AEROSPACE
SAFETY
UNITED STATES AIR F

DECEMBER 1965

AEROSPACE SAFETY

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AFRP 62-1 DECEMBER 1965 VOLUME 21 NUMBER 12

FALLOUT

HOLDING PATTERN ENTRY

Reference POINT TO PONDER (The IPIS Approach, pg 9) in the September issue.

After spending many years as an Instrument Flying Instructor, it was difficult to stomach the "no brains" type holding pattern entry implemented in the late 1950s. The gimmick suggested in POINT TO PONDER as "a convenient method to determine holding pattern entry" parlays the "no brain" into absurdity and could cause complacency that would lead to disorientation. It is this type of crutch that we must not allow to creep into our procedure in order to maintain our professionalism and aerospace safety.

Maj Henry DeGraaf
NSALO, AFETR
Patrick AFB, Fla

Following is a reply from the USAF Instrument Pilot Instructor School (ATC):

"The technique cited was developed here in the School and is presented to each student for his acceptance or rejection during the course of training. Every class of students must be out of step with the Major since they enthusiastically accept and use the technique!"

DID YOU KNOW THAT . . . ?

Here is an item I believe would be of interest to others as it explains one use of the computer which is not clearly defined in other publications:

Did you know that the answer to the question "am I still on the airway?", is readily available on the back side of your computer? Simply note the number of degrees the VOR/TACAN needle differs from the published airway course and set this figure in the drift correction window. Next read your DME (or use DR mileage) and opposite this mileage figure on the minutes scale, read the number of miles from the airway centerline on the miles scale. For example: set 5 degrees in the drift correction window, then opposite 45 NM (minutes scale), read 3.9 NM (miles scale) from the airway centerline. (This is just within the established airway width of 4 NM from the published centerline.) This computation is most useful when flying at minimum enroute altitudes over mountainous terrain, and especially after switching from an outbound track to an inbound radial that may differ several degrees due to local magnetic disturbances.

Lt Col Ernest E. Bradley, Jr
Hq USAF (AFOAPG)
Washington, D.C.

MISREADING THE ALTIMETER

These are my comments on the subject covered in your fine article "How High Is Up?", in the September issue.

Using the F-100 as an example, since

continued on page 25

Maintaining A Ready State

A large segment of our national resources has been dedicated to the development of the most formidable aerospace force ever known. The Air Force is largely responsible for keeping this force in a ready state – capable of reacting reliably to support national policy requirements and the needs of our people.

The ready state of this force demands both effective equipment and peak efficiency from crew, maintenance and support personnel. More is needed. Everything possible must be done to preserve the ingredients that make up this force. The destruction of even one piece of equipment or the loss of a single airman degrades our capability irretrievably.

We can anticipate an even greater need of air power during the year ahead. Now is the time to take another look at the state of our safety. What has been done to prevent accidents is important. Equally or more important is a conscientious self-evaluation to learn what still remains to be done.

The President has established "Mission Safety–70" – a five-year accident-prevention goal. We in the Air Force must support this goal in every quadrant: nuclear, aircraft, missile and ground safety. These programs have achieved commendable gains in accident prevention, gains which are a product of the professionalism and dedication displayed by the entire Air Force – officers, airmen, civilians and families. These programs must be continued and accelerated to meet the increasing demand on the nation's air power in these critical times. ★

Glen W. Martin

GLEN W. MARTIN
LIEUTENANT GENERAL, USAF
THE INSPECTOR GENERAL

☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆


U.S. AIR FORCE
USAF

ICE CRYSTALS

. . . AND FLAMEOUTS

Lt Col Norman H. Frisbie
Directorate of Aerospace Safety

The following is a narrative of three test F-4C aircraft flown from the McDonnell Aircraft plant at St. Louis, MAC 876, MAC 1054 and MAC 1050:

On Thursday, 1 July 1965, at 0940, the three-plane flight took off from MAC, St. Louis, and climbed initially to an altitude of about 37,000 feet. An overcast was encountered at 20,000 feet; upon leveling off, the aircraft were still in the clouds. Climb was made to higher altitudes, MAC 876 to 42,000, MAC 1054 to 40,000 feet, and MAC 1050 to 38,000 feet. All aircraft were still in the clouds. After approximately 10 minutes at these altitudes, the following sequence took place: MAC 1054 had a flameout of the port engine; MAC 1050 lost his airspeed indicator; and MAC 876 experienced a double flameout.

MAC 1054 was flying at 40,000 feet at .9 IMN (indicated mach nr.) with approximately 90 per cent rpm. The pilot saw what he thought was visible moisture hitting the windshield prior to the first flameout. When the port engine flamed out, the pilot immediately advanced starboard throttle to full military and reported that EGT settled down at 625 degrees.

The port throttle was then retarded to idle detent and ignition was depressed. Relight was obtained at 60 per cent rpm. After 30 to 60 seconds the engine flamed out again. Another relight was obtained and this too lasted only for 30 to 60 seconds. Both of these relights and flameouts occured at 40,000 feet. In both cases the flameouts occurred after the engine had been relit and brought up to a stabilized 90 per cent rpm. After the third flameout the pilot felt that he was very slow, even though his airspeed indication had not dropped. Cross checking the angle of attack showed it was around 22 units. (Cruise is about eight units, approach at 19 and full stall at 30 units.) This confirmed that his airspeed indication was erroneous.

The pilot declared an emergency and pushed over to start a descent, using the angle of attack. At the instant of push over he felt the rudder shaker (a stall warning vibrator set at 22.3 units of attack), and his airspeed indicator unwound to zero. Pitot heat had been placed in the "On" position prior to encountering IFR conditions during the initial climbout. While pushing over, the third relight was made and this time the engine kept running for the rest of the flight. At no time during the flight was ice seen on any external surface.

Right after MAC 1054's initial flameout, MAC 1050 lost his airspeed indicator. When this occurred, pitot heat was turned on, a descent was started and the aircraft returned to base.

At about the same time that MAC 1054 was having his flame-

ICE CRYSTALS

. . . AND FLAMEOUTS

out difficulties, the first aircraft, MAC 876, experienced a double engine flameout. This aircraft was flying at 42,000 feet at .9 IMN. Both pitot heat and engine anti-ice had been placed in the "On" position before encountering IFR conditions in initial climbout. MAC 876 had reduced power on both engines to 2100 pph (pounds per hour) in order to slow down from .9 to .85 Mach. Although rpms were not noted, a fuel flow of 2100 pounds at 42,000 feet is equivalent to 90 per cent rpm. It was during this deceleration, at .87 IMN that dual flameout occurred. When this happened a descent was started and both throttles were immediately brought to idle. The port throttle was then placed in the cut-off position and the starboard throttle was pumped once toward military to be certain the flame was out. There was no response to this action, so the starboard throttle was placed in cut-off position. Intake ramps were checked visually and found to be operating normally. The pilot stated that the aircraft did not have any visible ice on any surface throughout the flight. Both throttles were then advanced to idle detent and ignition buttons were depressed. Port engine light off occurred at about 40,000 feet and starboard at about 37,000 feet. Relights were obtained before generator drop-out. After the engines relit, speed was allowed to build up and final recovery was made at 34,000 feet at .9 IMN. The pilot then returned to base and landed.

Temperature at 40,000 feet was minus 57 degrees C and visible moisture was present. Flight was in cirrus clouds. Turbulence was very light and flight was in the vicinity of a known wind shear. Thunderstorms were reported in the vicinity immediately after the flameouts.

MAC Investigation

During the investigation no malfunctions were found that could be pointed to as the definite cause of these flameouts. It should be noted that one of the pilots thought he saw visible moisture hitting the windshield prior to the flameouts. The moisture, it is believed, had to be ice crystals rather than super-cooled water. Each pilot specifically stated that the lips of the intake ducts were checked and found to be free of ice. These surfaces will be among the first to build up ice in the proper atmospheric conditions, and the fact that they were clean further substantiates that the moisture was in the form of ice crystals.

The foregoing investigation failed to reveal conclusive evidence of mechanical failures which could have caused or contributed to the flameouts.

The prevailing atmospheric conditions do indicate strongly that the flameouts were induced by ingestion of ice crystals.

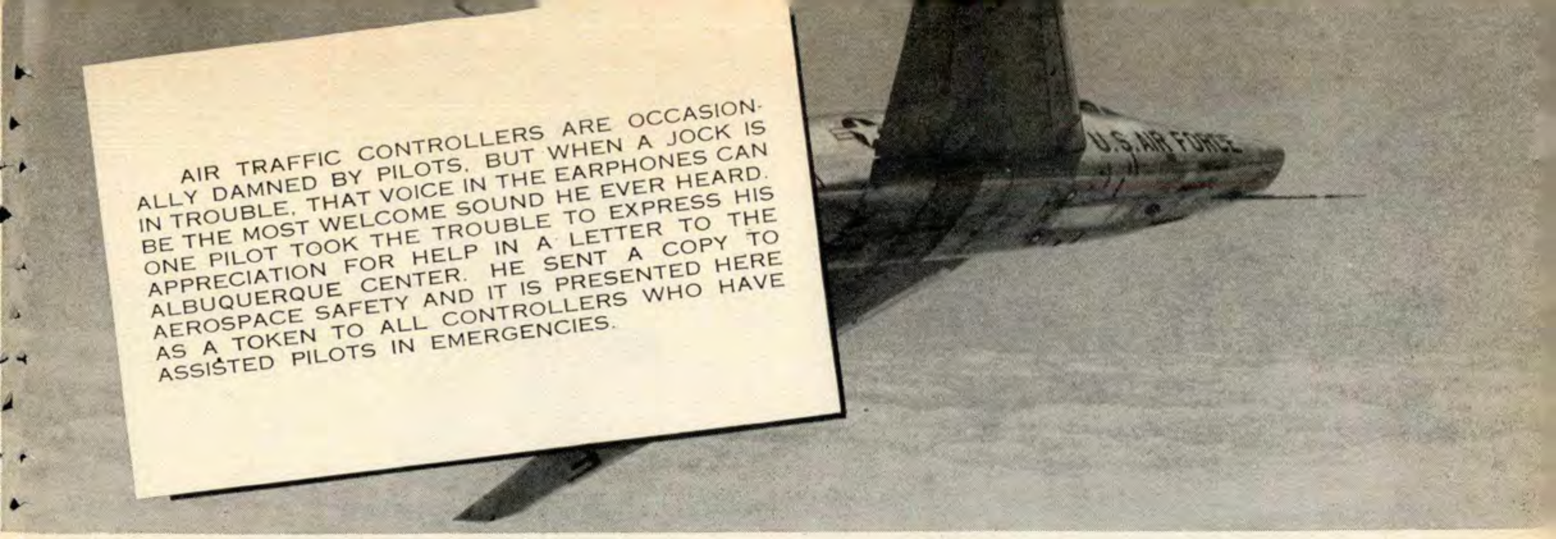
Aerospace Systems Division (ASD) flight test people at Wright-Patterson also have the problem under surveillance and have been conducting F-4C engine icing tests. They have been flying behind a KC-135 spraying water in freezing temperatures which, quite naturally, loads up the F-4C with enormous amounts of ice. So far, an informal evaluation of this test indicates that rapid movements of the throttle produce flameouts. ASD will issue supplements to the F-4 manuals and will continue the investigation as this phenomenon affects all aircraft. If any pilot knows of similar incidents such as described above, let ASZME at Wright-Patterson know.

We in Safety have made the following evaluation:

- Weather: It can be assumed that almost all clouds at high altitudes are of ice crystal content. The amount of ice crystal content varies with cloud type — translucency is the key. The more transparent formations contain fewer ice crystals. Thunderstorm clouds and clouds associated with thunderstorms (in the higher levels such as cirrus clouds) should be assumed to have high ice crystal content, although thunderstorm tops frequently are of super-cooled water content and to a lesser degree ice crystal formation. High level cirrus clouds associated with frontal activity can also be assumed to have high ice crystal content. However, the amount of ice crystallization in such clouds necessary to cause flameouts is so rare that we do not believe this problem, per se, exists. This opinion is supported by only three other reported occasions, once by B-52's, once by an F-102, and by three Navy F-4B's in 1961. Forecasting amounts of ice crystallization is impossible.

- Pilotage: Based on limited incidents, Directorate of Aerospace Safety recommends that crews be made aware that these unexplained flameouts did occur and that no mechanical malfunction was found on either the airframes or the engines which could be considered a contributing factor. When practicable, high performance aircraft should avoid flying in heavy or dense cirrus. If avoidance of this type clouds is impracticable, crews should realize that relights normally constitute no problem and that the area of high ice crystallization is limited to a very narrow band in the atmosphere. In all probability, a lower altitude will have to be selected in order to main the light.

In summary, forewarned is forearmed. The problem discussed is rare, but if it happens to you, don't panic. Get a relight, select another altitude, if possible, and please report the incident. ★



AIR TRAFFIC CONTROLLERS ARE OCCASIONALLY DAMNED BY PILOTS, BUT WHEN A JOCK IS IN TROUBLE, THAT VOICE IN THE EARPHONES CAN BE THE MOST WELCOME SOUND HE EVER HEARD. ONE PILOT TOOK THE TROUBLE TO EXPRESS HIS APPRECIATION FOR HELP IN A LETTER TO THE ALBUQUERQUE CENTER. HE SENT A COPY TO AEROSPACE SAFETY AND IT IS PRESENTED HERE AS A TOKEN TO ALL CONTROLLERS WHO HAVE ASSISTED PILOTS IN EMERGENCIES.

THANKS, FRIEND....

Reference is made to my flight in F-100, serial number 56-3948, 29 July 1965, from Edwards AFB to Holloman AFB. I departed Edwards approximately 1700 MST and arrived at Holloman 1830 MST. The flight was conducted under IFR conditions at FL 370.

Upon departure from Edwards and hand-off to Los Angeles Center, I experienced transmission difficulties; however, I was able to confirm my assigned altitude, FL 370, and clearance to proceed via my filed flight plan. Upon receiving further instructions from Los Angeles Center, I experienced complete transmitter failure. Later I was able to ascertain that my receiver was working, by virtue of hearing transmissions from Albuquerque Center in their attempt to contact me. In addition, at this time I was experiencing flight conditions of heavy turbulence due to numerous thunderstorms in the area. In fact, I could hear Albuquerque Center advising other traffic of severe weather cells and providing them information as to which direction to proceed to eliminate the possibility of encountering these weather cells. Having flown in the military for some 25 years, I naturally thought that my good friends in civilian flying were receiving preferential treatment.

At this time an Albuquerque Center controller, unknown to me, displayed what every pilot in the same circumstances that I was enjoying appreciates. This controller called me and stated that, if I was receiving him, to so indicate by identifying on my IFF. Upon his receipt of my identification from my transponder, he further advised me to change communications channels after which he would try to contact me again, and if he was unable to, I should come back to this previous channel. Upon changing channels again, confirmation of communications was established and at this time and for the duration of the flight I received what I considered VIP treatment. The controller steered me around all known severe weather cells in the area, cleared me through the restricted area 5107 and provided me with approach and letdown instructions to Holloman.

The professionalism displayed by your controllers in the Albuquerque area on this occasion makes it indeed a pleasure to fly a single place fighter with the realization that unusual occurrences in flight are readily apparent to your personnel and they handle them most expeditiously and with the full knowledge of the problems that are presented to the aircrew involved. I wish to personally express my thanks to this specific controller and to your Center for the excellent service they have provided me and my test activities here at Holloman. ★

Col Jack D. Beckelman
Holloman AFB, New Mexico

SOMEONE DOWN HERE

Robert W. Harrison

Flight operations during the winter are no more hazardous than during any other season, but there are peculiarities that must be overcome to make this a true statement. In fact, winter weather with its lower temperatures and fewer thunderstorms brings with it some benefits that offset some of the hazards it presents.

In dealing with winter-provided hazards we can look at them from various points of view, i.e., the pilot's, the operations officer's, the weatherman's, the base engineer's. Weather, existing and forecast, is the concern of all. What's the visibility? What will it be an hour from now, four hours? Runway Condition Reading, (RCR)? Barrier? Is it free and not clogged with ice? How about that cold front? Will the winds be as forecast?

While the pilot has many things to think about in regard to his aircraft, the weather, winter clothing, survival equipment, probably his biggest concern is centered on landing conditions. He will want to know the RCR and how the existing runway condition compares with his landing ability at this weight and configuration. If he can't hack it he wants to know soon enough to get to his alternate. If landing conditions are marginal, he would like to know that, in a fighter, the drag chute is going to operate as advertised, that the barrier is available and ready to stop the bird if necessary.

As for weather reports and forecasts, the pilot wants, needs and deserves to have the latest accurate information. Alternating with those bright, clear days with a hundred miles visibility are going to be some where the weather is in the weeds. When the vis and ceiling are marginal, breakout at 180 knots approach speed will not leave much time for judgment, decision and action. If he's not sharp on instruments, this is no time to practice this skill. This is the time when those hours in the simulator and all those practice instrument approaches will come in mighty handy.

While he has several things going for him – latest weather information, ILS, GCA, VASI – it is a great comfort to know that he can depend upon each and all of them. An unrealistic weather report can lead to an accident, regardless of how sharp the men in the GCA shack are, if the result is a pilot boxed into a corner with no way out except a landing at this base and pretty quick. Seems like every winter one or more unlucky jocks get into this kind of bind and the accident reports sometimes read like a chinese puzzle of ineptitude, confusion and indecision on the part of one or more of the several parties involved.

When these mishaps occur, poor planning often becomes apparent, sometimes compounded by a lack of expertise.

- The pilot can't hack the weather but he discovered this too late and has nowhere else to land, so he keeps trying. Sometimes he never makes it.
- The weatherman missed by a mile. Granted weather forecasting is not an exact science, but this doesn't help the pilot.
- GCA out of commission. Sometimes it takes an awfully long time to turn the van around, or, as has happened, it never got turned, the runway with which it was aligned is the worst available, and its services were of little or no use to the pilot.

Now most of the time the weatherman puts out very fine info. Most of the time radar is right on the money. Most of the time the pilot is sharp and the airplane and all its systems and gages are working as they should. But too frequently when one thing goes sour the old snowball starts rolling and then, look out!

Pilots have been known to squawk before they're hurt. Nevertheless, it behooves all those who support them to do their best, especially when their best may merely make a bad situation tenable. Ops has the responsibility for all flights. To launch or not to launch often is the nagging question facing the Ops officer. Sometimes his decision is a gamble, hedged by the experience of his aircrews, the facilities available and reliance on the weather forecasts. If he's wrong, then it is he who has

to sweat until the last bird is on the ground. Like the pilot, he deserves accurate information as to weather and the condition of all facilities supporting the pilot. He knows that, if he has aircraft scattered at other bases, tomorrow he's going to have scheduling problems. His natural tendency is to avoid this, if at all possible. On the other hand, an accident during a do-or-die attempt to get all the birds back to the home roost is disagreeable to contemplate. Sometime this winter there are going to be several operations officers who will face this dilemma. Their only way out is to know just what they can expect from their aircrews and the support people.

What about the latter. We keep ultimately pointing the finger at those who occupy the support role. We are demanding first class service with an iron clad guarantee to the men doing the flying and those in the office making decisions. Consider the weatherman. He has a big responsibility, and though he is on the receiving end of our ridicule at times, we depend on him one heck of a lot. In fact, we sometimes bet our lives on him. He is, during inclement weather, faced with a tremendous responsibility and even the very best he can do is occasionally not good enough. Weather is fickle, and while generalities in forecasts are pretty accurate, specifics frequently play tricks that, it would seem, could drive a weather man out of his mind.

The weather is not always the only problem he faces. Honesty is something he must have as part of his credo. It is a great temptation to call a shot on the optimistic side, perhaps because he knows that is what others want to hear, or because the pressure is on. It takes real guts to issue a gloomy forecast that might ground everything, while at the same time knowing that the fickle weather may make him look like a chump. But if he has what it takes to stand on his judgment and adjust to a changing situation, then he deserves the attention and respect of those depending on him — even when he's wrong.

Then there are the electronic guys with their tubes and transistors and scopes. Snow and rain foul them up and they lose their targets. At the same time they know that pilots are depending on them, sometimes critically. Their capability is based on the training and experience they have had, judgment, and an infinitely complicated maze of electronic gear. If one element fails them, then they may fail the pilot, perhaps with fatal results. Responsibility? They have a tremendous load of it sitting squarely on their shoulders.

This brings us to the people with, physically speaking, the nastiest job of all — the facilities people who clear the ice and snow, inspect and service the barriers, determine the RCR. Discomfort is a way of life, but they know they can't get the job done sitting in a warm building. Their work could have been made easier by good planning and execution of that planning back when the weather was a lot more comfortable. It is much easier to construct proper barrier well drainage in August than to have to get the ice out in January. Good training a few months ago would have prevented the accident that occurred when an inept driver drove his snowplow into the side of an aircraft. Conversely, the driver that knows his job will plow the taxiways wide enough so that an aircraft doesn't catch a wingtip in a snow bank.

Take a look at any airbase and what do you see? People? Machines? Buildings? Aircraft? Yes, all of these. What we must remember is that everything — people, buildings, machines, miles of pavement — are there for just one purpose: to support the pilot so that he may perform his mission. All of these things and the aircraft are, in final analysis, simply tools to be used by the aircrews to perform a vital job. This does not mean that any component is any less important than another. Take another look around. There are a lot of someones down here who help bring our aircraft home safely. ★

THE IPIS APPROACH

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

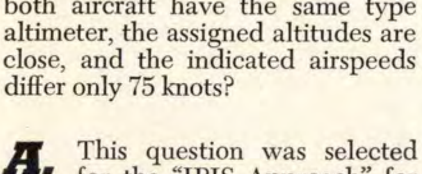
Q. I have recently been appointed Instrument Training Officer for our squadron. I am planning a briefing on altimeter installation error and have designed the following situation to emphasize the need for applying the correction factor on all flights.

• An F-102 indicating 350 knots (.82M) is eastbound on a certain Jet Route at an assigned altitude of FL 250. Altimeter installation error is minus 760 feet; therefore, the altimeter should indicate 24,-240 to maintain FL 250.

• A T-33 indicating 275 knots is westbound toward the F-102 on the same Jet Route at an assigned altitude of FL 260. Altimeter installation error is plus 240 feet; therefore, the altimeter should indicate 26,240 to maintain FL 260.

• If neither pilot corrected for the error, the aircraft would theoretically meet head on at the same altitude.

Would you help me explain why



the T-33 and F-102 installation errors are in opposite directions, since both aircraft have the same type altimeter, the assigned altitudes are close, and the indicated airspeeds differ only 75 knots?

A. This question was selected for the "IPIS Approach" for several reasons, one of which was to help clarify some of the existing flight manual instructions for applying altimeter corrections. For example:

• F-102 — "Add correction to obtain true pressure altitude; subtract correction to obtain indicated altitude."

• F-105 — "Indicated altitude equals pressure altitude minus (plus or minus) correction."

• RB-47H — "Pressure altitude equals indicated altitude plus or minus correction."

• T-39 — "Indicated pressure altitude equals calibrated altitude plus correction."

• B-57D — "Calibrated altitude equals indicated altitude plus correction." (Enter chart with true altitude.)

• T-38/F-5 — "Indicated altitude equals pressure altitude plus correction." (Correction may be plus or minus.)

• C-118 — "Add correction to altimeter reading to obtain altitude."

• C-54 — "Altimeter reading plus correction equals true altitude." . . . Confusing, isn't it?

Altimeter installation error (often called position error) is caused by the flow of air over the static source and is a function of indicated airspeed, altitude, and in some cases configuration.

Aircraft equipped with a pitot-static boom (F-102), when flying at subsonic speeds, will generally have higher pressure than ambient existing at the static source. This high pressure results from pressure waves that form on the pitot-static boom. The faster the aircraft moves through the air mass, the more pronounced the pressure wave becomes, until eventually the pressures reaches its maximum value, usually just prior to Mach 1. At this time the pressure wave would be located at the static source and error may be as great as 3000 feet in some aircraft. As the aircraft speed increases to supersonic, the pressure wave moves aft of the static source resulting in decreased pressure and possibly zero error or error in the opposite direction. The high pressure existing at the static source will cause the altimeter to indicate lower than the actual altitude. In other words, with the assigned altitude indicated on the altimeter, the aircraft will be erroneously high. Therefore, in order to maintain an assigned altitude, the altimeter must be indicating lower than the assigned altitude by the amount of the correction factor.

Aircraft equipped with the static source on the fuselage (T-33) have a different problem. With this installation the airflow across the static source usually creates a lower than ambient pressure because of the venturi effect. The low pressure existing at the static source will cause the altimeter to indicate higher than the actual altitude. In other words, with the assigned altitude indicated on the altimeter, the aircraft will be erroneously low. Therefore, in order to maintain an assigned altitude, the altimeter must be indicating higher than the assigned altitude by the amount of the correction factor.

Use the explanation here to help interpret your altimeter installation error charts. Apply the correction factor on *all* flights.

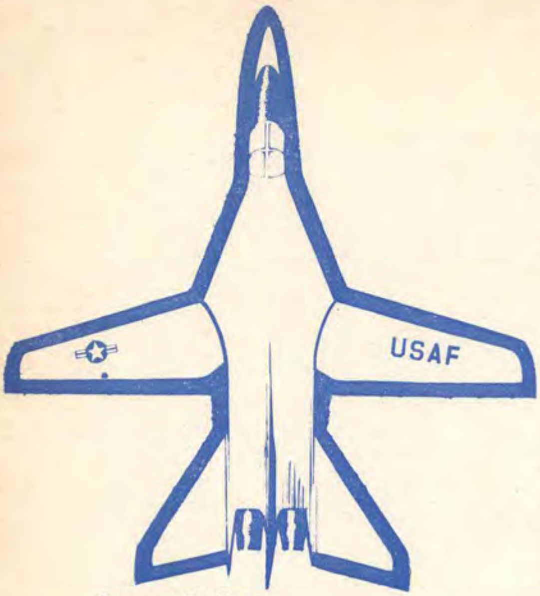
This issue marks the first anniversary of the "IPIS Approach." We greatly appreciate the tremendous response this feature has created. Continue to send us your questions and we will find the answers. Seasons greetings from your Instrument School.

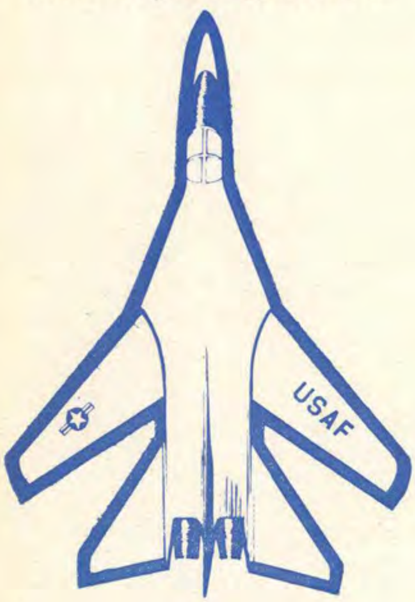
Robert D. Williams

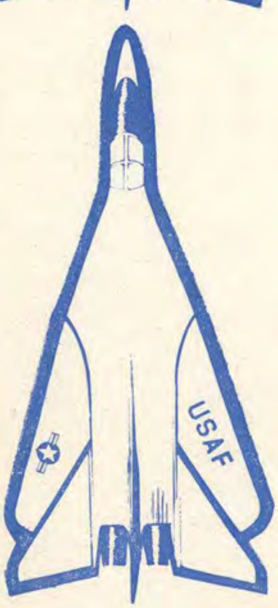
Robert D. Williams
Col, USAF
Commander, Instrument Pilot Instructor School

High, low slow and safe

Grover C. Tate
General Dynamics/Fort Worth







With the development of the General Dynamics variable wing-sweep F-111, the humor in the old warning to stay low and slow is lost. The pilot can change the sweep of the wings during flight and can essentially redesign his aircraft for safe performance for operating high and fast, high and slow, low and fast, or low and slow. This selectivity allows the pilot to tailor his wing position to give him maximum safe performance for the conditions of any assigned mission. The wing-sweeping capability allows the pilot to tame his mach busting mission tiger into a docile pussycat for takeoff and landing.

The variable sweep wing is but one, although perhaps the most outstanding, safety feature of the F-111. As a result of the safety organization that was established within the Air Force and General Dynamics F-111 Project Offices, safety considerations were emphasized as an integral part of the total design and development effort. Safety was a part of the aircraft and not a tolerated tag-along consideration. As a result of this organizational structure, flight safety representatives participated in pre-engineering inspections, symposiums conducted by flight safety groups, design engineering inspections and sub-contractor design reviews. They made orientation tours of operational bases, and took cruises aboard Naval aircraft carriers to become familiar with carrier operations. Records of Air Force and Navy accidents were studied and lessons learned from this review were put to work in the F-111 design program. Maintenance problems were studied and designs were made to avoid conditions that would create, or be subject to the same or similar problems. Because of the emphasized safety program during the design phase, safety has been given its just consideration all of the way from the idea stage to the finished product.

Many significant safety features evolved from the early considerations and others are there by basic inherent design characteristics. The variable sweep wing is the primary safety feature and is most significant during the takeoff and landing phase where the greatest number of aircraft operational accidents occur. When the wing sweep is used in conjunction with the flaps and slats it allows:

- Low takeoff and landing speeds.
- Short takeoff and landing roll.
- Low angle of attack during takeoff and landing and resultant good pilot visibility during both phases.
- Ability to use almost any type of airstrip for takeoff and landing.

Large, low pressure tires provide the ability to operate from relatively soft surfaces, increased blowout resistance, and exceptional braking effectiveness.

Both main wheels are attached to a single axle, eliminating the one wheel up-one wheel down landing.

Wheel brakes are powered by a dual system. An accumulator backup is provided for each system, an auxiliary brake is available if normal and backup fail, and as a court of last resort – a tail hook is available. Landing roll spoiler brakes aid in the braking effort. Proportional, modulating anti-skid is utilized to prevent wheel skid. Thermal plugs relieve tire pressures in the event of overheat. If a tire should fail, the wheels are nonfrangible and compound damage will not follow.

Once airborne, what does the pilot have going for him? First, there are two engines, both with automatic restart ignition. With one engine operating, the other can be started by cross bleeding. Both the constant speed drive oil system and the basic engine oil system are self contained – no feed lines exposed to damage or failure.

Two completely separate hydraulic systems provide power for the flight controls, landing gear, brakes, and other hydraulic functions. Each system has a pump on each engine. The primary hydraulic system is reserved for the operation of the flight controls and wing sweep. The utility system shares in the operation of these systems but also provides power for all of the other hydraulic demands of the aircraft. If the primary hydraulic system fails, all of the other functions of the utility system are isolated from the system. The flight control and wing sweep systems then have the exclusive services of the utility system. Backup accumulators and air bottles are available for the operation of other hydraulic functions in the event of utility system isolation. The flaps, normally hydraulically actuated, have an electrically actuated emergency system. To preclude hydraulic system failure, all of the hydraulic system pressure lines are made of steel.

Electrical power is generated by two independent systems for both AC and DC power. An AC generator on each engine powers a bus for its system and is capable of supplying all of the electrical demands of the aircraft plus a 30 per cent overload. If either generator fails, or is inoperative because of an engine shut down, the two busses are automatically connected and the remaining generator operates both systems. When a generator overheats, a thermal sensing device will cause the generator to be decoupled from the engine to prevent additional damage.

If the generator malfunctions, the pilot can decouple it from the engine by the press of a button. Transformer-rectifier units are arranged so that any time AC power is available, DC power will be provided. An emergency generator, driven by the utility hydraulic system, is activated if both main AC systems should fail and provides both AC and DC power within three seconds of the time of failure.

The flight control system is a dual control, triple redundant system. Separate channels of mechanical linkage control hydraulic servo actuators which move control surfaces. Stability augmentation is provided for roll, pitch and yaw by use of triple redundant electronic circuitry and electro-hydraulic dampers.

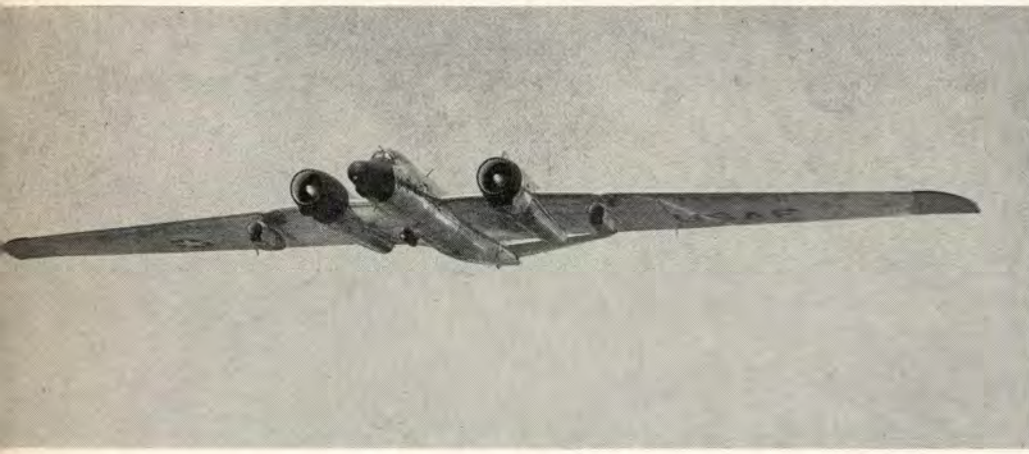
Symmetrical wing sweep movement is assured by two hydraulically powered motors driving threaded, mechanically synchronized actuators. Failure of either hydraulic system will not prevent changing the sweep position of the wing, but will only slow the rate of change.

Perhaps the most revolutionary safety feature of the F-111, in addition to the wing sweep, is the crew escape module. The first aircraft have conventional ejection seats. Present scheduling calls for installation of the escape module beginning with Nr 12 aircraft. The module feature gives the crew the capability to successfully escape from the aircraft at any point within the operational envelope — from static against the blocks through 2.5 mach at altitude. Redundant systems are provided for module separation initiation; reliable mild detonating cord and linear shaped charges are used in the severance system. After the module is separated, it provides the crew with the tools of survival for any environment — land or sea, hot or cold. The module is a close cousin to the escape vehicles used by the astronauts and provides the non-orbital pilot with the same escape and survival potential as his spaceman contemporaries.

Many years ago when the B-26 Marauder was the hottest bomber in the business, a pilot had successfully negotiated a complete mission only to have the copilot, with full cooperation of a malfunctioning gear safety switch, retract the landing gear at the end of the landing roll. The hero of this brown shoe epic then punched the copilot squarely in the nose and reported to the Ops Officer, "I took care of the copilot, you all take care of the aircraft." Now, in the case of the F-111, the designers and engineers have taken care of the aircraft, and of the pilot. ★

Ice fog, hurricane, foehn wind, typhoon, tropical thunderstorm, CAT – these are some of the weather phenomena that daily confront the aircrews of the 9th Weather Reconnaissance Wing, McClellan AFB. Commanded by Colonel Carl H. Morales, this Air Weather Service Wing has six squadrons, two detachments and three task flights. The aircraft? Five different types – WB-47E, RB-57B and C, RB-57F, WC-130B and E and WC-135B. The mission: To provide weather reconnaissance and atmospheric sampling as directed by the USAF and DOD.

To get a better picture of the operation let's look at the units and their locations.



WEATHER SCOUT

Maj Henry K. Good
Chief, Safety Division,
9 Weather Recon Wg
McClellan AFB, Calif.

The 53 Weather Reconnaissance Squadron (WB-47E's) is located at Hunter AFB, Ga., with a detachment flying WC-130B's at Ramey AFB, Puerto Rico. The area of responsibility is the Atlantic, Gulf of Mexico, Caribbean, Mediterranean and the Middle East. Known as "The Hurricane Hunters," the 53-WRS crews specialize in hurricane hunting, air refueling area support for TAC rotational moves, NATO exercises, weather reconnaissance for the Air Force Eastern Missile Test Range and similar missions.

The 54 WRS "Typhoon Chasers" is located at Andersen AFB, Guam. Their area of responsibility – the central and south Pacific and the Philippine Sea. Typhoons, weather reconnaissance for TAC fighter movements, atmospheric sampling and synoptic weather tracks are but a few of their assigned jobs.

At McClellan AFB is the 55 WRS (WB-47's and WC-135's) with a detachment at Eielson AFB, Alaska. These crews fly standard daily routes (or tracks) between the West Coast and Hawaii, in the Gulf of Alaska, and over the Arctic Ice Cap to 86 degrees N latitude. Special missions are also flown at the request of various agencies. These special mission requirements many times demand global weather reconnaissance and long TDY's. In addition, the 55th crews and aircraft have traditionally helped the other squadrons during periods of heavy commitments.

The 56 WRS (WB-47's and WC-135's) Yokota AB, Japan, provides atmospheric sampling, refueling area reconnaissance, etc., in the Northwest Pacific, Philippine Sea, Sea of Japan and the East and South China Sea.

The 57 WRS (WB-47's), Hickam AFB, Hawaii, has just moved from Avalon Airfield, Australia. At the same time it is changing from RB-57B and C's to WB-47's. The mission is support of the satellite programs, missile recovery projects, TAC rotational moves and numerous special missions.

The 58 WRS (RB-57B and C's and RB-57F's), Kirtland AFB, New Mexico, has three Task Flights, Alpha, Bravo and Charlie, located at Eielson AFB, Alaska, Albrook AFB, Canal Zone, and East Sale RAAF Station, Australia. The 58th is the only designated USAF unit whose primary mission is nuclear test and atmospheric/stratospheric sampling. The primary aircraft used is the RB-57F, an "exotic" of the first order. Powered by two TB-33-P11 turbo fans *and* two J-60-90 turbo jets, its angle-of-climb and high altitude performance are sensational. It is designed for flight above FL 600 and the crews must wear full pressure suits. As a result SMSgt John R. Penz, NCOIC of the Personal/Survival Equipment Section, is known as the wardrobe master of the most expensive clothes closet in the West. The four-layer suits are almost identical to those worn by the astronauts and cost the USAF $7800.00 apiece.

Needless to say, the varied missions and aircraft of the Wing present a number of challenges to mission effectiveness and safe operation. What are these challenges? How are they met?

Mobility requirements: The varied missions call for the use of civil airfields that have never before been used by RB-57F, B/WB-47 and C/WC-135 aircraft. With no normal base support, the crews are on their own. Refueling, Dash-6's, etc., all become crew duties. For use in warm climates the WB-47 must have water/alcohol available for takeoff, the runway approaches must be clear and the taxiways must be wide enough to support the out rigger gear (44 feet 4 inches apart). The RB-57F doesn't need long runways or water alcohol injection, instead it needs very smooth, wide taxiways and runways. Its flexible 122-foot wing has a tip clearance of 22 inches static. A rough taxiway combined with high taxi lights spells damage. Both the RB-57 and WB-47 have a critical crosswind factor followed closely by the WC-135. The answer? Airfield surveys are made on all questionable airfields prior to committing 9WRW aircraft to using them.

Historically, the weather recon squadrons have had very lean manning. The only UMD officer slots are Commander, Operations and Materiel, the rest are all crew slots. All crewmembers have additional duties such as Chief of Personnel and Administration, Safety, Assistant Operations Officer. This requires close coordination and command supervision since it is not unusual for half of the crew members to be on extended TDY and most of the rest flying local commitments. So — who's watching the store? Those who are left must be able to fill in and do the job correctly.

Hurricane and Typhoon penetrations: Due to structural limitations, the WB-47 cannot penetrate under any circumstance. When possible they overfly the storms; if not, they relay METRO information and take oblique radar photos. They do an excellent job, but now with a full complement of WC-130's an old system is returning. The WC-130's penetrate hurricanes and typhoons as the WB-50's did in the past. On Hurricane Betsy a new dimension was added to storm tracking and analysis. The RB-57F was used to overfly Betsy and take vertical photos, meanwhile the WC-130 penetrated, giving a horizontal cross section of the storm.

We feel that reconnaissance on this particularly vicious storm was typical of our capability. Excellent positions were maintained throughout the storm's life. When the storm established a new course toward Southern Florida, detection of the change enabled new forecasts to provide timely warning for the Florida Coast. The same was true for the storm's arrival along the Gulf Coast.

A "typical" WC-130 storm penetration is made in the following manner. First, the storm is surveyed by radar to obtain an overall view. Wall cloud thickness and intensity, eye size and shape and precipitation areas are the predominant features observed. If the wall cloud is thin or broken in one quadrant of the storm, the penetration track will usually go through this area. If the wall cloud is continuous, other factors such as precipitation returns, distance to the eye, etc., are considered in selecting a track to the eye. The idea is to get into the eye with a minimum exposure to turbulence. Once inside the eye, where the weather is very calm, much additional data is gathered. A radio-sonde instrument is ejected from the aircraft and floats to the surface at pre-determined rate of descent. Temperature, humidity and atmospheric pressure are continuously sent back to the aircraft until the instrument contacts the surface. Meanwhile the weather observer is also taking readings of temperature, humidity and atmospheric pressure. All of these data are charted to give an exact inside picture of the storm. The navigator plots the exact location of the eye and then the bumpy ride to the outside begins. Depending upon fuel remaining and distance to home base, the crew may loiter for three to six hours, make another penetration and then go home.

The special high altitude application of the RB-57F adds a whole family of challenges. The fatigue induced by six plus hours in a full pressure suit is immeasurable, thus crew rest time can be extended at the discretion of the attending flight surgeon. This, of course, extends the turnaround time.

During the 72-hour period prior to a pressure suit flight the crewmembers must go on a special diet of low residue, low-gas forming foods. The old rule of 12 hours from bottle to throttle is out; alcohol should not be taken for a minimum of 24 hours prior to flight.

Preflighting an aircraft while wearing a pressure suit is out of the question so another crew must do this job.

Once the pressure suits are donned they must be ventilated. Shock from dehydration and heat can occur in a matter of minutes in hot climates. A special air-conditioned van is used to transport the crews from P.E. locker room to the aircraft. That's right, before RB-57F's can operate from a base, one of these vans must be in place accompanied by a contingent of specially trained physiological support personnel. The 9WRW answer to these special physiological challenges is the assignment of three specially trained flight surgeons. They are all pressure suit qualified and maintain close contact with the crews at all times.

There you have it. If your job calls for driving a fighter to Europe or Asia with a "few" refuelings enroute, it should ease your mind to know that the weather over the entire track has been scouted not once but twice by crews that have spent a good bit of time on the receiving end of an airborne gas station themselves. If your question has to do with the current amount of radiological debris in the atmosphere or stratosphere, the 9WRW crews have an answer for you. Last but far from least, if you want to know the location and direction of movement of a hurricane, typhoon or tropical depression, the 9WRW crews will fly day and night to get you an answer. ★

Two of AWS' newest aircraft, the RB-57F of the 58 WRS, Kirtland AFB, N.Mex., and a new WC-130E belonging to the 54 WRS. The WC-130 has been specially modified for weather reconnaissance work to include penetration of tropical depressions, storms and typhoons. The RB-57 is a high-altitude aircraft designed for atmospheric sampling operations.

Arresting Barrier

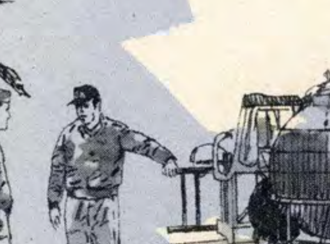
Monitor Safety Survey

Maj Jack R. Pulliam
Directorate of Aerospace Safety

Runway Distance Markers

Crash Rescue

Extinguisher Inspection



Time was when a major function of the Directorate of Aerospace Safety was conducting safety surveys. This has been replaced by the Monitor Safety Survey Program, whereby we look over the shoulder of the major air command during the course of the command survey. Our purpose is to evaluate the effectiveness of the command system by participating and observing the command team while they are conducting a safety survey.

The scope of the monitor survey encompasses flight, missile, nuclear, ground, and explosive safety aspects, as dictated by command mission requirements. Surveys include review, observation, and evaluation of the following:

- Survey pre-planning and preparation.
- Team Organization, composition, and qualification.
- Briefs and critique techniques.
- Survey execution and findings.
- Special items of command interest.

To accomplish the objective of evaluating command safety survey capabilities, the following approach is being used: An evaluation checklist has been developed. This checklist is flexible and may be amended to fit each situation and organization.

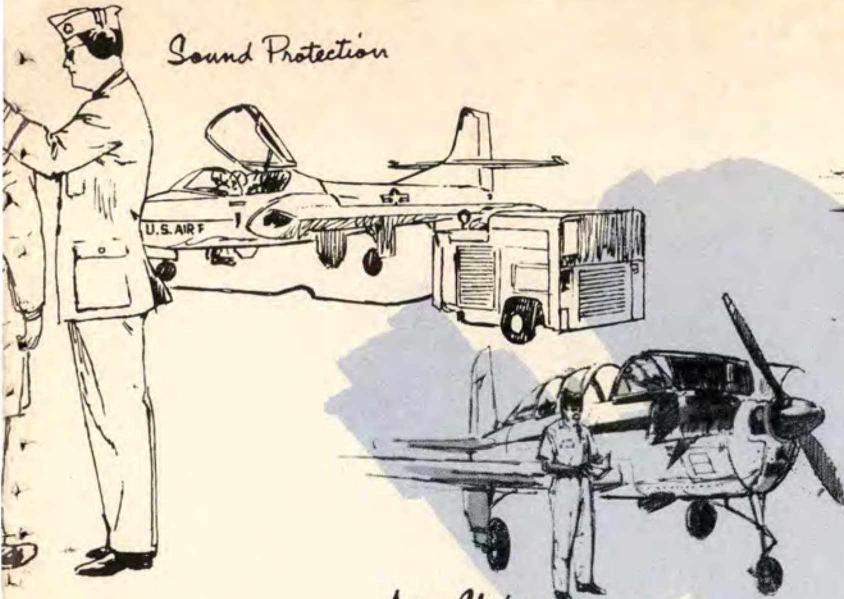
A pre-survey briefing is conducted to inform the command of the role of the USAF team and define areas of participation and observance.

USAF team members are assigned to specific areas and command team members to observe the latter's effectiveness, preparation and qualifications, and to insure that all essential areas of inquiry are surveyed.

Discrepancies discovered by the USAF team, except

Crash Rescue

Ground Safety Program



Sound Protection

Unscheduled Maintenance Inspection

Aero Club

Spot Inspections

for those considered as being critical, are reported only to the command survey team.

USAF team members attend command progress meetings, as well as the entrance and exit briefings, to observe briefing techniques, team control, and "on-site" planning techniques.

An exit briefing is given to the command safety survey team upon completion of the unit survey.

After returning to the Directorate of Aerospace Safety, team members prepare a memorandum report which is submitted to the command, indicating an evaluation of the command team efforts, adequacy of the command final report, and concurrence or nonconcurrence with findings. A passing or failing grade, or for that matter, any kind of score, is not a part of the survey report. Areas are indicated as being adequate or inadequate.

Particulars of one energetic, comprehensive safety survey we monitored are covered in the accompanying illustrations. Although the unit surveyed enjoys a low accident rate, the survey team observed several safety areas requiring corrective action. These were disclosed to the unit commander to assist him in his safety program.

The monitor safety survey program is a more efficient and economical method of determining the effectiveness of command and unit accident prevention programs, showing commanders where hazards can be lessened or eliminated. Since great variance in survey effectiveness has been noted between commands, it behooves every commander to insure that an effectual, energetic, comprehensive safety survey program exists throughout his command. ★

Heli-Arc Welding Shop

Egress and Explosives

ATC Critique

Briefing For FCF

Training Mission

Tower and RSU

RSU Remote Flare Guns

HOW WE TAMED THE TIGER IN OUR TRANSMITTER

Jack B. Scott, Director of Ground Safety
AFCS, Scott Air Force Base, Illinois

During a period prior to 1959, the Air Force Communications Service, then the Airways and Air Communications Service, was electrocuting a man a month in the maintenance and operation of electronic equipment. This rate has been gradually reduced to zero. There have been no fatalities from electrical shock in the past two years. This, in spite of the fact that the Communications Service now has twice the number of people it had prior to 1959 and is operating much more sophisticated equipment at higher voltages.

The elimination of electrocutions was not a matter of luck. It was brought about by systematic analysis of the hazards involved in the maintenance and operation of electronic gear and a program designed specifically to eliminate or guard these hazards, or to circumvent them by development of detailed safe operating procedures.

What is so special about ground safety hazards in communications facilities? Aren't these much the same as those likely to be found in any other base activity? Consider a typical safety survey recently conducted of one of our communications squadrons by well qualified base safety personnel. The survey report contained two discrepancies: (1) oily rags were found in an air conditioning room and (2) a fire escape rope was old and worn. In contrast, an AFCS safety survey of the same squadron listed 65 discrepancies. Why the difference? "Why the difference" is one of the reasons for this article. I hope to give you some idea of AFCS facilities and functions, the safety hazards peculiar to our operations, some idea of what we expect in the way of accident prevention measures by our units, and an indication of the educational and training requirements we have that are peculiar to the Communications Command.

The TACAN transmitter component shown in Figure 1 illustrates some of the typical hazards that we encounter on a day-to-day basis. If the equipment handled by this man were in a hot condition, this would be a typical "How Not To Do It" picture. The component he is working with has many points of exposure of 300 volts or over. Much of this equipment must be

Fig 1, left, some typical hazards encountered daily. If equipment being handled were in a hot condition, this would be an ideal "How Not To" illustration, particularly for airman wearing metal pencil and security badge.

Fig 2, right, another NAVAID — a VOR transmitter. The safety observer is a standard requirement rigidly enforced in AFCS. Work on high voltage equipment is not permitted unless he is present.

Fig 3, right, the Mark 85 tropospheric scatter antenna reaches 118 feet into the air and requires maintenance in all kinds of weather.

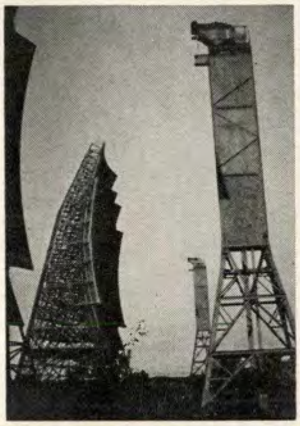


Fig 4, left, tropo site with transmission equipment. Tubes and checkpoints are accessible from exterior, eliminating working "in the blind."

adjusted while hot, must be handled in confined quarters, and often has to be repaired in the minimum of time, such as would be the case with this TACAN component. Note this maintenance man is wearing a metal pencil and a metal security badge—this is not done when maintaining live equipment.

Figure 2 shows another NAVID — a VOR transmitter. Note the safety observer. This is a standard requirement that is rigidly enforced in AFCS. We do not permit any work to be done on high voltage equipment unless a trained safety observer is present.

Figure 3 shows our Mark 85 tropospheric scatter antenna and illustrates several of the other problems that we face. Personnel must climb up into the feed horn. This is usually done with the equipment de-activated. However, some adjustments are made while the equipment is hot. If a man gets between the reflector and the antenna, he can receive quick, serious and, perhaps, fatal RF burns.

Tropospheric scatter is a system of communications which depends upon propagation of a high intensity power output reflected from the tropospheric layer back down to a receiver site. High power outputs are required in order for the next receiver site to receive a minute amount of energy, which is then amplified and, if required, retransmitted to the next station. The advantages of this system are less interference by atmospheric conditions, difficulty of jamming, and lack of interference by terrain factors. From a safety standpoint, however, the high power output of up to 100 kilowatts (constant power output) presents many problems. The antenna reaches 118 feet into the air and often requires maintenance in all kinds of weather.

Although not shown here, the microwave transmitter antenna is often co-located on the tropospheric antenna. The microwave antenna requires frequent maintenance and adjustment. Safe exposure level for RF radiation is established at 0.01 watt/cm^2, and precautions should be taken to avoid exposure of personnel to ambient power levels in excess of this amount for any prolonged periods of time.

Figure 4 shows some of the transmission equipment employed in a tropo site. Note the safety factors in connection with this equipment. Tubes and checkpoints are accessible from the exterior. A minimum of exposure to high voltages is required. Equipment is well lighted so that maintenance can be done without use of flashlights. Working "in the blind" is eliminated.

There are 10,000 volts on the klystron tube in the microwave power amplifier (Figure 5). Note that all high voltage points are behind plexiglass or are metered on the surface of the equipment and cabinets are interlocked. All electronic devices or tubes capable of producing external X-radiation in excess of 300 MR per week must be protected by radiation-proof enclosures or the tubes must be properly shielded. Wherever any radiation hazard is expected, either RF or X-ray, a site survey may be requested from the nearest GEEIA Region. (Reference T.O. 31Z-10-4).

Figure 6 shows a typical 350 kilowatt diesel generator. Note the color coding of various supply lines, i.e., water, fuel, etc. Also, note electrically rated rubber matting in the front of the generator. A little known hazard in connection with diesel engines is that, with either no load or when a governor failure occurs, a diesel generator will seek the infinite speed. It will try to increase its speed until it blows up. If this runaway occurs, the only way to stop the engine is by shutting off the fuel supply. Our large generating plants also have a noise problem, and ear defenders are required. Personnel working in these locations must have periodic audiometric examinations.

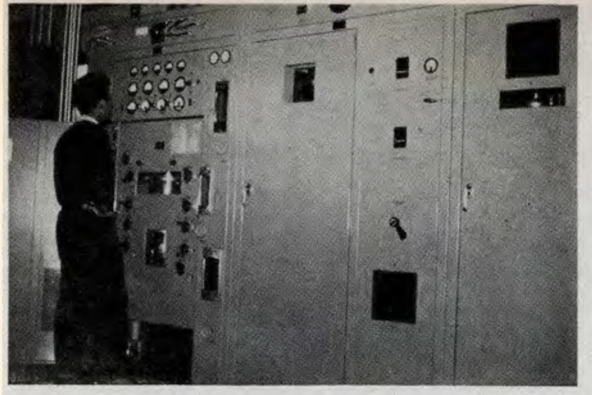
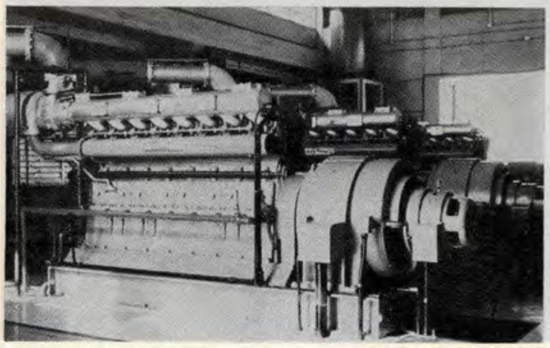


Fig 5, above. Note all high voltage points are behind plexiglass or are metered on the surface of the equipment and cabinets are interlocked.

Fig 6, below. A typical 360 kw diesel generator with color coding of water and fuel lines, with rubber matting in front of generator.



One of the common hazards in AFCS facilities, namely, the closeness of the equipment, is shown in Figure 7. This is particularly true of mobile gear. It is virtually impossible to work on one piece of equipment without having part of your body against the cabinet of an adjacent piece, thus affording a sure continuity of ground through the person doing the work. The only real solution to this problem is extremely good grounding and bonding of all equipment and components. Incidentally, grounding sticks are required to be permanently installed on all equipment cabinets on which high voltages are employed.

Figure 8 shows a typical CPN/4 mobile GCA. Personnel working on the equipment in this unit are exposed to as much as 27,000 volts in the magnetron circuitry. A magnetron is a high vacuum tube containing a cathode and an anode. The latter usually is divided into two or more segments in which a constant magnetic field modifies the shape charge distribution and the voltage current relations. In modern usage, the term magnetron usually refers to magnetron oscillators in which there is an interaction of the electronic space charge with the resonant system which converts direct current power into alternating current power, usually at microwave frequencies. RF at the antenna may be in the order of 750 kilowatts (pulsed power). Most mobile NAVAID equipment employs battery banks of wet cells operating at 28 volts, but up to 300 amperes of current. At least one electrocution and numerous other accidents have occurred as a result of a high intensity DC arc, such as from a screw driver, causing the person to jerk involuntarily and contact a high voltage point in the equipment.

Battery compartments in mobile vans have blown up on several occasions from accumulated hydrogen gas. An installed blower motor partially eliminates this problem. Antenna rotation has also caused a number of accidents. One contract technician was knocked off the roof of a piece of equipment when an airman inadvertently turned on the switch. Cathode-ray tubes employing up to 10,000 volts will be found in these units. One of the primary hazards in connection with GCA, RAPCON, and the new AN/FPN-47 is the fact that personnel must operate, adjust and maintain the equipment in the dark. Darkness is required in order to operate the scopes. Standby equipment is located in the same van, and the facility usually cannot be shut down during maintenance activities.

These are only a few of the more typical facilities found at almost every AFCS squadron. In addition, of course, we have a number of large communications centers and long haul transmitter sites employing monstrous communications equipment. I use the word "monstrous" literally. We have had airmen fresh out of communications school who took their first look at the FRT/4 and actually started shaking at the thought of working on this monster. It is no wonder that Safety or Inspection personnel are extremely wary about conducting surveys in a communications facility. The unfamiliarity with equipment and the fact that extremely high voltages are present are certain to have a diluent effect on a prudent safety man's incentive to visit these areas.

Another problem in connection with transmission equipment is the proximity to electro-explosives devices. Electro-explosives devices (EED's), such as squibs, blasting caps, primers, dimple motors, initiators, igniters, etc., are susceptible to being inadvertently ignited by exposure to the radiated RF fields of communications, navigation, radar, etc., type transmitters. The response of an EED to an RF field depends on such factors as the power output and frequency of the transmitters, the antenna propagation (directional) characteristics and polarization, the distance between the antenna and the EED's and their firing circuitry, type and configuration of the firing circuitry, etc. Careful consideration to these factors must be given in the locating of AFCS facilities (see para. 0623 and Chart 6-1, AFM 127-100).

To sum up the safety problems peculiar to AFCS:

• We must ground or bond all equipment.

• Protect people from inadvertent contact with high voltage by guarding or re-designing the equipment.

• Protect personnel from exposure to X-radiation and RF energies.

• Establish procedures whereby testing and tuning of equipment can be done with minimum risk.

• Minimize the hazards of antenna maintenance operations.

The above problems have been largely overcome by newer functional design of equipment, including several new techniques, such as servo tuning, probe holes for testing, key interlocks, antennae grouping, and others.

Each AFCS facility is now equipped with a Standard Safety Board. These boards are an innovation of AFCS and contain emergency rescue items, such as rope, hook with hardwood handle, resuscitube, flashlight, first aid kit, fuse puller, spare shorting stick, etc. The board is painted red with a white border and is clearly visible and readily accessible.

Training has also played a part in the success of safety in communications operations. All AFCS personnel who work with high voltage electricity are thoroughly trained in closed chest heart massage and mouth-to-mouth resuscitation procedures. Several lives have already been saved as a result of this training. (Reference film, "Pulse of Life," SFI 1322.) Frequent exercising of emergency equipment to communications facilities has been a special interest item for the past three years. In addition, extensive training is given the the rescue of personnel in contact with high voltage. This training emphasizes the use of the emergency equipment found on the Standard Safety Board described above. A film was developed for this specific training. (Reference FTA 554, "Emergency Procedures for Communications Facilities.")

It should also be mentioned that protective equipment has played a part in the elimination of electrocutions. The floor adjacent to high voltage equipment is covered by electrically rated matting. Each equipment rack has a shorting stick that is readily accessible, and personnel are required to ground each component at the exact point where work is being conducted. Electrically rated shoes are also a standard item for all personnel who work with high voltages.

It is one thing to prescribe a program and another to put one into operation. To insure that the AFCS Safety Program is functional, we stress periodic safety surveys of every organization in the command. To standardize these surveys, a comprehensive, specific survey guide (checklist) has been developed. This guide is self-rating and provides a good picture of the safety program of the AFCS facility that is being surveyed.

I hope this article has provided an insight into some of the problems encountered in the maintenance and operations of communications and NAVAID equipment and that it has also given some idea of how we are trying to solve these problems. If our 1958 on-duty fatality rate had continued through 1964, an additional 64 lives would have been sacrificed to the "tiger in our transmitter." We believe the results of the program speak for themselves. ★

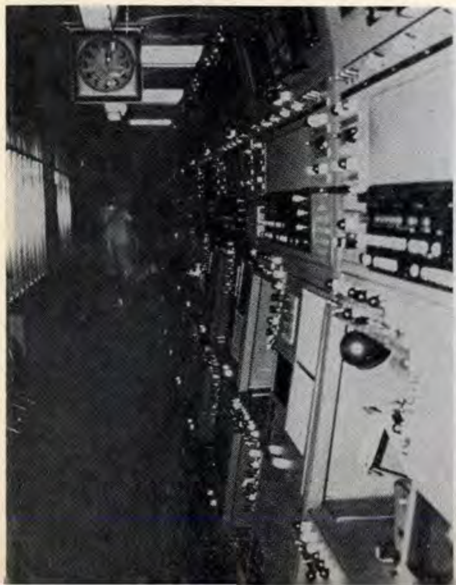


Fig 7, left, the closeness of equipment is a common hazard in AFCS facilities, since it is virtually impossible to work on one piece of equipment without some part of your body being against the adjacent cabinet. One solution is good grounding and bonding of all equipment and components.

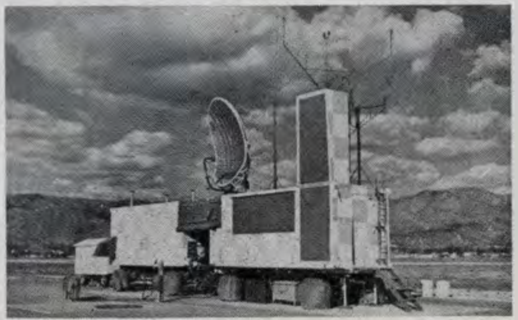


Fig 8, above, a typical CPN/4 mobile GCA. Personnel maintaining this equipment are exposed to as much as 27,000 volts in magnetron circuitry. Accidents have occurred as result of persons contacting high voltage point in equip-

Missilanea

SHOELACED FALCON. It happened during a mass loading exercise. With a handling bar, two young, energetic load-crew troops picked up their trusty Falcon (AIM-4A type) from its storage container, headed for a handling frame and ultimately to the F-102 for loading. The first one or two steps were okay, but then came that *third* step alongside the empty storage container as they were moving out and over the handling frame. That's when one man's shoelace caught on one of the latches of the empty storage case. No, you're wrong! Latches had been laid flat against the storage case before loading started. Still, the shoelace caught it sufficiently to cause one man to stumble just enough to drop the fragile bird. He recovered his balance, but not before Nr 2 stabilizer on the bottom of the bird came in contact with the edge of the storage container. Result: Nicked (3/16 inch deep) stabilizer leading edge just forward of triggering area decal. A substitute Falcon was used to complete the load.

The ruffled bird was lucky — only one man-hour estimated to repair it. Had the entire missile dropped to the ramp, it might have been a completely "demoralized" Falcon, requiring motor disposal and depot repair — all because of a shoelace.

The report stated that this crew is currently wearing their shoelace ends inside their shoes when loading missiles. Another recommended solution to get rid of *excess* shoelace length and ends is to wrap them around and tie them at the back of the shoe. In any case, looks like an area that could be monitored by unit MSO's and crew chiefs.

FALCON IN A GARBAGE CAN! The tired F-106 was recovered back at the home pad after completion of alert at a forward strip. Because of a fuel leak at the refueling valve, the recovery crew chief placed a nice red and yellow garbage can under the single point refueling receptacle area to catch the leaking fuel. The bird was scheduled for missile downloading to facilitate repair of the fuel leak. Now, it being toward the end of a long day and time for maintenance crew change, the maintenance crew chief returned to the office. Downloading of the missiles was accomplished prior to the night maintenance crew's return to repair the fuel leak.

Downloading. Now here, somehow, is where the Falcon got together with the red and yellow garbage can. After missiles had been extended, and as the nose cone cover was being installed prior to downloading from the launcher rails, this badly bent Falcon was discovered. Damage consisted of:

- Forward section of fuselage buckled on launcher hook side of the missile approximately 20 inches aft of guidance unit.

- Guidance unit was dented two and one-half inches long, one inch wide, and three-sixteenths inches deep.
- Sealing sleeve had launcher rail indentation on launcher hook side.
- Forward stabilizers Nr 1 and 4 were separated from sealing sleeve.
- Apparent separation between forward fuselage and forward launcher hook ring.
- Stabilizer latch hook on left side of missile broken off.

In other words, a badly ruffled Falcon, not reparable at base level.

"Who done it?" No one seemed to know — just "There it is!" But it was rather apparent by the red and yellow paint on the missile that the garbage can was involved.

Again, mishaps don't just happen — someone usually causes them. Cause? You guessed it! Someone did not follow the printed word and clear obstructions from beneath the doors. This Falcon, when extended on the launcher rail, came down on the top edge of the garbage can. Result: Best part of a $15,778 Falcon ended up in a garbage can.

Lt Col L. S. Tyler
Directorate of Aerospace Safety

A piece of cake...

Capt Joseph Bera
166 Air Transport Group
Wilmington, Del

When the alarm went off, I leaped out of bed, stumbled across the room and pushed the button down. The luminous hands said two-thirty in the morning. While dressing, I ventured a look outside and the sky looked like the lights of a large city. A typical cool, crisp January in southern Florida.

My wife had roused herself sufficiently to mumble something about breakfast before leaving for work. I declined, I could pick something up on the way. Work today was a thousand miles away in Memphis, Tennessee. As a part-time pilot in the Tennessee Air National Guard, I was scheduled for a trip to Madrid, Spain, in three days. I had to check in with my unit today.

The sleepy bundle on the bed was given a hug and kiss, and her parting words were "drive carefully."

"No sweat," I replied, "this is a piece of cake to a fearless aviator."

On the way out of town I stopped and had breakfast and several cups of coffee to wake me up, then picked up Highway 41 West through the Everglades. The engine in the car was purring smoothly, the radio playing soft music and the night was abnormally quiet except for an occasional passing truck and semi-trailer. Some 100 miles later, Route 41 intersected Highway 27. This would take me north through the citrus belt. Idly I heard one of the news broadcasters mention that, because of the frost danger, the citrus growers were burning old tires, common practice to ward off frost. He said also that smoke and fog would be a problem in the low areas that day. It didn't sound very significant at the time.

By 0700, having come about 200 miles, I stopped for gas at a station eight miles south of Haines City. After telling the attendant to fill it up, I engaged in the usual small talk about the weather. The attendant mentioned that there was a heavy concentration of fog about three miles down the road. He said there were several wrecks. I was sorry to hear that, I told him, but I had to go and with a full tank I drove off.

Sure enough, in about three miles the road disappeared into a solid fog bank. Approaching it, I turned on the headlights, slowed to 40 mph and punched right in. After all, wasn't I the fearless pilot with an instrument card? After about 200 yards the hair stood up on my neck and I had a peculiar sensation that all was not right. I immediately slowed down. At 30 mph I shifted into third gear. Suddenly, directly in front of me, a vehicle's tail lights! Instinctively I swerved to the left. Wham! It was too late. I rammed into the rear end. I was thrown into the windshield and continued upward to bounce off the frame of the window. The pain wasn't great, but I was conscious of a numb sensation and I could not see due to blood in my eyes. Something jarred my stunned brain — get out of the car before someone hits me from behind. After stumbling out of the car and walking in the direction which might take me to the side of the road I felt soft grass under my feet and knew, for the present, at least, I was safe.

Now I began to be concerned about my injuries. My thoughts were distracted by the sound of an approaching vehicle, then the screech of brakes and crash of metal. So now there were three.

Shortly after that I heard voices down the road. I called out for assistance. A man came over and started to lead me away. He made no effort to evaluate my injuries. The one thing that did flash before my bloody eyes was the mental vision that my flying career seemed to be over.

Because of the enormity of the accident it was only minutes before the highway patrol and an ambulance arrived. I was whisked away to the hospital. The doctor ordered x-rays and then started in on the gory mess.

The result of all this was no trip to Spain, $800 damage to the vehicle, severed ear, lacerations about the face and head, broken nose, scarred eyeball, torn leg ligaments and twenty-two days in bed.

This was a piece of cake?? ★

THE MOST DANGEROUS FLAME

Willie Hammer
Directorate of Aerospace Safety

Do you like to live dangerously? Would you like to have tremendous destructive powers under your control? Would you like to have a job which gives you a wide assortment of ways in which you can kill yourself? Be a welder. Especially a careless welder!

As a welder you can get yourself electrocuted, blasted in an explosion, burned to various degrees, asphyxiated, or afflicted in other ways. This country's costliest fires of the past 50 years were caused by welders. Among these were:

- Loss of the ocean liner, S.S. Normandie, which eventually capsized at a cost of 53 million dollars.

- The destruction of the General Motors Livonia Plant, at a cost of 6 lives and 45 million dollars.

- Damage to the newly launched, but uncompleted aircraft carrier, U.S.S. Constellation, with a loss of 50 lives and more than 40 million dollars.

All three of these accidents had two factors in common. Each was caused by a welder carrying out duties he had probably performed thousands of times previously without incident. Then, each welder, on a different day in his own different way, was careless. Catastrophies resulted.

Fires have been caused at Air Force installations by welding performed carelessly by both Air Force and contractor personnel. Those concerned with welding operations must be aware of the hazards and precautionary measures involved.

One of the factors which contributes to carelessness is the harmelss appearance of the flame or arc. The welding or cutting flame is only two to three inches long when acetylene or hydrogen gas is used. Although the flame is hot, it radiates little heat. When electrical equipment is used, there is no flame or heat until welding actually starts. Then, the arc is only one-quarter to one-half inch in length.

The sizes of these flames and arcs are misleading indicators of their potential hazards. An oxyacetylene flame may have a temperature as high as 5600°F; some types of welds run even hotter, as high as 11,000°F in the atomic hydrogen method. At these temperatures, materials which are generally regarded as nonflammable, will ignite, and in some cases, explode. Residues of materials which are only moderately flammable may burst into flame even when they are not immediately under the flame or arc. Although they may be some distance away, the heat conducted through the metal being welded may cause them to vaporize and raise their temperatures above the auto-ignition point. During a Titan I update program, insulation close to the area where a pipeline weld was being made was not removed. The heat caused charring and burning of the normally stable insulation.

Because of its high conductivity, metal remote from a surface being welded, but part of the object, may be dangerous to the welder. This metal may not be hot enough to glow, but still hot enough to burn the skin badly.

Hot spatter, dripping weld metal (slag), and sparks may cause burns, fires, and other damage at consider-

able distances from the welding operation. A fire in a Titan I silo started when sparks generated during electric welding ignited hydrocarbons in a sump. After update of an Atlas F silo, a small burned hole was found in the pressure balance joint (PBJ-2) in the liquid oxygen system. The hole was probably caused by slag drip from heliarc welding at a higher level.

Another hazard is created when acetylene or hydrogen from gas welding or cutting equipment leaks into an enclosed space. This may result in a flammable or explosive atmosphere needing only a spark or initiation of a welding flame to cause an uncontrolled fire. Leakage of oxygen from gas cylinders may make the atmosphere oxidizer rich, contributing to easy ignition of grease, oil, solvents, or other flammable materials.

Welding in enclosed spaces is also more hazardous than open air welding, since gases and fumes which are generated may not be dissipated. Some of the deleterious materials may be: (a) acetylene, carbon dioxide, and other inert gases; (b) fumes of zinc, lead, cadmium, or other metals; (c) decomposition products such as phosgene from halogenated hydrocarbons such as trichloroethylene, or fluorides from electrode coatings; (c) exhaust gases from engine-driven electric welding equipment; (d) or oxides of nitrogen formed by the effect of intense welding heat on the constituents of air.

Electric welding equipment constitutes more than an ordinary hazard to personnel because of the extremely high amperage involved. Welding current flow for manual work varies from 15 to 500 amperes and from 14 to 40 volts, dependent on the thickness of the work, the size and type of electrode, and the welding speed. Currents as low as .025 ampere can cause pain; .100 to .300 ampere for one-quarter of a second can cause ventricular fibrillation of the heart, which is generally fatal; 2.5 amperes or more can cause stoppage of the heart, paralysis, and severe burns.

Under normal conditions, shock to the welder is not likely. With the comparatively low voltages in use, dry skin forms an effective insulator which limits the flow of current. The electrical resistance of the body is reduced substantially when the body is wet. Electric welding should, therefore, be avoided under such a condition, unless additional insulation is provided. Further, where insulation on a cable becomes worn, its resistance is lowered or even lost entirely. Contact with a cable at such a worn part may permit a short circuit to take place. A person in such contact, even mildly wet with perspiration, may be electrocuted.

An electric arc, and a welding flame to a lesser extent, emits intense ultraviolet and infrared radiation. Welders are equipped with welding goggles or masks which minimize the amounts of these radiations reaching the eyes. However, other personnel in the vicinity of welding operations should not only avoid looking directly toward an arc or flame without pro-

". . . . . there are old welders and there are careless welders; but, there are no old, careless welders . . ."

tection, but should avoid looking toward strong reflections from walls, ceilings, or equipment. Inflammation caused by ultraviolet radiation may be extremely painful. The affected person may later find his eyes badly bloodshot and have the sensation that they have been filled with sandlike abrasive.

The hazards indicated so far illustrate certain of the dangers to personnel and facilities. Poor welds may also cause part failure at a later date, possibly resulting in a mishap. Welding may reduce the structural strength of welded parts if not done properly, or if stresses caused by temperature differences are not relieved. The high heat of welding and subsequent cooling may cause internal stresses and distortion of welded parts. Investigation of an Atlas D mishap revealed that a pipe in the system was welded to a control valve. Thermal stresses caused warpage of the valve seat so that the valve would not close.

Welds must be complete but without undercutting. Lack of penetration, undercut areas, or improperly fused surfaces may result in high-stress concentrations or inadequate strength. Inadequate welds will not sustain loads imposed. Spot welds on several Bullpup missiles lacked penetration, so that the missiles broke up after launch.

Melting of metals may change their properties, causing loss of strength or of corrosion resistance. Welding of cast iron causes segregation of carbon in the iron, making the metal extremely brittle and likely to fail next to the weld. Where volatile materials are present, they may boil out under heat, leaving a porous weld. Porous or cracked welds may allow leakage of fluids.

Welds and adjacent areas must be cleaned, both before and after a welding operation. Prior cleaning will remove flammable materials or materials which will make the welds porous. Cleaning after welding is necessary to remove accumulations of debris which might corrode or cause corrosion. Oxidizer leakage in the Bomarc A system was attributed to moisture accumulation in rough areas adjacent to welds in the bottom of the oxidizer tank. Nitric acid in the presence of moisture becomes more corrosive, and in this case, caused eating away of the metal which permitted oxidizer leakage.

Welding is done safely every day. A good welder learns certain precautionary measures for safe welding operations, which he follows until they become a habit. These may be summarized as follows:

Welding on missiles or missile systems equipment or facilities should be performed by qualified welders ONLY.

Welding operations should be performed away from flammable materials. Enclose the welding zone in fireproof blankets or other protective shields when materials in nearby areas may be affected by welding arcs, flames, sparks, spatter, slag, or heat.

Manned fire protection equipment should be available and ready-for-use, and kept close to the welding site.

Take care to prevent acetylene or hydrogen leakage into an enclosed area where it might create a flammable or explosive atmosphere.

Oxygen from supply cylinders should not be permitted to leak into an enclosed space, since it contributes to easier ignition of flammable materials. Keep grease and oil away from oxygen and oxygen cylinders, valves, and regulators.

Flammable and other deleterious materials should be cleaned from surfaces to be welded before welding is started.

The face, body, and hands should be covered to prevent burns from spatter, sparks, slag, or hot metal. Flameproof, heat-insulating gloves should be worn during welding operations. Wet or excessively worn gloves should not be used.

Suitable precautions should be taken to avoid shock from electric welding equipment. Do not stand in water while doing electric welding. Hot electrode holders should not be dipped in water. Do not use defective cables.

Adequate ventilation or respiratory protective equipment should be provided as protection against accumulations of toxic gases.

Enclosed areas should be ventilated adequately before a welder enters; if not, he should wear respiratory equipment.

The eyes and skin should be protected against the glare and radiation from a welding flame or arc. Personnel in the vicinity of a welding operation should not watch a flame or arc, and should guard against reflections.

After completion, welds should be inspected and tested to make certain they do not leak and are sound, strong, and clean.

Gas cylinders must be handled carefully; the neck broken from a full cylinder can turn the bottle into a lethal missile! Secure the cylinders to keep them from falling; store them away from the direct rays of the sun and other sources of heat.

There used to be a saying, "There are old pilots and there are bold pilots; but, there are no old, bold pilots." A similar statement would be true for welders: "There are old welders and there are careless welders; but, there are no old, careless welders!" ★

FALLOUT

continued from inside front cover

there is no cabin pressurization until it reaches 12,500, the cabin pressure altimeter can be used for an additional check of aircraft altitude. This altimeter can be checked while passing through about 17-18,000 feet. A reading of about 13,000 means the aircraft is at least as high as the pilot thinks it is, while a reading of 7-8,000 indicates the aircraft to be 10,000 feet lower. Also, a check of the cabin altimeter at approximately final approach altitude is in order. For example, if the final approach altitude is 2500 feet and the cabin altimeter indicates about 12,500, the old glideslope's going to have to be steepened a whole lot to hack the approach.

Granted, the cabin altimeter isn't the most precise instrument ever installed in an aircraft, but it is accurate enough to give a check within a couple of thousand feet at least, and most certainly it will show any 10,000-foot discrepancy. Also, I'll admit that, due to pressurization peculiarities, this method isn't going to work for all aircraft. However, it does provide a simple check that can help minimize a pilot's chances of ending a flight in a ball of fire on penetration turn, or with a flameout after repeated approaches 10,000 feet above the proper altitude.

Capt Richard F. Strohmeier
185 Tac Ftr Gp (OPS) Iowa ANG
Sergeant Bluff, Iowa 51054

BOOTS

In reference to your picture accompanying the article "IFR-VFR Have One," for shame!! Look at the half Wellington bootie!

Capt James N. Heggarty
Reese AFB, Texas

I have just read "Have One . . . But Not the Other," October 1965. The picture on page 2 facing the article, is intriguing. I wonder where the model's boots were issued and I wonder how long they would remain with the pilot during ejection.

Lt Col Richard S. Griffith
Lackland AFB, Tex

These appear to be Probst custom made boots. Herr Probst has built boots for thousands of pilots while they were in Europe. We would expect to see many of them in any fighter operations lounge these days, but will try not to publish a picture of anyone heading toward his bird in them.

MY OWN KNIFE

Concerning the article "Cut With My Own Knife" (September, pg 8), here is a procedure I've used for two years: After coiling the cord (shown in Fig 3), tape one round of Scotch tape around the knife case, over the coiled cord. The tape is easily broken by pulling on the cord (same principle as tearing the cellophane from a pack of cigarettes), and it saves your recoiling the cord each time you change flight suits.

Capt Paul O. Kandt
3750 ABGp, Sheppard AFB, Tex.

The method shown and described in the article does not seem to be the best way to store the knife for immediate use.

Wrapping the cord around the knife, as shown, means that the pilot has to unwind the cord before he can raise the knife above his head and cut the chute risers. The flying suit knife pocket has a small pocket designed into the flap. The nylon cord attaching the knife should be folded and stuffed into this small pocket as shown in these pictures. The cord will then immediately unravel when the knife is withdrawn for use.

Maj John C. Machun
Chief of Safety, Hq 78 Ftr Wg
Hamilton AFB, Calif. 94935

. . . THREE STRIKES . . .

Your October Aerospace Safety Magazine carried an extremely interesting article titled "Two Strikes . . . Three, YOU'RE OUT!" which deals with aircraft voltage regulator malfunctions and an almost non-existent history of U.R.'s being submitted on these malfunctions. Specifically your item pointed out that during a three-year period there were 26 voltage regulators reported on U.R.'s while during a six month period in 1964, 12,600 voltage regulator malfunctions existed. Your article concluded with the remark that . . . Pilots are not reporting or causing this discrepancy to be reported so that the personnel responsible for analysis of such problems can take the necessary action.

This brings me to the reason for my letter, which is "Proper Preventive Procedures." As an example, the Air Force has been flying the T-33 aircraft over 15 years with a very hazardous latching arrangement on the nose compartment doors. If these doors should open in flight, an extremely critical situation occurs. All these years the tech order has been teaching procedures to be used *after* malfunction occurs. Finally one of the using Commands originated a simple modification to the doors to preclude the latches from opening and the problem was solved. I believe a program of "Proper Preventive Procedures" would have emphasized an approach to eliminating the problem rather than living with it and teaching pilots how to cope with the situation *after* it occurs.

A "Proper Preventive Procedure" insofar as aircraft malfunctions are concerned would not hold pilots responsible for initiating U.R. action. The pilot observes the effects, not the cause. The caution light that illuminates in the cockpit may take a trained specialist days to trace, and the pilot may be halfway around the world on rotational duty by that time. The entire discrepancy reporting system is not oriented toward keeping pilots informed of the corrective action taken to eliminate the cause of the problems they encounter in flight. It is not uncommon for pilots in an operational squadron to fly two or more different aircraft in a day's time. An attempt to maintain a record of every discrepancy encountered and its cause, for each flight, by each pilot, would grow to be a task of monstrous proportions.

A much simpler system would be to charge the person that enters the corrective action in the aircraft forms with the responsibility of U.R. action in all cases where flight discrepancies can be traced to a specific component. The U.R. number can be entered directly into the form by the same person, and Inspector personnel can insure U.R. action is taken before signing off the forms. The system would police itself and the personnel responsible for the analysis of such problems would be assured of the data they require.

W. A. Hogarty, Capt, USAF
AFWTR (WTOSO)
Vandenberg AFB, Calif

The author's intention was that pilots should see that such items are the subject of Incident Reports when they meet the criteria in paragraph 4d, AFR 127-4. If the pilot insures that the incident is reported, then a U.R. should be submitted IAW T.O. 00-35D-54. QC people are responsible for U.R. action and we feel this responsibility should remain there.

Aerobits

TAIL HEAVY — Loading of the C-124 with a pair of 2½-ton trucks and a trailer was apparently normal until the aircraft tail stand was removed. The aircraft began to assume a climb attitude sitting on the ramp as the tail began to settle. Power was quickly applied to all four engines and the tail stand re-installed. What had been manifested as empty was a truck that actually contained a full load of assorted materials. During loading the truck's rear enclosure was sealed and padlocked, therefore no one suspected that it was other than manifested.

This has been a frequent occurrence, especially during exercises in which Air Force aircraft have been loaded with equipment prepared for shipment by other agencies. The hazard potential is obvious. In this case, what if the weight had not been quite heavy enough to be obvious and the aircraft had taken off with a big aft CG?

T-34's — SCRATCH TWO — This is kinda hard to believe, but a pair of T-34's crashed within a couple of minutes of each other after taking off in opposite directions from the mid-point of the same runway. Both accidents resulted from the same cause.

No, these weren't Aero Club aircraft, but since our clubs have so many of these birds we thought we'd pass on the bare details. AND, what happened to these T-34's could happen (and has) to many of our Air Force aircraft.

Takeoff was just after 0700. There was practically no wind, so a long runway was used with the aircraft starting takeoff midway from each end. Temperature was 30°, dewpoint 30°, and relative humidity 100 per cent. During the night a healthy coating of frost formed on the canopies and surfaces of the aircraft. This was not removed and was later computed to have added 5 to 10 per cent to the stall speed and an increase in takeoff distance of about 21 per cent.

Other pilots reported that just after lift-off, the situation was similar to flying through prop wash. This was no doubt caused by the ice-coating on the wings. The pilots involved in the accidents could not get airborne and after aborting were unable to stop prior to running off the end of the runway.

SEAT BELTS SAVE A LIFE. Recently, we received an accident report from one of our bases. This accident told us a story. We like to think it proved a point.

A young airman (Reservist) was driving his private automobile to the base during the early morning hours. Suddenly, there was another car trying to occupy the same side of the highway he was using, only it was traveling in the opposite direction. The collision must have occurred in a flash. There were no skid marks on the highway that might indicate just how much time there was. The crash must have made a very loud

and sickening sound as both cars were estimated to be traveling somewhere near the 65 miles per hour speed limit.

Perhaps we will never know why, but the other vehicle had swerved across the center line. The two cars met left side to left side. Both cars were a total loss. Both cars were equipped with seat belts. One driver was using his; the other, unfortunately, was not.

The airman, who was using his seat belt, received only minor injuries — abrasions about the body and a possible concussion. The other man was killed.

We feel that this is a life that was saved through the efforts of the base seat belt program. Seat belts in all private automobiles has been stressed for years at the base of duty for training of the young airman involved and have been available at greatly reduced prices. All personnel have been encouraged to purchase and use seat belts in all their privately owned vehicles, whether they have one or a dozen.

This is the story. We think it proves a point. "Seat Belts Save Lives."

William T. Perry, CONAC, Robins AFB, Ga

T-33 ICING TESTS — In December, 1964, a Systems Command T-33 landed short of the runway resulting in a destroyed aircraft and major back injuries to both pilots. During the accident investigation the effects of structural, and pitot/static ice on the T-33 were considered. Results of any previous icing tests conducted on the T-33 could not be found, so Aeronautical Systems Division (ASD) was requested to conduct T-33 Icing Stall Tests. The primary purpose of these tests was to determine the effects of various ice accretions on the T-33 stall speeds in the power approach configuration. The secondary objectives were to re-investigate static port icing feasibility and to determine the effects of various ice accretions on airspeed indications. A summary of the ASD Flight Test Report is given below:

- It was found that with an extremely heavy accretion of ice on the aircraft the stall airspeed increased on the order of eleven knots above the ice free stall airspeed for similar gross weights and configurations.
- To induce airspeed errors, icing was carried to an unrealistic degree in order to ice over the static ports. With the static ports iced over, all errors were on the safe side.

AFSC SYSTEMS SAFETY

T-BIRD. Approximately 40 minutes after takeoff, at FL 260, the T-33 flamed out. The aircraft was in level cruise at 96 per cent, in clouds with very mild turbulence. Although there was slight visible precipitation in the form of snow or ice crystals, no airframe icing was encountered and the aircraft had not flown through rain.

The gangstart was activated and the throttle brought to IDLE but the RPM did not increase. The pilot then stop cocked the throttle, notified Center and began a descent. At FL 240 gang start was tried again and the engine started. The RPM went to 26 per cent and stabilized there, but when the throttle was brought from OFF to IDLE, the RPM started to drop. Again the throttle was stop cocked and the RPM went to approximately 30 per cent. When the throttle was returned to IDLE, the RPM dropped and when it was advanced, the RPM increased. The flight was continued at FL 220 but the maximum RPM that could be attained in the emergency fuel system was 96 per cent. The aircraft landed out of a precautionary pattern, the gangstart and engine shut off.

The incident investigator recommended that all T-33 pilots be briefed that a slight drop in RPM may occur when gangstart is actuated and the throttle moved from stopcock to IDLE.

Aerobits

AERO CLUB. The engine of the Cessna 150 quit just after the pilot entered the pattern and was still too far out to make the runway. So he quite sensibly chose to land in a cultivated field. Not so sensible was what put him there and his landing. He allowed the aircraft to touch down nose gear first, which flipped it into its back. Luckily the occupants were not injured.

The not-so-sensible thing that put this pilot in this predicament was lack of fuel induced by lack of judgment. This model airplane normally will fly a little over four hours on a full fuel load. Total flying time for this trip was 4:00 hours. So, with a bit more consumption here and a slight undercalculation of the time there, it is reasonable to have expected the airplane to run out of gas. Sad part was that, at the last landing, 45 minutes from home, the tanks indicated only one-fourth full. Gage accuracy being what it is, fuel indicated versus length of the remaining leg indicates that poor judgment allowed departure on the final leg without refueling.

Questions for aero clubs: Do low time (better make it all) pilots understand fuel consumption? Amount usable? And do they allow for gage error? Instructors and check pilots bear a big responsibility to see that these questions can be answered in the affirmative.

B-47. While the B-47 was turning onto final approach, the tower operator transmitted a 16 to 25 knot crosswind component from the left. The tower officer then personally added a caution to "Keep the left wing down." This was acknowledged by the aircraft commander, "Roger, it's down."

The aircraft touched down first approximately 3000-4000 feet down the runway, to the right of the centerline. Contact was made nose gear first and the aircraft bounced back into the air. Several more bounces followed and the pilot, believing that he would not be able to keep the aircraft on the runway, initiated a go-around. The aircraft left the runway to the right and the right wing struck the 4000 feet to go runway marker. Shortly thereafter the Nr 6 engine and right wingtip contacted the ground. The aircraft then heeled to the left and the left wingtip and Nr 1 engine contacted the ground. The left inboard engine strut bent which caused a piece of the strut fairing to depart the aircraft at taxiway Nr 4. After crossing this taxiway, the aircraft became airborne for the last time and assumed an excessively nose-high attitude at an airspeed reported to be 110 knots. The left wing dropped and the aircraft struck the ground, left wing first then forward main gear and nose section. The violent impact caused severe aircraft break-up and fire. The final impact point was 100 feet from the end of the overrun at the takeoff end of the runway, to the left of the extended centerline.

Two crewmembers received fatal injuries in this mishap.

Pilots landing in near maximum crosswind conditions must be prepared for such landings or proceed to an alternate airfield. Radio navigational aids such as GCA or ILS must be used as a guide on the approach to prevent landing long. If a go-around is required, very careful but positive control and power inputs are required to maintain directional control until flying speed is attained.

★

Lt Col David J. Schmidt
Directorate of Aerospace Safety

☆ U.S. GOVERNMENT PRINTING OFFICE 1965 201-212/3

WELL DONE

CAPTAIN JAMES W. ANDERSON

27 TACTICAL FIGHTER WING, CANNON AFB, NEW MEXICO

The Pacific island was under the effect of a typhoon when the flight of four F-100's arrived. This was the second leg of a deployment and winds made fuel a problem. With no alternate available and Captain Anderson's TACAN and ADF inoperative, the element he was in started a RAPCON approach. Radar contact was temporarily lost but re-established in time for a GCA handoff. However, the element leader failed to follow GCA instructions.

Captain Anderson realized his leader's UHF was out and took the lead. Due to the time lag, this left the element much too high on the glide path. On the missed approach, with 750 pounds of fuel, Captain Anderson's UHF transmitter went out. He re-established communication by using the emergency squawk and IP button on the IFF/SIF and the element was directed to final approach. To conserve fuel he held the gear and flaps until two miles out, and at precision approach minimums, with insufficient fuel for another approach, continued following the controller's directions, finally observing the runway lights less than a half mile from touchdown. A successful formation landing was completed in a heavy rainstorm.

Captain Anderson exhibited great presence of mind and proficient airmanship under extremely adverse conditions. WELL DONE! ★