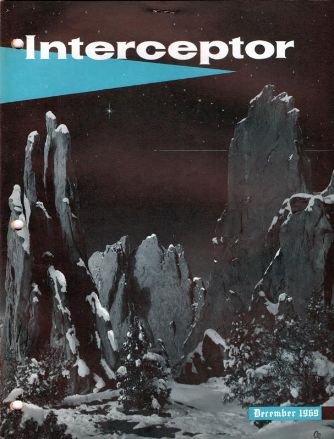
Interceptor



December 1969

FOR THE MEN RESPONSIBLE FOR AEROSPACE DEFENSE

Interceptor

volume 11
number 12
ADCRP 127-2

spotlight

It is not necessary to understand things in order to argue about them.
Beaumarchais

departments

special features

Aerospace Defense Command
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Seasons Greetings
from the
INTERCEPTOR STAFF

memo

from the CHIEF OF SAFETY

A VULNERABLE TIME

Col H. C. Gibson

Reductions in the Defense budget and the subsequent effects on operational capabilities are not unusual in the course of military history. Men in uniform have met the challenge before and we will meet it again. However, if we are to approach the problem intelligently, we must review and learn from the lessons of the past.

Unit deactivations and transfers, base closures and personnel separations, etc, increase our vulnerability to accidents, both flight and ground. It is human nature to be concerned about imminent changes which threaten to disrupt our professional and private lives. Fear, uncertainty, and disappointment can preoccupy the mind to the extent that judgment is impaired. When distraction becomes excessive, it also becomes hazardous. Our profession demands that we remain constantly alert under normal circumstances. To successfully overcome additional hardships, we must make a more determined effort to apply our skills to the task at hand, whether it means flying a 3 million dollar airplane, installing a jet engine or driving the family automobile. The consequences for not doing so can be tragic.

Several years ago, a pilot landed his F-86 gear up at night. The aircraft was destroyed and he nearly lost his life. He could give no explanation for not lowering the gear other than the fact that he was upset because his squadron was in the process of deactivation. His mind was occupied with the thought of having to move again after just a year, of having to remove his children from school in mid-term, of having to drive the long road to a nonflying assignment.

Those of us who have been there at one time or another will agree that this pilot was not confronted by the happiest of circumstances. And yet, how much more tragic would the situation have been if he had lost his life? For this reason, I would like to leave some thoughts with those who will be affected by the reductions.

To Supervisors: Be on your guard for degraded performance, whatever the reason. Attempt to make the transition as painless and convenient as humanly possible.

To all the rest: Continue to exercise good judgment on and off the job. The world is not coming to an end, but if you allow yourself to throw caution to the wind — yours might!

COL. H. C. GIBSON

HOT LINE

NO PLACE FOR CHECKLISTS. Some Deuce pilots have picked up the habit of placing their checklists between the survival kit and the side of the seat. During a recent emergency ground egress, the pilot experienced difficulty in getting out of the seat after pulling the survival kit release handle. It seems that the checklist interfered with normal release of the kit and the pilot was unable to stand up. This incident also reveals the possibility that seat/man separation could be adversely affected during ejection. It's recommended that F-102 pilots find a safer place to stow their checklists until such time that a study can be made on the problem.

T-BIRD TACAN TRAP. "If the TACAN 28 dc circuit breaker in the front cockpit pops, all TACAN capability will be lost, control shift will be lost, and control of the VOR/ILS will revert to the rear cockpit. It is recommended that pilots, flying solo or with a passenger, set up a destination VOR station in the rear cockpit." That's on page 4-11 of the Dash One. We thought everyone was familiar with this trick arrangement. We were wrong.

CUSTOM FITTED HELMETS. Basically, a system for custom fitting helmets at squadron level is under consideration. The OT&E program is scheduled to begin in October 1969 with TAC doing the prime testing.

The system is designed in such a way that a helmet liner can be shaped to an aircrew's head by use of a mold. The mold is filled with a liquid substance while on the head. It dries in a short period of time whereupon the liner is removed from the mold and covered with foam rubber. It is then inserted into a standard HGU helmet. Earphones are built into a different foam rubber substance and mated to the liner and helmet shell. The whole outfit weighs a few ounces less than the standard helmets presently in use and promises a perfect fit.

The idea was developed by a member of ADC and is being investigated because of its very low cost and the minimum training required for unit level personnel. Head molds have been on contract since 15 July 1969. Kits and chemicals will be provided by Wright-Patterson AFB. Impact testing begins during the last part of September. It will be six to nine months before anything definite is known. More on the techniques in a future issue.

FLIGHT LINE DAMAGE. Not long ago, a B-57 sustained major fire damage when the pilot made a second takeoff attempt after getting a low line speed on the first try. During the second abort, the brakes overheated and caused the fire. The reason for the low line speed was a pilot tube which was bent out of shape. Someone or something gave it a sharp blow and damaged it sufficiently enough to cause the low speed reading.

More recently, an F-106 had an afterburner failure due to fatigue cracking of one of the mounting lugs. The failure resulted from mechanical damage to the outer rear wall adjacent to the mounting lug. Apparently, someone got overenthusiastic with tools during assembly.

These are just two examples of what can happen when people get careless about how they use equipment around airplanes. Haste is usually the culprit. In any event, if an aircraft is accidentally damaged, the damage should be assessed and repairs made when necessary. Don't clam up! The price can be too high.

CASE OF THE MISSING ISSUE. To those of our faithful followers who have noticed the absence of October's INTERCEPTOR along the highways and byways of magazine land, we offer our humble apologies and an excuse. Amid thick smoke and evil noises, our printing press came to an inconvenient halt, spitting forth neither pamphlets NORS the October issue. After having rebuilt that which broke down, it was decided to publish one INTERCEPTOR for October/November for indexing purposes. We realize, of course, that our subscribers will read the combined issue twice in order to make up for the one in absentia. For that, we are grateful and in return promise to use only the best oil on our roller bearings.

NEW LAP BELT

A new ejection seat lap belt is about to enter the Air Force inventory. It will bear two designations. The first is the HBU-2A/A for use with parachutes having an arming lanyard (Gold Key) and the second is the HBU-4A/A for use with parachutes not equipped with arming lanyards (examples: F-105 and F-106). The two belts are identical in appearance but the HBU-4A/A lap belt does not require insertion of the Gold Key prior to connecting the lap belt buckle. In fact, the two belts are identical in construction but the Gold Key interlock is rendered passive by installation of a special screw into the assembly for the HBU-4A/A. Usage of the new lap belts will be to completely replace all MA-5/MA-6 lap belts currently installed on operational upward and downward ejection seats.

At the present time, the MA-5/MA-6 lap belt has an adverse history of inadvertent opening of the manual latch or binding of the automatic release during the ejection process. These two faults have been completely corrected in the HBU-2A/A and HBU-4A/A lap belts. The MA-5/MA-6 manual latch has been replaced by a guarded rotary mechanism which must be rotated 20 degrees before anything happens. The binding failure can no longer occur because the new mechanical design has omitted the condition that was subject to occurrence of adverse binding loads on mechanical parts.

MA-5 / MA-6 lap belts are equipped with three inch webbing and adjusters that are difficult to operate. The new lap belts will have 1¾ inch webbing and a new adjuster designated the HBU-5/A. This adjuster is extremely easy to operate and has recently completed OT&E by Headquarters TAC.

The new lap belts are being delivered to SAAMA beginning in the first week of November 1969. They are scheduled at the rate of 500 belts per week until a total of 17,000 have been delivered. The lap belts delivered to SAAMA will have to be packaged into retrofit kits for each type of aircraft requiring new belts. The retrofit will accomplish rerouting of the gas pressure hose on the left side of the seat. Retrofit kits will include hose rerouting instructions and new hoses where necessary. In addition, SAAMA will determine the priority for retrofit.

The following series of photographs illustrate the operation of the HBU-2A / A. Operation of the HBU-4A/A will be identical except for the Gold Key usage.

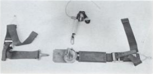


Fig 1. The two halves of the lap belt and the parachute arming lanyard (Gold Key) are shown.

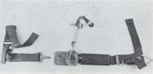


Fig 2. Gold Key is connected to the lap belt which is necessary prerequisite to lap belt connection.

HBU-2A/A Lap Belt Procedure

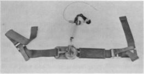


Fig 3. Lap belt is connected.

Fig 4. Aircrew holds Gold Key ready for insertion into buckle.

Fig 7. Lap belt link is inserted into buckle for completed hook-up.

Fig 8. Lap belt is fully connected.

Fig 5. Aircrew inserts Gold Key into buckle.

Fig 6. Shoulder harness loops are installed on lap belt link.

Fig 9. Aircrew pulls webbing to tighten belt. Pull direction is altered to show adjuster.

Fig 10. Aircrew pulls tab to loosen belt.

DEUCE²

F-102 MID-AIR

A 110 degree rocket beam intercept mission was scheduled with an 1830 takeoff planned. Briefing was on schedule and a review of rocket beam intercept geometry was given when one of the three mission pilots requested it.

The aircrews proceeded to preflight, taxi, and takeoff on schedule. Climbout for the three aircraft was normal and cloud tops were about 23 to 24,000 feet. The mission was handed over to a SAGE control agency and a 110 degree rocket beam set-up was attempted.

One aircraft at FL270 was acting as target and two fighters at FL250 were committed to an intercept. The first fighter made a successful attack, but the second fighter did not have a reliable contact and broke off the attack when told to do so by GCI. The target was turned to a new heading and another set-up initiated.

The first aircraft to attack received a contact at 17 degrees port, 10 miles. The heading crossing angle was about 150 degrees at this time. The attack was continued, 20 seconds called, and the target pilot answered by saying, "I don't have you, are you in the clouds?" The interceptor pilot went visual, saw that he was in the clouds, and started a left "breakaway." The two aircraft collided almost head-on.

The left wing of the target aircraft was "mangled" and the drop tank was torn away. The interceptor aircraft had similar damage and when both aircraft became uncontrollable, the pilots ejected successfully. Later investigation revealed the left wing tip of the target aircraft had scraped the left edge of the interceptor's canopy. Had the interceptor been more to the left, the possibility of the canopy area being demolished, or at least damaged to the extent that ejection would not have been possible, is quite likely. Be that as it may, the aircraft were both destroyed and the pilots were safely recovered.

However both aircrews experienced severe tumbling after ejection and despite their best efforts, co not get the tumbling stopped. Finally, both pilots deployed their chutes manually. The opening shock was rather sharp, but not injurious.

An unusual aspect of these ejections is that both pilots also experienced severe oscillations after deploying their survival kits. These kits were standard with the exception that no life rafts were installed. The oscillations were so severe in one case that the kit was jettisoned after the pilot saw a farmhouse near the place where he was going to alight. Both crew members suffered minor injuries and one had a broken ankle. Some power lines had disconcerted the pilot and he wasn't in the proper "PLF" position when he hit the ground. The ankle snapped before he had a chance to try his forward, backward, left, or right "PLF."

This, in a nutshell, is a resume of a very expensive accident. Why did the accident happen? What factors led to this result? What can be done to prevent a recurrence of this type of accident?

This accident happened because people were involved and human error resulted. What do we mean by human error? Just that the intercept director let the intercept continue beyond safe heading crossing angle limits; the interceptor pilot continued the intercept after he should have recognized an unsafe intercept; the target pilot did not order a "breakaway" when he didn't see the interceptor at 20 seconds; and the system (SAGE) has limits that should have been understood by both the intercept director and the pilot. The human error referred to is not wanting to accept a director error on the part of the IND; the interceptor pilot not wanting to accept a missed intercept; and the target pilot not wanting to break off an intercept until absolutely necessary. These are normal reactions for each of these individuals, but, in this instance, the combination caused an accident. What, then, can we do to create a better understanding for all INDs and interceptor and target pilots?

First, let's analyze the control capability available. The SAGE system provides automatic computer generated information to the interceptor pilot. The system was designed for profile (wartime) type missions. When we prostitute this design limit and use the computer to set-up short leg "bumphead" intercepts, the computer does not smooth out the target speed in time to give a good 110 degree rocket beam. We will almost always be ahead or behind the beam, depending upon the target speed selected. This is a limitation and must be understood as such.

This should tell the IND and the pilots that the 110 degree beam is an intercept tactic that has to be monitored continuously. The IND cannot zap the target with his light gun and say, "Go get 'em, computer," because it will solve the problem, but not the way we want it solved.

Second, the interceptor pilot also has to do certain things. He has to maintain his altitude and airspeed until he has a contact, then check his aircraft heading, and angle off. If all is well, continue the intercept; if not, convert or break off the attack. The problem here is that everyone tries to "get the hack" and rightly so to a certain degree. However, when the IND sees the interceptor ahead of the 135 degree TCA, *tell the pilot to break off* and when the pilot recognizes an excessively hot or cold intercept, convert immediately to a position within the area 25 degrees ahead of the 110 degree beam or 45 degrees behind the 110 degree beam. These are reasonable limits and they give you something to shoot for. They give you parameters in which a safe intercept can be made and yet assure a probable kill had you been firing live armament.

Third, just because ADC has one interceptor with rocket capability, don't shut the book and say, "This doesn't affect me, I don't control or fly that type of aircraft." It does affect you, because the same problem exists in an ECM environment for all interceptors. So, do your homework on minimum ranges, angle ranging, range rate, and attack geometry before you strap into the aircraft or sit down at the console. An intercept against an ECM emitting target at night, and at high mach, is not the place to wonder about the intercept figures. Brief the mission to include all the important factors just mentioned and you'll get that MA and do it safely.

In line with this thought, supervisors cannot simply say that it is the pilot's responsibility to avoid collisions and ignore the issue. True, the pilots ultimately are the end link in a long chain; but, are the instructor directors at the direction center teaching rocket beam geometry and its associated hazards to the new troops? Are the squadron weapons instructors briefing on the problems of excessive track crossing angle and proper antenna train angle, correct speed, conversion techniques, altimeter correction, and recognition of a collision course? These are the supervisor's problems and if all these are not being done, this same accident can be repeated. The chances are that even if we do all these things, we could still have another Deuce[2]; but the likelihood is lessened with education.

In summary, each of us has to know the system, the console, the aircraft, and the airborne weapons system! Especially their capabilities and limitations! Any less and we court Dame Misfortune. ★

LONG LINE LOITER

When an aircrew member is forced to abandon his aircraft, his most immediate concern is landing safely on land or water. No one can help him in this endeavor. Only training and knowledge of procedures will influence the outcome.

Assuming a safe landing has been made and the man is not incapacitated to any great extent, his attention is now directed toward rescue. First, he must be located and then recovered by the most expeditious means available. This two-pronged effort is not always easy. Few landing zones are in the soft grasslands adjoining the outskirts of a large city. Many occur over water and in isolated areas. Again, the crew member is instrumental in making his presence known by proper use of signaling equipment. Once he has been found, the problem becomes one of retrieval. Time and distance are critical factors. If he is far out to sea or in an inaccessible area, the problem is compounded. Search aircraft are not normally equipped for recovery, and must request rescue assistance. But this procedure takes time and can sometimes lead to lengthy delays. Every minute spent in a survival situation presents the downed aircrew with additional hazards.

An airborne recovery system which would enable fixed-wing search aircraft to effect immediate pickup would be a welcome addition to the rescue mission. Such a system is presently in the advanced planning stage at Wright-Patterson AFB. The project is called the "Long-Line Loiter" and research is being conducted by the Flight Environments Branch of the 6570th Aerospace Medical Research Laboratory.

The LLL project involves the development of techniques and equipment for maneuvering fixed-wing aircraft in order to position a towed mass near the center of a ground drop zone. By connecting a rescue package to the end of a long line (2,000—3,000 feet), a pilot could release the package from his aircraft, guide it to a downed airman, hold the package in place until the airman is strapped in, and then pluck him up and out with an acceleration force of slightly over 1 "G". Initial testing with dummies has achieved significant success.

The circling line concept is unique. For delivery, the aircraft reels out line and circles the pickup site until the deployed line moves into a state of equilibrium whereby the lower end describes a circle over the ground at the same angular velocity as the aircraft, but of much smaller diameter. In effect, a predictable amount of the lower p

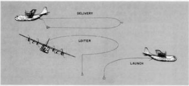


Fig. 1. Double-line free-fall technique

tion of the line stalls out aerodynamically and droops to earth. The orbit size of the attached mass can, for example, be decreased by either increasing the aircraft velocity or decreasing the radius of the aircraft orbit until a near zero velocity component of the mass is achieved.

Because difficulties were encountered with straight reel-out of the line and subsequent oscillation of the mass during the circling-line deployment, an improved delivery technique was devised. Called "Double-Line Free-Fall" (Fig 1), this technique virtually halved delivery time and consistently placed the mass near the target area. An aerodynamic cone and a light weight are used in the deployment (Fig 2). A light weight, attached to the end of the line, is held in the aircraft. A small sliding cone is released with 2,000 feet of line which then forms a trailing loop. The small cone stabilizes the loop and prevents knotting. The light weight is level-bombed from approximately 1,000 feet over the pickup area. Immediately, the aircraft begins a constant radius turn to hold the line in a stalled condition. The ease of the maneuver was demonstrated when 27 consecutive orbits were flown in a 15 knot wind. The ground observer handheld the cone during the orbits and the line never touched the ground

Fig. 2. Cessna 182 with test reel and aerodynamic cones

Fig. 3. Ground observer holding the end of a weighted line while the aircraft orbits

(Fig 3).

When it was determined that the double-line delivery was feasible, pickup trials were conducted using assorted weights. Initial tests disclosed that lighter loads departed the ground nearer to the vertical than heavier loads. For instance, a sixty pound weight ascended at about 30 degrees from the vertical while an eighty pound weight ascended at about 55 degrees. All launches were smooth and the masses ascended without subsequent ground contacts. The half loop of circling line unwound after the aircraft departed its orbit and flew the launch pattern (Fig 4) (straight and level, into the wind, across the pickup area). Because of the ease of the maneuver, it was decided to man-rate the rescue application. Pickups of 45 to 205 pound dummies were successfully performed (Fig 5). As a result, live subject launches are presently scheduled.

With regard to aircraft type and configuration, there are two concepts which can be applied to the rescue mission.

The first is a single pickup system for light aircraft. The LLL rescue kit is being designed as a standby unit which can be installed quickly and without major modification to aircraft such as the Cessna 175 and 182 (Fig 6 and 7). These aircraft were actually used in the testing. The method of pickup presently under study is the Closed Chute Rescue System. Under this system, a light aircraft delivers a fully packed parachute kit along with associated gear, such as a helmet, to the survivor on the ground. He dons the harness and signals for

Fig. 4. Launch pattern

Fig. 5. Weighted dummy being launched

Fig. 6. Interior view of test reel in Cessna 182

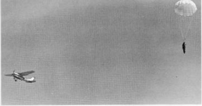


Fig. 7. Dummy floating to earth after release from Cessna 182

launch. The aircraft then tows him to an area where a safe parachute landing can be made. After an orbit is established the survivor pulls a D-ring which releases him from the tow line. A static line automatically deploys the chute and the survivor descends into the waiting arms of a ground rescue party. A reel-in system using a electrohydraulic winch will also be man-rated for light aircraft.

The second concept involves the use of large cabin, long-range aircraft such as the C-130 and C-131B (Fig 8) for performing a complete rescue cycle. The heavy aircraft system would be designed for longer lines and a permanent winch-in installation (Fig 9). Future vehicles could include free and podded multipersonnel pickup systems (Fig 10) using lifting surfaces (Fig 11) for heavier loads.

Training requirements for pickup are as yet undetermined. However, a minimum training period is indicated by the successes recently experienced. The circling-line concept has been limited to a method of loitering after delivery and before launch. Free-fall techniques for delivery have proven the most accurate and eliminated many of the problems encountered during circling-line delivery attempts. Straight tow techniques for launch have proven to be the smoothest and easiest for pickup.

Research will continue in order to develop essential equipment, finalize procedures, and man-rate the total system. Successful completion of the Long-Line Loiter project could lead to a significant increase in the overall rescue mission capability without the necessity for enlarging the aircraft inventory. ★

Fig. 8. C-131B modified for LLL tests

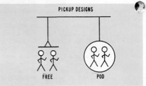


Fig. 10. Free and podded multipersonnel pickup systems

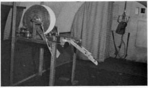


Fig. 9. Interior of C-131B fitted with test reel

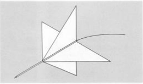


Fig. 11. Lifting surface

★SPECIAL RECOGNITION★

4650th

Combat Support Squadron

The 4650th Combat Support Squadron, Richards-Gebaur AFB, Missouri, has recently completed TEN YEARS of accident free flying. The unit has the nickname, "Dogpatch Airlines," and the name is appropriate because they haul anything, anywhere, anytime. A "You Call, We Haul, You All" motto might be in order for the squadron.

The squadron began flying C-54 and C-123 aircraft in September 1959. Since that time they have airlifted 70 million pounds of cargo, 222,000 passengers, and flown 231 million passenger miles. Aircrews have logged more than 171,000 flying hours during this period in support of the ADC mission.

The 4650th transitioned from C-123s to C-119s in 1967. Supervisors and flying safety officers cringe at the thought of transitioning to a different type of aircraft. However, the unit completed the transition without a mishap and can be doubly proud of their record.

The organization now possesses six C-118s at Richards-Gebaur AFB, MO.; nine C-119s at Detachment One, Stewart AFB, NY; and nine C-119s at Detachment Two, Hamilton AFB, CA.

In recognition of their outstanding achievement, we salute the 4650th Combat Support Squadron and wish them continued success in their mission. ★

It is very embarrassing to taxi a tipless T-Bird into its parking space and see a reception committee waiting for you. Of course, you use the checklist, shut the old "girl" down, and climb out of the cockpit to answer their questions! (Boy, is the boss stern and steely eyed!)

The inflight loss of the tip tanks may have been due to incorrect wiring, a short in the circuit, or just one finger too many in the cockpit. Whatever the reason, questions must be asked, answers given, causes uncovered, and corrective action initiated. These actions are necessary and must be accomplished without delay.

After an aircraft has shed parts across the countryside, what else occurs? First, a search must be conducted to attempt to locate the items. This is time consuming, costly, and often fruitless. Often the area where the objects departed the aircraft is difficult to pinpoint and therefore the search area is widespread and almost impossible to cover thoroughly.

However, assume that the "losties" are found and we can proceed.

Now the damage to private property must be determined and an attempt made to recover the parts.

For argument sake, suppose that a full drop tank went through the roof of a farmer's barn, killed a "PRIZE" cow, damaged the floor, and the JP-4 ruined 4,000 bushels of corn. It wasn't bad enough that the tank cost of $500.00 had to be borne, but now the cost is in the thousands and one farmer has declared war on the USAF.

The point has been made that "jettisoning" of objects in flight can cost money and lives. Why are we concerned about a few dropped parts? After all, we aren't perfect! If it were just an isolated case, we wouldn't be as concerned as we are, but a heck of a lot of pieces have been strewn across the countryside this past year and a half. To be specific: four travel pods or parts thereof; seventeen tanks or sets of tanks; nine panels of various types; twenty-one doors; fifteen canopies or parts thereof; three engine parts; two windscreens; eleven darts, delmars, MSRs, or WSEMs; and eleven assorted items such as B-4 bags, radomes, drag chutes and speed brakes. This is an impressive list. When we consider that one of the canopies landed twenty-five feet from a residence and one tip tank landed seventy-five feet from a railroad station, you can understand the concern. That canopy weighed 180 pounds and the tip tank weighed about 100 pounds. Visualize the impact they had when they fell from an aircraft at 2,000 feet altitude doing about 300 knots. They sure dig up the turf when they hit! With this list echoing through our mind, what can we do to eliminate the problem?

These incidents had two primary causes: personnel factor and materiel failure. In order to be effective in controlling this "litter bug" problem, each of us has an important part.

First, "Johnny Wrenchbender," can really help in two ways. He can report any suspected materiel problem and by using the "EUR" system, obtain a better product that will withstand flight stresses. Next, the maintenance types can eliminate their share of personnel factor incidents. To accomplish this part of the task requires self-discipline and understanding. The self-discipline is relevant to the tedious job that takes hours to perform. Sure, it's cold and windy, and your fingers get numb, but you only have a little left to do, so you finish up the job, sign it off and head for the line shack. Unfortunately that last safety wire didn't hold the nut in place, or those numb fingers couldn't quite feel the nut seat properly. **On time takeoffs** are important, **completing maintenance on schedule** is important, but DOING THE JOB RIGHT is **more important.** So, take that ten-minute warm-up break and go back out and do the task properly. You'll solve the problem and it'll pay big dividends.

Now, the aircrews have to take their lumps. The other half of the personnel factor has to be eliminated by your efforts. Taking off with a canopy unlocked is guaranteed to cause a very dusty, windy, embarrassing, and dangerous ride. If there is a reason for the canopy not getting locked, put it in writing and maybe the warning light can be moved, or maybe the over center locks can be improved. We can't correct the problem if we don't know it exists.

Next, if there isn't a real pressing reason to push a button without looking, **LOOK, READ,** then **PUSH.** For example, in the F-102 the emergency gear up button and the tank jettison button are mighty close together. It is very easy to get the wrong one!

This type of problem exists in almost every aircraft. Cramped space and weight limitations are a bug-a-boo that fighter pilots especially have to live with. OK! We have to live with it, not die with it. Use your blindfold cockpit checks to become more proficient in knowing switch locations, but once again, **time permitting,** use your head; **LOOK, READ,** then **PUSH!**

One last item to mention. The cost of these strewn paraphernalia is high, but usually one problem leads to another. For example, a canopy blows off just as the gear is cycled. The dust in the cockpit blinds the pilot, the aircraft crashes! The cost is now out of this world.

Up to now, serious accidents caused by lost objects have been at a minimum. That isn't to say our luck will continue to hold. Any time something falls off an aircraft a potentially dangerous situation exists. The problem can be eliminated only if we make a conscious effort to do so. ★

No one hurt, however . . .

As if a bomb . . .

F-101 MB-5 SYSTEM

by **MAJOR KENNETH E. NELLE** / *Air Defense Weapons Center, Tyndall AFB, Florida*

In June, 1969, the Air Defense Weapons Center was directed to act as executive agent to test and evaluate the improved MB-5 Autopilot (AFCS) system for ADC. The modifications to be made on this program are designed to increase the MB-5 AFCS reliability and maintainability in the F-101B/F fleet. In addition, the MCSL limiter system was remechanized to provide dual redundant MCSL limiting, thus increasing flying safety. The flight test program was completed at Tyndall AFB, Florida, on 13 July 1969 and was designed to evaluate the system in the ADC environment to insure that it was compatible with the ADC mission and would provide flight safety throughout the flight envelope of the aircraft. Ten flights were made on the test aircraft.

DESCRIPTION OF TEST ITEM AND ACTIVITIES

The improved MB-5 AFCS consists of two completely independent pitch control systems—channels "A" and "B". Channel "A", which is the primary channel obtains its aerodynamic information from a probe on the left side of the aircraft nose and provides manual control stick limiting and also provides protection with the presently installed AFCS. Channel "A" is powered by the utility hydraulic system. Channel "B" is installed to take its information from a probe mounted on the right side of the nose of the aircraft and is completely independent of Channel "A." Channel "B" is powered by the primary hydraulic system. When the aircraft is flown manually, both channels are computing boundary proximity independently. When the "A" boundary is reached, Channel "A" hydraulic servo will engage and limit aft stick movement with a 60 pound force. Channel "B" is calibrated to the same boundary as Channel "A;" however, when Channel "A" is armed and operating properly, Channel "B" is automatically biased to a point deeper into the flight envelope to prevent simultaneous engagement of both channels. Should a failure occur in Channel "A" or should the angle of attack or stick rate inputs reach the Channel "B" boundary, Channel "B" disengages Channel "A" from the system by turning off the switch and then fades into and provides "g" limiting on the boundary previously established by Channel "A."

When the aircraft is flown on autopilot, the Channel "A" servo is engaged as the AFCS pitch axis controls the aircraft. Channel "A" is again the primary limiter channel. Should a failure occur such that limiting is not present at the "A" boundary and "B" boundary is reached, Channel "B" will engage and control. This results in AFCS disengagement and complete disengagement of Channel "A." Channel "B's" boundary will again fade to Channel "A's" level.

The actual limit point during AFCS operation is a function of "g" level or alpha, whichever is met first. For manual (MCSL) operation, the limit level is a function of alpha only. Both channels have a negative 1.5g disengage function. When the aircraft is flown with the AFCS engaged, the limiter in the AFCS prevents nose down command either from the pilot or the AFCS from exceeding -.5g. Should a failure occur on this circuit, disengagement of the AFCS and both "A" and "B" Channels will occur upon reaching -1.5 g's. During the positive g's, limiting is prevented in excess of 4 g's with AFCS engaged. Disarming of both systems will also occur rate with a rapid forward nose down stick movement.

Complete monitoring provisions have also been designed into the system to detect and prevent a malfunction that could result in an unwanted stick movement or a nose down force of 60 pounds and consists of the following:

a. Discrete Monitors: Cause disengagement or prevent engagement of the defective channel in the event that AC power, DC power, or hydraulic pressure is lost in that system.

b. Comparison Monitor. Compares the signal levels of the two channels. If the signal levels differ between the two channels due to a malfunction, the monitor indicates this by turning on the Pitch Control Warning and Master Caution Lights.

c. Pre-Arming Monitor: Prevents initial arming of the circuit where a faulty nose down command exists in the system.

A warning horn has also been incorporated in the system. A safety wired guarded switch on the control panel must be turned Off to prevent the horn from blowing in any configuration when Channels "A" and "B" are disarmed. When the landing gear is down, the warning horn will blow only when the alpha limit is exceeded. When the gear has been retracted, and Channels "A" and "B" are disarmed, the warning horn will sound when the alpha limit has been reached or when stick rates have been introduced which could result in the aircraft exceeding the flight envelope.

The entire system is controlled, monitored, and tested during normal operations, by the paddle switch, the telelight panel, and master caution light.

a. The paddle switch is an immediate disengage of the systems. When the paddle switch is depressed both channels drop off the line and remain off the line as long as the paddle switch is depressed. When the paddle switch is released, all systems that were previously on the line will come back into operation.

b. The pitch inhibitor light on the telelight panel and the Master Caution illuminate to tell the pilot that some event has occurred in the system that could be a malfunction and that he should check his control panel on the left hand console.

c. The control panel on the left hand console provides the means to test and control the system (Figure 1). It consists of:

(1) Two solenoid held "ON-OFF" switches, one for each respective channel. Just behind each switch is a small light which illuminates when its respective channel is disarmed.

(2) An "ON-OFF" guarded test switch and a six position rotary test switch. During preflight the guarded test switch is used to activate the self-test system and the rotary switch is then used to induce artificial inflight conditions into the system. As the pilot changes the rotary switch he monitors the PBI, the warning lights, and the flights controls to insure the system is reacting properly. A fail safe microswitch is incorporated in the nose gear to disable the test circuit in case of a malfunction or pilot error in repositioning the test switch prior to flight.

(3) An "ON-OFF" horn switch is incorporated to enable the pilot to disable the horn in case of a malfunction. This switch will be safety wired to the "ON" position.

(4) A "push to reset" monitor light illuminates when the monitor circuitry indicates an error or a malfunction within the system. The light will remain illuminated until the error or malfunction has disappeared and the light has been pressed to reset.

The system also includes a pitch boundary indicator. This indicator, through the use of a warning flag and an alpha needle gives the pilot

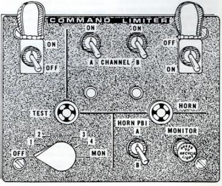


Fig. 1.

a continuous presentation of angle of attack in units of alpha in relation to the limit boundary of the aircraft. As airspeed is changed, the warning flag is constantly changing, indicating maneuvering area available to the pilot. As the pilot changes his angle of attack for various flight conditions, the alpha needle changes correspondingly. When flying the aircraft on the limit boundary, the leading edges of the alpha wand and the warning flags meet. The pilot has the option to select either Channel "A" or "B" for control of the PBI.

RESULTS

All test objectives were met. When the AFLC pilot had finished with the test requirements, the aircraft was turned over to ADC for their evaluation. A total of 15 flights were made to satisfy the ADC requirement. Three flights were made at Hill AFB, then the aircraft was ferried to Tyndall AFB for further testing. System operation is simple. The preflight procedures are easy to accomplish and, after a very short period of practice, preflight could be accomplished in under one minute. There is no requirement for ground crew assistance. Present procedures call for the system to be turned "ON" climbing through 5,000 feet and it is turned "OFF" for flight below 5,000 feet and prior to entering the traffic pattern. As confidence is gained in the system, these restrictions can be eased.

Above 20,000 feet, the flight envelope is the same as the previously installed MCSL; however, below 20,000 feet more maneuverability is available to the pilot. As an example, at 20,000 feet, the envelope has been increased by .3g at any given airspeed. This release in available "g" becomes even more pronounced at lower altitudes.

Turns on the boundary were made at all altitudes and all airspeeds. When holding on the boundary and "A" channel is disarmed, there is an increase of .1 to .2 of "g" and the "g's" smoothly decrease to that "g" value previously established when "A" channel was in operation.

For the purposes of the test, once the system was armed, it was left on for the remainder of the flight to gear lowering in the traffic pattern. In the break, if the turn to downwind was made on the boundary, the downwind resulted in a slightly too "close-in" pattern. When the gear was lowered, both channels would disarm as designed, and the landing would be completed with the horn only. During coupled approaches, when the gear was lowered, only Channel "B" would disarm; however, Channel "A" would drop out simultaneously with AFCS disengagement in the round-out. Several landings were made with the AFCS engaged with little or no problem. Landing with AFCS engaged would be necessitated by an emergency condition whereby the feel-trim system was malfunctioning. Maximum aft stick rates were induced on several occasions and at no time did the aircraft approach a dangerous situation. When the rate inputs were induced, the limiter would immediately snub the stick and then slowly allow the pitch to increase into the limit boundary. The following items were also considered:

a. Tactics: The tests at Tyndall AFB had the primary purpose of insuring that the system was compatible with the ADC mission. Attacks were made or simulated at all altitudes from 1,000 feet to 56,000 feet. Airspeed ranged from maximum attainable within the flight envelope of the aircraft.

b. Low Altitude: Low altitude attacks were made at 1,000 feet with primary interest being in the escape maneuver. Escape maneuvers were initiated at airspeeds ranging from 300 to 470 knots. After afterburners were selected, a max "g" level turn on the boundary was made. The system performed well and safely limited the aircraft and at the same time gave the pilot maximum turn capability for the particular flight condition. As an example, during the 400 knots maneuver, 3.5 "g's" were available, the "g's" then increased to 4 "g's" as the aircraft accelerated during the turn. It took 18 seconds to complete 135 degrees of turn.

c. Automatic Co-altitude Attacks: Performance in automatic co-altitude attack maneuvers was satisfactory; these maneuvers were performed at medium airspeeds and altitudes against a target aircraft at similar altitude and airspeed. During attacks and recovery in both control stick steering (AFCS) and manual flight control modes, the limiter system prevented limiter boundary overshoots without restricting maneuverability.

d. Snap-Up Attacks: Limiter performance in coupled automatic AFCS and manually steered snap-up attacks was satisfactory. Maneuvers were performed at altitudes of 5,000 to 56,000 feet with target altitude separation of 5,000 to 30,000 feet. Aircraft velocities bled down to 200 / 170 knots at different gross weights up to 9,000 pounds of fuel, at the peak altitude attained during recovery phase. During these maneuvers, the limiter system smoothly prevented boundary overshoots without restricting maneuverability. At 51,000 feet, for example, at 180 knots inverted, +.8g's were available for the escape maneuver.

e. Formation: Formation flight was accomplished to include flight at all airspeeds and gross weights. Inflight maneuvers were accomplished with no difficulties. Formation takeoffs and landings were accomplished. The system performed satisfactorily.

f. Functional Check Flight Procedures:

(1) Present functional check flight procedures were reviewed and recommended changes to the technical orders were made in cooperation with the AFLC pilot. The system is initially calibrated at .8 Mach — 35,000 feet in one "g" flight condition with a bias adjustment. This bias adjustment is made to compensate for the difference in air flow between the left and the right side of the aircraft. It is accomplished with an adjustment knob on the left console and a mega-amps meter installed only on FCF's and mounted on the right console. The meter is zeroed out by turning the knob left or right with corresponding needle deflection. Once the setting is made it is not adjusted again; however, the pilot can expect a ±20 mega-amp deflection of the needle as the varying flight conditions change the air flow over the nose. Installing one or both external fuel tanks on the aircraft could change the bias readings to vary as much as ±15 mega-amps; however, this had little or no effect on the limit level.

(2) After adjustment of the bias, an adjustment of the limit level is made at .8 Mach — 35,000 feet. This initial check is made at .8 Mach to ascertain where the level is and to give the pilot a rough look at his instruments, "g" meters, and other parameters to insure that everything is working right prior to making the final adjustment and exact checks at .9 Mach where little or no buffet warning is available prior to pitchup. The final setting is then made at .9 Mach, followed by a check at 1.1 Mach — 40,000 feet, and a wind down turn to .7 Mach on the boundary. Deceleration checks are made at 20,000 feet completing the system checkout. Limit level adjustment is made by the limit level adjustment knob on the same panel as the bias adjust knob (Figure 2).

Fig. 2.

Turning the knob clockwise increases "g's." It is interesting to note that throughout the test it was unnecessary to change the limit level from that as originally set on the first flight at Hill AFB by the AFLC pilot. In fact, during the course of the test flights, the limit level was changed for other purposes three times and when the systems were properly calibrated on the ground to its original limit level prior to flight, the system performed exactly as it had on the previous flights.

THREE PROBLEM AREAS DEVELOPED DURING THE TESTS

a. If AFCS engagement or disengagement is attempted while holding on the limit boundary, Channel "A" would disarm. This was considered unacceptable due to the loss of safety factor and pilot's concern. Relay 1A27K1 was modified to prevent Channel "A" disengagement. On the subsequent test flight however, it was found then that the stick would freeze if the AFCS was disengaged with a slight back pressure on the stick. The stick force could be relieved by turning off "A" Channel, a momentary forward pressure on the stick, or by hitting the paddle switch. A further modification was made by adding a diode between 1A27K1-1 and 1A27J1A. This was considered satisfactory as attempts could now be made at anytime to engage or disengage the AFCS without loss of the "A" Channel. Engagement of the AFCS is not positive, however full protection of both "A" and "B" Channels is realized which is considered satisfactory. If engagement can be accomplished or AFCS is disengaged while on the boundary, very light unobjectionable stick pump is felt.

b. At low engine power settings, disengagement of either channel would occur during high demands on the hydraulic systems. Channel "A" would disengage during speed brake retraction and the momentary use of any other hydraulic system to include flight controls. Channel "B" would disengage on rapid flight control movement.

c. Electrical Monitors could possibly cause channel disengagement. One unexplained disarm of Channel "A" was experienced that could not be traced or pinned down to any particular cause. At the time of the incident, flying straight and level, the weapons system officer was having problems with the power supply in the fire control system. It is felt that this caused a temporary surge in the system and caused Channel "A" disarm through the discrete monitors.

CONCLUSION

The improved MB-5 AFCS autopilot system will be a definite asset to the ADC mission, improve flying safety and improve reliability. ★

ABOUT THE AUTHOR

Major Kenneth E. Nelle enlisted in the Air Force in 1953. He entered Aviation Cadets and graduated with Class 55-F in 1954. Following F-84 gunnery training at Laughlin and Luke, Major Nelle was assigned to the 81 TFW at Manston, England. During this time, the 81st moved from Manston to Bentwaters and acquired F-101 fighter bombers. In 1959, he moved to the 437 FIS at Oxnard AFB, California. He attended Westmar College, LeMars, Iowa, and received a degree in mathematics. He was assigned to the 29 FIS at Malmstrom and then in 1966 to Vietnam as an A-1 advisor to the VNAF. Presently, he is Quality Control Officer at Tyndall AFB, Florida.

TOUCH & GO

by **MAJOR ROBERT E. ROSS** / *ADOOT-WS*

Now that touch and go landings in the T-33 have official sanction, a discussion of the how's and wherefore's appears to be in order.

First of all, let's take a look at the rules of engagement for conducting touch and go landings in the T-Bird. The Air Force directive covering touch and go landings is AFR 60-4. It spells out the parameters under which touch and go landings may be conducted. The Air Force regulation states that commanders will insure that touch and go landings are conducted only for essential training, evaluation, or mission accomplishment in conjunction with an "integrated, aggressive, and effective accident prevention program . . . ." It further states that touch and go landings, with certain specific exceptions, are limited to aircraft with two operable sets of controls when one set is manned by either an Instructor Pilot or Flight Examiner. The recent change to ADC Sup 1/AFR 60-4 opened the door for ADC to conduct touch and go landings in the T-33. It should be noted that commanders at all levels are charged with establishing and maintaining an effective accident prevention program. It goes without saying that the primary safety factor concerned with shooting touch and go landings is the chance of mission termination accompanied by an expensive scraping noise. It therefore makes good common sense, and is highly recommended that unit commanders take appropriate action to insure that ALL landings will be made in a geardown configuration.

As a starting point, commanders must insure that touch and go landings are conducted IAW the implementing and regulating directives (AFR 60-4, AFM 51-33, T.O. 1T-33A-1). He must insist that touch and go landings be specifically briefed if they are to be practiced, and discourage spur-of-the-moment decisions to practice a landing stage.

A current practice at Perrin is to require that an aircraft shooting a series of closed patterns break out of traffic and re-enter for the final landing. This procedure is highly recommended as a deterrent to an inadvertent gear up landing. Since it has been more years than most of us care to remember since touch and go landings were generally condoned in ADC, most of our airplane operators are going to have to dust off their dash one's and do a little homework. The procedure is simple, but most of our IP/FEs are going to have to sharpen their judgment and refine their techniques a little bit to fully exploit the new tool with which we have been provided. In other words, practice before you preach.

In summary, we should consider it a privilege to be able to conduct touch and go's in the Lockheed Racer, so let's play it cool. It took a long time to get this far, but one "scrape" and the ball game will be over.

CAT clear air turbulence

While complete answers as to the cause of CAT are yet unknown, it is generally conceded that CAT is closely related to high temperature gradients that develop in the atmosphere. Any high pressure ridge aloft preceded by rapid temperature changes; any trough aloft or surface front accompanied by exceptionally high temperature changes . . . either can be a source of CAT. Also, areas aloft downstream from strong warm air advection in the lower levels (850 to 500 mb) are CAT prone. Recent studies produced the following suggestions:

Insofar as possible, avoid—

- Mountain wave zones* at times when a strong tongue of warm air, at 850 mb, lies over or to the lee of the mountain range and the 500 mb minds are blowing across the mountains at 30 kts or more and increasing.
- Mountain wave zones at times when any surface fronts with exceptionally high thermal gradients accompanying them are moving across the mountains.
- Mountain wave zones when temperatures aloft are colder than standard and winds are blowing across the mountain range, especially when temperatures at 500 mb are well above standard.
- Strong jet stream winds curved anticyclonically, especially when winds in the lower levels (surface to 500 mb) are cutting in under the jet stream from the northwest or west.
- Areas above and downstream from sharply curving isotherms at 500 mb, especially when the wind flow has a flatter curve than the isotherms.
- Narrow lines or ribbons of cold air aloft, especially when the temperature changes rapidly on either side. Temperatures that drop at a rate of 1°C or more per minute in flight indicate possible turbulence ahead.
- Zones of apparent strong cold air advection aloft.
- Zones where winds are blowing across contours toward higher pressure ranges.
- Flying at or near the tropopause. This feature is usually indicated by a definite change in sky color. The pale blue-gray or haziness of the upper troposphere gives way to the clear, often deep blue of the stratosphere. The change is more apparent in strong inversions where CAT exposure is higher than in the weaker inversion situations. Climbing to about 4,000 feet about the tropopause level should minimize turbulence exposure.

Relatively CAT-free areas will be found—

- In the warm air above the tropopause in areas of weak temperature changes.
- In areas of weak temperature gradients, provided no sharp wind shifts or strong winds are found in adjacent layers.
- Above the tropopause in areas of apparent warm air advection or when flying toward warmer temperatures.
- In relatively straight or slightly curved wind flow, when only minor variations in wind speed and direction are found below.
- In penetrating the tropopause where temperature changes on either side are minor.

For your additional information, there are 18 mountain wave zones in the U.S. These are:

Zone 1—Cascades and Coastal Ranges (Wash., Ore.)
Zone 2—Siskiyous and Coast Range of N. Calif.
Zone 3—Sierra Nevada in Calif., Nevada
Zone 4—Tehachapis and Santa Ana in S. Calif.
Zone 5—Arizona Mountains
Zone 6—Blue Bell Knoll in Utah
Zone 7—The Oquirrhs, Uintas, Wasatches (Utah)
Zone 8—Rubies and East Humbolt Range (Nev.)
Zone 9—Blue and Raft River Mts. (Idaho and E. Oregon)
Zone 10—Continental Divide (Montana, NW Wyo.)
Zone 11—Continental Divide in SE Wyoming
Zone 12—Continental Divide—N. Colorado
Zone 13—Continental Divide S. of Denver
Zone 14—Black Hills (South Dakota)
Zone 15—The Ozarks
Zone 16—Southern Appalachians
Zone 17—Alleghenies and Catskills
Zone 18—Adirondacks and White Mountains

*(From UAL's "The Cockpit" and PSEB 58-101)
(Flight Safety Foundation) ★

ORI

OPERATIONAL READINESS INSPECTION TEAM
HQ, ADC

ADC ORI TEAM

WHO'S KIDDIN' WHO or There's two sides to every radar dish

Occasionally during an ORI, when an outfit is right on the razor's edge of making or breaking the AWST, we are greeted by the apparition of a sweated out interceptor jock staggering into debriefing. Tears streaming down his face, he cries, "Colonel, I got two MIs because that *&%# target pilot put on a show that would shame the Thunderbirds! He'd make a downtown Wild Weasel mission look like a retirement flyby for a "BUF" Wing Commander! You just **can't** charge me for those intercepts!"

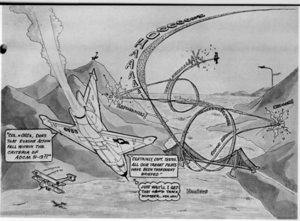
Unfortunately, unless excessive evasive action is confirmed by our Ground Environment types, by an ORI team member aloft on the mission or during film/NADAR assessment, those intercepts will be charged.

Let's make a few observations on what constitutes legal evasion, some trends we've seen, and what's been done about it.

ADCM 51-13 generally lays down the rules — 30 degrees max bank, 30 degrees turn either side of target track, up or down 1000' from the basic altitude at no more than 500'/min, a designated minimum altitude above the terrain, and change of A/S not to exceed plus or minus 50 knots. None of these acts, or any combination thereof, is beyond the capability of any bomber since the Gotha. So they're certainly not unrealistic in the intent of frustrating your intercepts. If anything, we're perhaps overly restrictive because we recognize that a T-33 doesn't present the radar picture of a Bear and we pass on the benefit of doubt to the interceptor crew. It's common knowledge that AIM missiles do not require a centered dot to give an acceptable PK. However, any evaluation system requires criteria and restricting evasive maneuvers makes this "dot in the hole" criterion easier to live with. We also know that WSEM results don't always reflect the true low altitude capability of the weapon system. Mere achievement of a firing sig[nal] is not all that's required for AWST. Consequently [...] ask for a higher minimum altitude than would really be necessary if you were shooting the red ones.

Some of the main complaints we receive concern the target that made a turn into you, or changed altitude 2000'. Since our first day in Primary, 30 degrees either side of track can add up to a total turn of 60 degrees; same as 1000' above and below a given altitude equals 2000'. These maneuvers, performed in combination and at the right time, present a difficult target. But, they certainly are representative of what a bomber pilot would attempt if you were at 6 o'clock. And they **can** be hacked; which leads to another observation.

We seldom receive complaints of "wild targets" from the real sharpshooters. They may make an offhand comment about a bit of dodg'em, usually somewhat understated and with just a touch of pride (conceit??). The howls come from the sandbaggers who missed. Invariably their scope recorder will show some pretty wild wing walking inside of "B" time, rather than the smooth stalk of the old pro. There's a basket full of morals here. Perhaps the most constructive is that practice makes perfect. When it's day-to-day head-bumping time, work out on evasive action rather than attempting to amass an unbroken string of c[...]



red dots on a straight and level target. Then things won't appear so rough during the ORI.

We also can't help commenting on the fact that the degree of evasive action reported is inversely proportional to the current squadron hack rate. Our interpretation of this cause and effect phenomena, based on long experience, is generally the obverse of that made by the squadron. Corollary to this theorem is the observation that the rate of complaints increases sharply about three-quarters of the way through the reliability phase. It's difficult to accept that target pilots suddenly get bored or that interceptor pilots have suddenly run out of adrenalin at this particular point.

So much for observations, most of which aren't particularly complimentary to the troops. What's been done to give them a fair break? Target force consistency is absolutely necessary in our business of evaluation. Unless their maneuvers remain within a given envelope we could well see some fine outfits go down the tubes. Contrary to public opinion, this is not our desire. Therefore, some strong command interest on proper target flying has emanated in the form of letters and messages from this and numbered Air Force headquarters. Target force coordinators deliver very explicit briefings to participants prior to each go. Our Own Ground Environment personnel, looking over the shoulder in controlling agencies during each exercise, are on alert for apparent deviations. Finally, our ORI Team pilots, chasing or filling a right/rear seat, will be quick to report any airborne posterior polishing. The target pilots have been warned. Dark clouds of official wrath will descend upon him whose transgression is substantiated. This is why, where we receive an avalanche of complaints, we try to make clear to the complainants — "Are you absolutely sure? A man's career may be hanging on your judgment." In most cases, consideration of this aspect results in some second thoughts, if unit pride has not already done so.

The business of the ORI Team is measurement, not direction. But in this case a recommendation is appropriate. With reference to evasive action, we'd like to see everybody on both sides of the radar dish learn, know, and practice ADCM 51-13. This would not only result in less rancor toward the target pilots, which is usually misdirected at us, but more important, would upgrade everybody's mission performance capability. In the final analysis, isn't that what we're all after? **Good Hunting!**

WILLIAM C. NORRIS, Colonel, USAF
Director, Operational Inspection

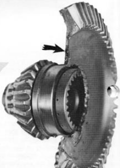
F-106 ENGINE FAILURE

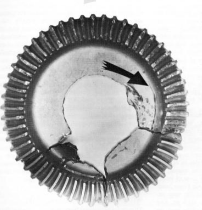
Briefing, preflight, engine start, taxi, and takeoff were conducted in a normal manner with no discrepancies noted. The purpose of the flight was a practice scramble of two F-106s to be followed by high altitude intercepts. After two intercepts were completed, the flight leader developed radio difficulties. The wingman joined up to escort him back to home plate. The wingman assumed the lead and executed a normal descent. Fuel remaining was 8,300 pounds. Number 3 tanks were checked and showed full. The flight leveled at 1700 feet at approximately 18 miles from the runway and proceeded on initial approach to the break for a 360° overhead pattern. A normal break was accomplished and the leader's aircraft rolled out on downwind at 250 knots where the gear was lowered.

At this point the pilot heard an unfamiliar grinding noise which he could not associate with gear lowering. The master caution light, hydraulic low pressure light, and, as the pilot recalled, most of the telltale lights on the master warning panel illuminated. The main lights observed were AC and DC power failure, oil pressure light, fuel boost, and flight mode fail.

As the gear indicated safe, he began a left turn to base leg at 1600 feet indicated altitude. Here he attempted an airstart as there was a

DOWN and out





rapid decay in RPM and EGT. From pitchout to flameout, the engine RPM had been set at 89%. Emergency fuel was selected and airstart ignition depressed. There was no indication that the airstart was successful. The flight controls became unresponsive and so the pilot lowered the Ram Air Turbine. Control returned. A second airstart was

tempted without success. At about 800 feet and judging he could not make the runway, he rolled the wings level and pointed the aircraft toward an open field. He ejected at 300 feet or lower and at 210 knots. The aircraft impacted in a plowed field in about a 35° dive. The pilot swung once in his parachute before landing among some trees. The equipment had functioned normally and all he received was a scratch on the left leg.

Investigation and analysis revealed that the engine main accessory drive gear failed catastrophically. The failure occurred due to the presence of a substantial pre-existing fatigue crack which had developed at some undetermined time prior to the accident. This type failure substantiates the pilot's report of a grinding noise when the landing gear was lowered. Disengagement of the drive also caused the loss of hydraulic pressure, CSD, tachometer indication, and fuel flow. The engine flameout was caused by fuel starvation.

Based on the above observations and findings, the primary cause of the accident was determined to be materiel failure of the main accessory drive gear.

The sudden, catastrophic nature of this accident surely points out the need for every pilot to be prepared. As with engine failure on takeoff, you have to decide in advance what actions the capability of the ejection equipment will allow. In order to be able to make a sound judgment, you first have to know the systems, both aircraft and ejection. Too many pilots have become statistics because they traded off their only means of escape to salvage a hopeless situation. Did they know what they were doing? Probably not. It doesn't seem reasonable that a knowledgeable pilot would continue airstart attempts below an altitude where, even if the engine started, there wouldn't be enough room to accelerate for recovery. The only answer appears to be that he didn't know the consequences.

All that is expected of a throttle jockey is to give it an honest try if time and conditions permit. To do that, he must have the emergency procedures at his fingertips. When approaching the limits of ejection equipment, there's no time to think. Try the **"Bold Face"** — no soap — get out. You don't owe that sick machine a plugged nickel.

✓ POINTS

We would sincerely appreciate your inputs mailed directly to: The Editor, INTERCEPTOR, Hq ADC (ADCSA-E), Ent AFB CO 80912

✓ PAINTING OF AIRCRAFT WHEELS. T.O. 4W-1-61 states that aircraft wheels will be painted only with two coats of acrylic lacquer, MIL-L-19537, color code No. 16473 Grey. This restriction is particularly important in regard to aluminum pigmented paints. Such paints have a nitrocellulose base and create problems by not dissolving in depainting vats and also contaminating corrosion control acid treatment equipment. Reference: T.O. 4W-1-61. (4600WGMME-Q)

✓ The first blanket of snow has already left its mark on Air Force personnel. The hundreds of stalled cars in local areas provided a graphic example of "failure to be prepared" for the wiles of Mother Nature. Studded snow tires, or snow tires with chains can be worth their weight in gold. For those of you in snow belt country, or out in the plains where towering drifts are not uncommon, an emergency kit could be your lifesaver. We would suggest blankets, matches in a moisture resistant container or wrapped in plastic wrap, candles to heat the inside of the car, flashlight (check the batteries), dry rations, and emergency road flares. Check ADCP 127-7, Volume II, Operation Wintersafe, for additional suggestions. (ADCSA)

✓ The port main gear downlock was noted binding during preflight inspection. Ground crewman removed downlock. Port main landing gear collapsed!!! (Flight Safety Foundation)

✓ Aircraft accident/incident reports reveal that some aircrews and controllers do not completely understand correct radio phraseology — **which may be contributing to aircraft accidents/incidents.** Specifically, aircrews/controllers misuse and misinterpret the term "ROGER" when replying to specific questions or instructions — confusing it with "WILCO" or "AFFIRMATIVE." Section III, FLIP Planning, "Communications Procedures," defines these terms:

- AFFIRMATIVE: "Yes" or "permission granted."
- ROGER: "I have received all of your last transmission." (Under no circumstances to be used as an affirmative.)
- WILCO: "Your last message (or message indicated) received, understood, and will be complied with."

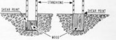
✓ T-33A STALLS. Approximate stall will be 105 KIAS for a clean aircraft and 95 KIAS with gear and flaps down. Reference: T.O 1T-33A-6CF-1. (4600WGMME-Q)

If your unit has had a lot of dead aircraft batteries lately, you might check and see how many times maintenance is being performed using battery power. Also, check and see if pilots are making battery starts. An APU used for these purposes can save batteries for that critical time when the battery is the **only** power source available. (TIG Brief)

The MG-10 wire bundle that is normally routed along the right edge of the F/TF-102 nose wheel well, recently caused a nose gear UP landing. The unit involved has initiated a procedure to perform gear retraction/lowering tests anytime this wire bundle is moved, installed, or re-clamped. Sounds good! (ADCSA)

Investigation of a recent Aero Club incident involving a T-34 revealed that a 1959 T. O. specifying replacement of a part in the landing gear retraction linkage may not have been accomplished. Or, if the T.O. was complied with, the part was replaced with one that should have been removed from the supply system. This situation occurred even though the airplane had undergone regular 100-hour and annual airworthiness inspections during the ensuing years. Technical Order compliance is vital to the safe operation of aircraft. It is a requirement emphasized recently by the Chief of Staff for the reduction of the USAF aircraft accident rate. In view of the accident described above, inspectors should assure tech order compliance on aircraft removed from storage or loaned to activities, such as the CAP or USAF Aero Clubs. Aircraft taken out of daily maintenance, or removed from activities where T.O. distribution is automatic, may not be getting the required safety inspections and parts replacements. (TIG Brief)

Are your barrier (MA-1) stanchions properly positioned?



INCORRECT CORRECT

Also, the webbing, quick release chains **still** require 18" spacing, or "SAG." Any spacing other than this gives undesirable webbing release! (ATC Flight Safety)

BLUE ZOO

"Well, I'm not gonna stick my neck out for pro pay!"

safety officers'

FIELD REPORTS

F-101B CONTROL PROBLEMS. During flight it was noted that the flight controls were erratic in pitch and that aileron control appeared to be sluggish. Rolling movements of the aircraft were accompanied by a slight transient yaw. Troubleshooting of the system after an emergency landing showed that the line leading to the stabilator feel system bellows was disconnected at the ram intake duct. Cause of the yaw condition was determined to be a malfunction in the rudder power cylinder actuator servo. The ailerons were then re-rigged to allow maximum deflection.

TF-102A COCKPIT FIRE. After takeoff, the aircraft was leveled at 4,000 feet and the pilots noticed what appeared to be condensation fog in the cockpit. Further checks by the aircrew determined the "fog" to be smoke, which continued to increase in density. An immediate return to base was initiated and the cabin pressurization switch was placed to Ram in attempting to clear the smoke. All electrical power was turned off, but the smoke continued to increase to the point that the pilots could not see the instrument panel. The canopy was then jettisoned by the instructor pilot. The smoke cleared almost immediately, and a successful downwind precautionary landing was completed. Investigation revealed an air leak at the right front rain clear duct nozzle coupling, which ignited the forward canvas portion of the glare shield.

F-106B OIL LOSS. The oil pressure low warning light came on ten minutes after takeoff. The pressure fluctuated between 10 and 30 PSI, went to steady 20 PSI at 90% rpm, 10 PSI at 85%. An uneventful landing was made about 10 minutes later from an SFO. When the power was reduced from 85% to idle in the flare, the pressure dropped to zero. The engine did not vibrate or stall, but after engine shutdown at the end of the runway, a small oil fire continued in the tailpipe and was easily extinguished by the fire department. The engine froze after shutdown. No oil remained in the engine. The reason for the oil loss is unknown. Suspect possible loss of number 6 bearing oil due to no oil scavenging action, or from cracks in number 6 bearing oil return line.

F-101B NOSE GEAR When the gear handle was placed in the down position, the aircrew heard a loud noise. The nose gear indicated safe immediately. A low approach was made, and the tower confirmed all gear appeared down and locked. A precautionary landing with a normal rollout was accomplished. After clearing the runway, the aircraft was stopped and the crash crew discovered the nose gear locking link was broken. Suspected cause: Materiel failure of the nose gear locking link assembly due to fatigue.

F-102 SECONDARY HYDRAULIC FAILURE. While descending through 15,000 feet during combat descent, the hydraulic pressure started fluctuating between 2000 and 3000 PSI. Fluctuations continued as pressure dropped to 0-1000 PSI accompanied by a flashing low pressure light and mild control oscillations. Speed brakes closed although switch was in neutral. Dampers were disengaged and speed reduced to 240 KIAS. A VFR straight-in recovery was made without incident. Emergency gear extension and emergency drag chute used. The hydraulic oil hot light illuminated just before aircraft was shut down off runway. Secondary hydraulic fluid was depleted, but a definite cause could not be determined. Excessive fluid was found in the area of the emergency speed brake control. It may be possible for the speed brake shuttle valve to become unseated during flight and vent fluid overboard. The secondary hydraulic pump bench checked at 2800 PSI and was changed.

F-106A FLAMEOUT. The pilot was cruising at FL 410, .93 Mach TAS, 93% RPM, twenty-five minutes after takeoff. The AC and DC generator failure lights came on and the MA-1 electrical power systems failed. Engine RPM immediately began to decrease. The pilot selected the emergency fuel system, depressed the air-start ignition button, and reduced the throttle setting to match engine RPM. An engine restart was obtained at approximately 70% RPM. An emergency landing was made without further difficulty. The AC/DC power failed due to CSD failure. Investigation revealed no cause factor for the RPM decay. The fuel control unit was replaced.

F-102A HYDRAULIC LIGHT. Passing through 8,000 feet at 320 knots, the pilot heard several thumps. He checked the instruments and saw the Hyd light flashing. The Hyd gauge indicated primary system failure. The RAT had come open in flight and caused the failure. Adjusted locking mechanism. Drained and flushed primary system.

THE WAY THE BALL Bounces

ACCIDENT RATE

1 JAN THRU 30 SEPTEMBER 1969

	ADC	ANG
Thru September 1969	5.4	*6.4

MAJOR — ALL AIRCRAFT

ON TOP OF THE HEAP

MO	ADC	MO	ADC	MO	ANG
65	48 FIS	24	343 Ftr Gp	80	162 Ftr Gp
40	4603 AB Gp	19	49 FIS	78	112 Ftr Gp
32	75 FIS	18	71 FIS	59	148 Ftr Gp
30	4758 DSES	18	78 Ftr Wg	37	147 Ftr Gp

ACCIDENT FREE

BOX SCORE

ACCIDENTS FOR Sep / CUM TOTAL	1st AF Sep	1st AF Cum	4th AF Sep	4th AF Cum	10th AF Sep	10th AF Cum	ADWC Sep	ADWC Cum	4600 Sep	4600 Cum	ANG Sep	ANG Cum
T-33	1	1		1								2
F-100												
F-101		1				1						
F/TF-102						1						2
F-104												
F-106	1	3		2		1						
B-57		1		1								
F-84												1
EC-121		1										
OTHER CONV												1

MINOR ACCIDENTS THIS PERIOD — 0
MINOR ACCIDENTS CUMULATIVE — 3

CUMULATIVE RATE

1 JAN THRU 30 SEPTEMBER 1969

	ADC	ANG
JET	6.9	*5.8
CONVENTIONAL	1.4	*13.1

BY AIRCRAFT

	ADC	ANG
T-33	3.0	*13.6
F-100	0	0
F-101	7.7	0
F TF-102	4.7	*2.8
F-104	0	0
F-106	13	0
B-57	14.3	0
EC-121	2.5	0

RATE = MAJOR ACCIDENTS PER 100,000 FLYING HOURS

*Estimated

we point with PRIDE

MAJOR JAMES L. FULK
84 FIS
Hamilton AFB, CA

F-106A FLIGHT CONTROLS

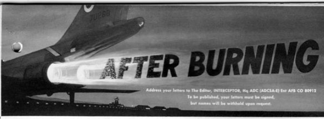
Major Fulk, an F-106 pilot, had just completed a normal radar intercept training mission and had entered the VFR traffic pattern for landing. He began a left pitch out using speed brakes through the first 90 degrees of turn. As he approached the 180 degree point, he began to roll the aircraft upright and, much to his chagrin, couldn't stop the right roll. The aircraft continued through 90 degrees of right bank and on past the 135 degree point.

The decision to eject was discarded as the aircraft attitude was such that an ejection would have been suicidal.

Major Fulk quickly realized that his only hope was to increase speed and use rudder to counteract the roll. He selected afterburner, applied left rudder and, at about 100 feet above the ground, the aircraft began to level off, rolled upright, and then began to gain altitude.

The aircraft was climbed to a safe altitude and a control check was made. All control responses were normal and the decision was made to attempt a straight-in approach. Thankfully, the approach and landing were made without further difficulty.

"We Point with Pride" to Major Fulk for his professional skill in coping with an unusual emergency and saving a valuable ADC aircraft.



JOINT COMMUNIQUE

This organization (Philippine Air Defense Control Center) would like to be put on distribution for six copies of the INTERCEPTOR.

We operate the Philippine Air Defense Control Center jointly with the Philippine Air Force. The assigned personnel are extremely interested in your publication and the information it contains would be helpful and informative.

Lt Colonel Irwin Sherman
Chief, Air Defense Control Center
Hq 6th Air Division
Clark AB, RP

***You're on!**

FROM AFCENT

USAF personnel assigned here at Allied Forces Central Europe, currently only have access to one command flying safety magazine, AIRSCOOP. There are several U.S. members of the staff that came here from ADC who will probably return to that command upon completion of their tour because of their background. It would assist them in their transition back into the Aerospace Defense Command if they had continued access to your flying safety magazine.

Request this office be put on distribution for five copies of you magazine. We will distribute the magazine internally to our Air Operations staff and to the Exercise Branch.

Major Edwin C. Hudson
U. S. Liaison Officer
AFCENT
APO New York 09011

Glad we can help and you're on for five.

"GCA AND YOU"

I would like to extend my appreciation for the article "GCA and You" in the July 1969 issue of the INTERCEPTOR Magazine, authored by Lt Colonel F. G. Schellenberger, ADOOP-SC. The support of our effort provided by the article is extremely beneficial to our program. It is with great reluctance that we are forced to reduce or refuse service to our flying customers. The recognition given both to our problem and our effort to eliminate the deficiency by your magazine will help to soften any disappointments or operational problems suffered by the ADC pilot. I am happy to advise you that our current austere manning situation will be relieved in the not too distant future. In the interim, we could not expect better cooperation and assistance than that provided by your magazine.

Colonel Jerome M. Kennedy
Asst/DCS Flight Facilities
Hq AFCS
Scott AFB IL

***Thanks, and we're glad to have been of assistance.**

OUR ANG FRIENDS

As our Base Safety Division is newly organized, we would appreciate being placed on distribution for six copies of the INTERCEPTOR Magazine to aid us in the accomplishment of our mission responsibilities.

Major Jerry F. Moore
Chief, Safety Division
Colorado Air National Guard
Buckley ANG Base, CO

***You're on for six, and good luck in your Safety program.**

FEEDBACK

"The Hole Card" (September INTERCEPTOR) touched upon many a familiar story with McChordites, and, by and large, it was an excellent article. However, the front cover of the INTERCEPTOR, corresponding to the article, did not measure up to your normal flying safety, common sense, and "by the book" standards and we were sorry to see it.

Where did the INTERCEPTOR's photographer come up with an ADC aviator so sloppy as to have his gloves hanging from the unzippered pocket of his flying suit? What Air Force Base is using an F-102 ladder on an F-106 aircraft (both photos, cover, and page 5)? Where did you find a maintenance outfit so lax as to open the canopy (B-model yet) with no canopy jacks? Just as an offside — safety-wise pilots remove all rings prior to preflight — the finger (or life) you save may be your own.

Maybe you were just checking to see if we are paying attention.

Major Richard P. Painter
Chief of Maintenance
318 Ftr Intcp Sq
McChord AFB WA

***Sonamagun. You passed with 75%. Our Afterburning mail bag has been limp lately, so we decided to find out whether we still had any sharpshooters around. Sorry you missed the rolled-up sleeves and the deck of cards in the left hand.**

P.S. Don't snicker for too long over the 102 ladder and canopy jacks. There may come a day when all you have are T-bird ladders and broom handles.

We welcome your requests, comments, and constructive criticism . . . please keep them coming.

The Editors

the Cold Hard Facts...

The four line cut . . . NO KNIFE — JUST PULL

After the chute opens, check the chute — No malfunctions — locate the lanyards

PULL BOTH LANYARDS

A completed four line jettison

Turn the chute by pulling the lanyard on the side to which you want to turn.

FOR A BETTER "PLF"