, aircraft accident fatalities were reduced by thirty per cent. By conserving lives and materiel, while accomplishing its worldwide commitments, the Strategic Air Command has made a substantial contribution to the mission of the USAF. This accomplishment was the result of superior teamwork of unit commanders, aircrews, maintenance and support personnel. The achievement made by the Strategic Air Command in aircraft accident prevention perpetuates the highest standards and traditions established for the Daedalian Flying Safety Trophy, and reflects the highest credit upon the command and the United States Air Force. ★