UNITED STATES AIR FORCE • DECEMBER 1970

Aerospace SAFETY

COVER PHOTOGRAPH BY KENNETH L. HACKMAN, AEROSPACE AUDIO VISUAL SERVICE

DECEMBER 1970

UNITED STATES AIR FORCE

Aerospace SAFETY

FOR AIRCREWS, MAINTENANCE & SUPPORT TECHNICIANS

SPECIAL FEATURES

REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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DECEMBER 1970 AFRP 127-2 VOLUME 26 NUMBER 12

BEYOND THE GATE

There are certain hazards attached to military flying. The Air Force recognizes them and has identified, trained, motivated, inspected, surveyed and planned to eliminate, or at least, accommodate them. And we have been quite successful. But there is another area in which hazards abound and it lies right outside the base gates. It is our public streets and highways.

During this holiday season many aircrewmen will enter this arena where nearly 60,000 people lost their lives last year. Your exposure will range from to-and-fro trips between the base and home, store, etc., to visits to the folks for the holidays. You will be putting your judgment, driving skill and degree of maturity on the line against other drivers with trigger tempers—poor driving skill—substandard cars—fatigue—booze—careless driving habits—an urge to beat the other guy.

With the inclement weather normal for this time of year, you will face

wet pavement—snow—ice—fog—rain—possibly blizzard conditions.

Drive with the care and judgment with which you fly. The Air Force needs you back on the job when the holidays are over—fit, refreshed and ready to resume your profession, not DOA. ★

OF CHRISTMAS, OF AIRPLANES, AND OF THE SEA

Grover C. Tate, Jr, General Dynamics
Fort Worth, Texas

Humbug!

Like always, I waited until the last minute to start getting the Christmas cards ready for mailing. When it was necessary to really face the issue, I got all of the paraphernalia together, chased the kids out of the den, chastised my wife for delegating this chore to me, growled another "Humbug" and started to get with it.

First order of business was to go through the address book, old correspondence, and the phone book to get current addresses. This operation was like sorting out magazines, you find so many interesting things to read that you lose sight of the job at hand. There would be a name that would start the memory to function, a name that would dredge up memories of the big war, of schools, of bars in faraway places, of excitement, and of friendship. Then there would be a name that would bring sadness, a friend no

OF CHRISTMAS OF AIRPLANES AND OF THE SEA

CONTINUED...

longer among us, a name to which no Christmas card would be sent. As I read through the names, it was startling to see how many of the old friends were gone. I could never find the strength to draw a line through these names, for a cold black mark did not seem a proper way to dismiss a friend.

Captain D. C. Bass was the first of these names. Several years ago he had tried to penetrate a thunderstorm rather than go around it. He was flying a multi-crew airplane and when it was smashed to bits, a number of names were eliminated from my Christmas card list.

After that was an old buddy named Blake. He was a natural flyer and seemed to make no mistakes, until he buzzed a beach in Florida and hit the water with the props. He and Langfeld, the copilot, managed to get about 600 feet before the aircraft dived into the sea.

Then there was my old philosopher friend whom we all called The Deacon. His only mistake was to leave his oxygen mask in his equipment bag while flying in the pressurized compartment of a big bomber. A sudden flash fire caused decompression, gobbled up what oxygen was available, and by the time other crewmembers could get to him, The Deacon was gone.

Reuben Diehl was the next name that should have been crossed from the list. Reuben had taken a flight check with an old buddy as flight examiner. With anyone else along, Reuben would have failed miserably, but old buddy-boy had given him the gentle treatment, warned him to sharpen up a bit, and then signed him off as qualified. Reuben failed to recognize his shortcomings, didn't make any effort to sharpen up, and when he lost an engine after takeoff, just didn't do the right things.

Now came Erbach, the engineer, the precise, the reader of the fine print in the tech orders, the one who didn't make mistakes. It was ironic that he should be the victim of the mistakes of others. A mechanic had failed to safety wire a prop governor control and the prop ran away during flight. Erbach got it feathered but it went on by the stops and into reverse. He managed to hold the shaking beast until the rest of the crew got out, but he rode it into the ground.

Graham was another victim of someone else failing to do a good job. He was lined up for takeoff on a 110° day when his airplane exploded. A simple fuel tank vent line had been kinked during installation and when the pressure exceeded the tank limits, the bird just came apart in one big boom.

Now came Honaker. With a six engine aircraft he started his takeoff with two in reverse, didn't make check speed, still tried to go, and wound up in a lake at the end of the runway.

Then Hartman, who let an approach controller who was talking to one airplane and watching another, talk him right into a mountain peak.

And Judson, a navigator buddy, who didn't have the right chart handy and let the pilot descend into the side of a mountain.

So on down the list. Some of the names had been lost in combat, but more in operational accidents than anything else.

Monty—didn't understand the fuel system.

Sgt. Neely—washing the struts of an airplane with hi-octane fuel.

Greene—off altitude resulting in midair collision.

Fitzhugh—accepting a fix for an engine malfunction that hadn't been thoroughly investigated.

Harris—one flight too many after several drinks too many.

Lake—slow rolls in an airplane in which the maneuver was prohibited.

Smitty—trying to abort a takeoff about 20 knots above refusal.

"My God," I thought, "doesn't the airplane forgive any mistakes?"

Yes, it forgives many. Look at some of the living, look at the goofs we've pulled and still managed to survive. Look at yourself.

How does the warning go? "Aviation in itself is not inherently dangerous but like the sea, it is terribly unforgiving of any carelessness, incapacity or neglect."

By now the night had grown late, the mood was changed and I had not addressed a single card. Too many thoughts of Christmas cards past, clouded with other thoughts of flying, and of the sea. ★

THE I.P.I.S. APPROACH

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

Q Consider the following situation. You have been radar vectored to the final approach course and cleared to execute a low altitude approach which depicts a procedure turn. Are you required to fly the procedure turn?

A Whenever you are given radar vectors to a final approach position, the ATC controller is not required to provide separation throughout the procedure turn airspace. If you desire to fly the procedure turn, then you *must* specifically request it. Additionally, there are two other situations in which a procedure turn should not be flown. They are:

1. When issued an ATC clearance for a "straight-in" approach; or
2. When the initial approach is via a NoPT (No Procedure Turn Authorized) course.

In any of these situations, proceed over the FAF at the prescribed altitude and continue inbound on the final approach course without making a procedure turn, holding pattern, or other aligning maneuver.

HOLDING

Q At right are three typical TACAN holding patterns. Considering the position of the aircraft, what do you do when ATC clears you for an approach?

A In Figures 1 and 2 you have the option to continue in the holding pattern to the IAF or turn and proceed direct to the IAF. In Figure 3 you have the option to continue in the holding pattern to the *holding fix,* or turn direct to the *holding fix,* then direct to the IAF. You may go direct from the holding fix to the IAF unless there is a specific route designated on the approach chart. If there is any question in your mind, ask the controller if you are cleared direct to the IAF.

NOTE

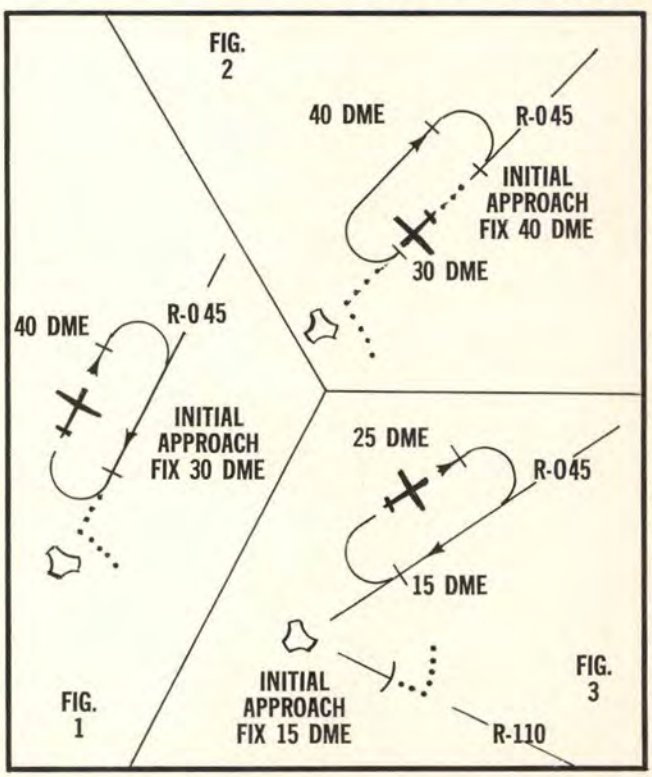
July 1970 Approach article stated that the tower cannot deny a VFR takeoff request even though an IFR flight plan was filed. A word of caution is in order. In requesting a VFR takeoff, you must remember that future IFR clearance may be denied or delayed.

USAF IPIS GREETINGS

December 1970 marks the sixth year of continuous monthly IPIS Approach articles. As you are aware, questions from the field have been a significant portion of these articles. The IPIS is your representative and point of contact for instrument flying needs. Continuous revision to manuals, regulations and documents (e.g., AFM 60-16, AFR 51-37, AFM 55-9 [TERPs], and FLIP) will prompt many new questions and problems which will require interpretation and answers. We are receptive to your questions and suggestions and they are used to help us develop instrument flying procedures and techniques. Address questions and suggestions to USAF IPIS (FT-FTYI) Approach, Randolph AFB, Texas 87148, telephone extension 4207, 4884 and 3092.

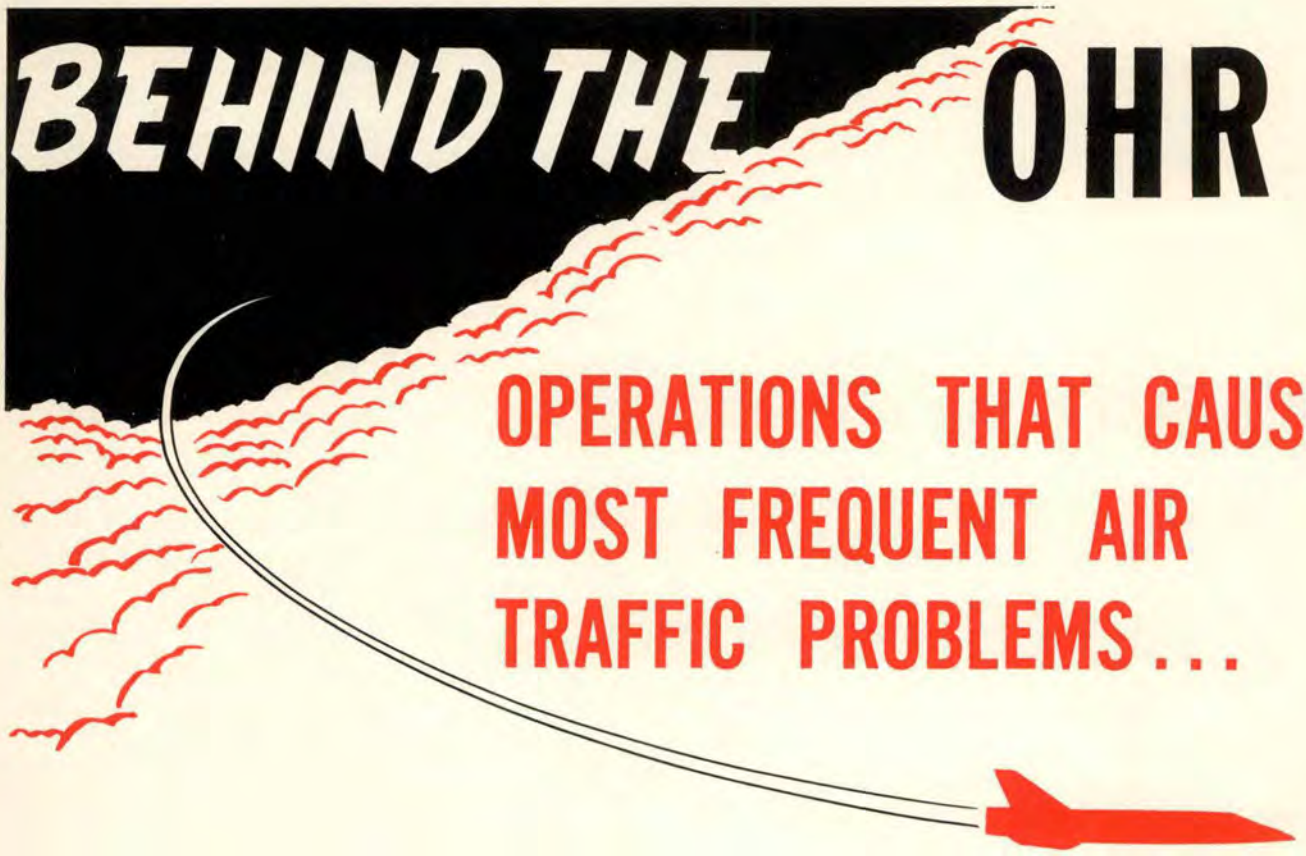
The USAF IPIS wishes you and your family a very Merry Christmas and a safe and prosperous 1971.

H. D. ALLSHOUSE, Lt Colonel, USAF
Commander, USAF IPIS



BEHIND THE OHR

OPERATIONS THAT CAUSE MOST FREQUENT AIR TRAFFIC PROBLEMS...



CMSgt James R. Kelley, AFCS, Richards-Gebaur AFB, Missouri

"Approach, this is SCAT 41, over X-RAY on the hour, 7000, heading 270, estimating your station at 20, request GCA, advise my IFF is inoperative."

"SCAT 41, Drumfire approach, turn left heading 180, maintain 7000, for radar identification."

"SCAT 41, Drumfire approach, radar contact, 28 miles north, descend and maintain . . . etc."

Don't let the apparent routine conversation above fool you. A period of sheer panic developed only minutes later when SCAT 41 broke out of the undercast lined up with a mountain just 12 miles east and 20 miles north of his destination. Approach kept telling him he was on a long final to runway 18.

You ask, "What happened?" In this case, SCAT 41 had made one small error. He never reached X-RAY and, through some fluke of human frailty, had reported over X-RAY when in fact he was over an intersection 15 miles east of X-RAY. Why didn't the controller catch the error? Because there was a west-bound aircraft near X-RAY which did turn inbound to the base at the time the controller issued the identifying turn.

Fortunately such incidents are very rare. But they do happen, and part of the job of the Deputy Chief of Staff, Flight Facilities, HQ AFCS, is to analyze these incidents and do what is necessary to eliminate or reduce the possibility of occurrence.

As might be expected, the information on SCAT 41 arrived via an Operational Hazard Report (OHR). Each OHR involving air traffic control or navigational aids that is received by an AFCS unit is processed in two ways. First, the local flying safety office is given the results of the investigation and the report is then processed back to the originator. The second method results in the report being processed through AFCS channels. A condensed report of each OHR is forwarded to DCS/Flight Facilities and included in their data analysis program.

This may sound like the beginning of another headquarters-oriented paper exercise, but, in fact, the effort has proven well worthwhile. While a single incident may be of only passing interest, a pattern of repetition or similarity sometimes shows that it's not the individual who is at fault, but the system itself. As a result, the command has been able to effect many changes to air traffic procedures, locally and worldwide, which should help both the pilot and controller.

While compiling the statistics, there is a category called "Pilot Error/Education." Data is logged in this category when a pilot fails to comply with a pilot-oriented directive or appears to be unfamiliar with an air traffic control directive. Sometimes the fault rests with the same pilot who submitted the OHR. More often it's the fault of the pilot of another aircraft who set the scene for the incident. A relatively small percentage of the OHRs are caused by pilots, but it's surprising how often the same operations continue to crop up in the reports. Here's a rundown on the operational areas which cause the most problems.

Paragraph 2-3c, AFM 60-16, defines the procedures that are applied to aircraft in a "minimum fuel" condition. Traffic priority is not given to aircraft that have declared minimum fuel. Too often the pilot feels that normal sequencing with other traffic does not satisfactorily recognize the urgency of the situation. Pilots should be aware that the provision of priority is not applicable to minimum fuel operations.

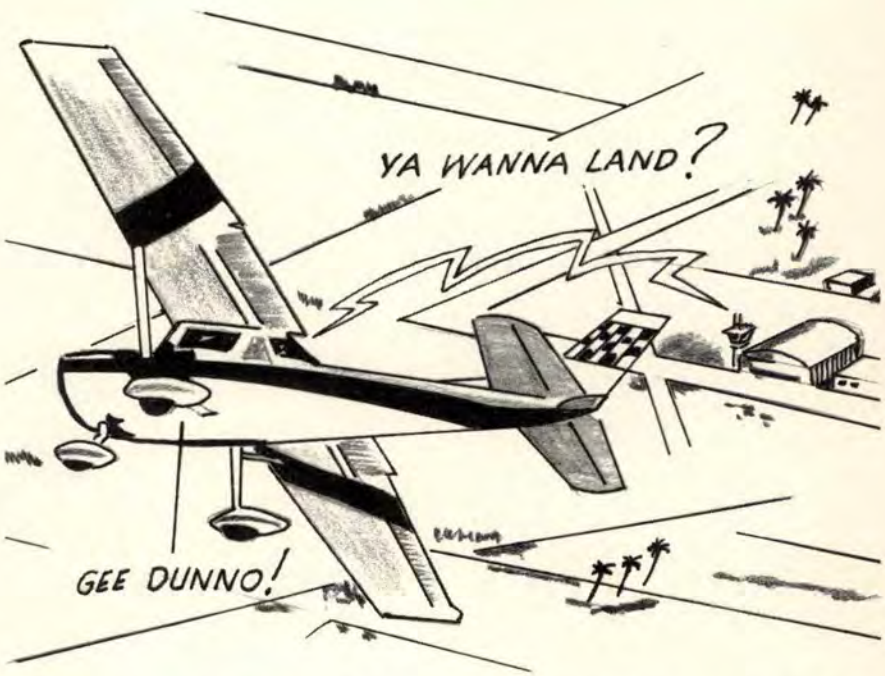
Paragraph 4-6, AFM 60-16, requires compliance with all instructions issued by an air traffic control agency unless an emergency or safety consideration makes compliance impractical. If compliance is impractical, the pilot has available several courses of action. He should not accept a clearance that requires a compromise to safety. Conversely, if the clearance does not require a compromise to safety and an emergency does not exist, the pilot is expected to follow the clearance. In any event, if the clearance is not followed for any reason, the ATC agency should be notified and/or an amended clearance requested.

Paragraph 5-5, AFM 60-16, is closely related to the paragraph above. *All* operations in an airport traffic area require ATC authorization. The majority of the discrepancies involved in this category concerned non-USAF aircraft proceeding into the airport traffic area without authorization and causing conflictions with the USAF traffic. Paragraph 7-2, AFM 60-16, concerning the "see and avoid" responsibility of the pilot is the primary means of averting a catastrophe in such instances.

Paragraphs 116, 420 and 422, FAA Handbook 7110.8A, are concerned with VFR runway separation criteria. If reduced runway separation procedures are in effect, all locally assigned pilots should be familiar with their use. Also, all

Continued

WHAT'S A LEFT DOWNWIND?



The following exchange took place at a major airport serving all kinds of private, commercial and military traffic. It vividly illustrates why pilots must keep their "head out of the cockpit," especially around airports. *(The identification of the light aircraft has been altered. Ed.)*

1627—Honolulu Tower: Cessna 123 report left downwind, Runway 4.

1628—Honolulu Tower: 123, report left downwind Runway 4. Over.

Cessna 123: Roger, this is Cessna 123. Please repeat and explain.

Honolulu Tower: Cessna 123, what is your request?

Cessna 123: I don't know what

Continued

OHR

VFR arrival separation applied by the controller is totally dependent on the actions or reactions of the pilots involved. If the controller, in his judgment, feels that adequate separation exists, or anticipates that it will exist, he will issue appropriate clearances. The pilot has an opportunity, and the responsibility, to insure that compliance with this clearance does not cause a hazard. A go-around initiated by a pilot, for example, only confirms the fact that the controller cannot guarantee separation during such operations. Pilots should be aware of the joint pilot-controller responsibility for the success of VFR operations, and not consider the provision of separation a controller responsibility.

Paragraph 775, FAA Handbook 7110.8A, concerns the provision of additional services to aircraft under radar control. A review of the OHRs indicates that some pilots are not aware of what an "additional service" is, or the circumstances under which such service can be provided or terminated. Section 15, Chapter 5, FAA Handbook 7110.8A, provides complete definition of the services involved, their application and makes reference to the priorities employed. Every pilot should be familiar with these procedures and the controllers' responsibilities and limitations.

Paragraph 845, FAA Handbook 7110.8A. Several pilots objected to the controller requesting information during an emergency. Their objections were valid; i.e., the nature of the emergency made it impossible to provide the information when requested. The controller, however, is complying with directives when he requests such data. If it is not possible to provide the information, the pilot should so state. The requirement for requesting such information cannot be deleted due to the needs of the various base rescue agencies. The procedures for obtaining this information are defined in paragraph 845, FAA Handbook 7110.8A.

You might want to kick some of these subjects around during your next flight safety meeting or instrument school session. While many of these points are controversial and argumentative, the more discussion the better. If changes are needed, AFCS is prepared to assist. Recommendations for change should be forwarded on an AF Form 847 through the Commander, AFCS, Richards-Gebaur AFB, MO 64030 to HQ USAF (XOOTFA), Washington, DC 20330. ★

DOWNWIND

you mean by what you said.

Honolulu Tower: What do you want? Do you want to come in for a landing?

Cessna 123: Yes.

Honolulu Tower: O.K. I want you to report on the left downwind for Runway 4. Over.

Cessna 123: On a left downwind? I don't know what you mean.

Honolulu Tower: You don't know what a left downwind is?

Cessna 123: No.

Honolulu Tower: O.K., where are you now?

Cessna 123: I am coming over the golf course.

Honolulu Tower: O.K., you want to turn right and fly a southwest heading.

Cessna 123: O.K.

At this time another aircraft intervened: I am over the golf course and I don't see him.

Honolulu Tower: Cessna 123, rock your wings.

Honolulu Tower: Cessna 123, rock your wings. Over.

Cessna 123: Roger.

Honolulu Tower: O.K. I have you in sight. Come toward the tower and fly your present heading. I will tell you when to turn.

Cessna 123: Roger.

Honolulu Tower: Cessna 123, turn right to a southwest heading now. Southwest about 220 degrees. Over.

Cessna 123: Roger.

Honolulu Tower: Cessna 123, do you see the Cessna ahead and to your left on a base leg over the Hickam Golf Course? Over.

Cessna 123: I can't see what you mean—over the Golf Course.

Honolulu Tower: Do you see the Cessna over the Hickam Golf Course about to turn over Runway 4? Over.

Cessna 123: I can't spot him. The sun . . . There he is. Yeah!

Honolulu Tower: O.K. Follow him. Wherever he goes, you go. You can start a base leg anytime.

Cessna 123: Roger.

Honolulu Tower: Cessna 123, clear to land Runway 4R. Land on the same runway the Cessna did.

Cessna 123: Roger.

Heads up! ★

Contributed by:
Maj Thomas E. Boyle,
6486th Air Base Wing.

JUST ONE OF THOSE THINGS . . .

OR WAS IT?

Col Clarence L. Carson, 380 Strategic Aerospace Wing, Plattsburgh AFB, New York

A man in uniform, wearing the Chaplain's Cross over his left breast pocket rings a doorbell in the family housing area of an Air Force base.

A petite brunette hurries from the kitchen, wiping her hands on her apron. She has been preparing dinner and is expecting her husband home any minute, tired and hungry from a long training flight.

The meal she has so carefully prepared will never be eaten. Her world has suddenly fallen apart and there is little anyone can do to change that awful fact.

The Wing Commander comes to call. He knows there is little he can do or say to comfort the wife but he tries. ". . . It was just one of those things that happen. He was turning to final approach for landing when something went wrong and there wasn't enough time or altitude for him to recover or bail out. It was just one of those things that can happen. . . ."

Hold it! *Was* it just one of those things? Are accidents that occur because of mechanical failure inevitable? In this case a flap hinge bolt was improperly installed and the flap tore loose from the aircraft. *Somebody* forgot to safety the bolt so it couldn't work loose. *Somebody* signed the "Inspected By" block in the form, certifying that he had inspected the work and found it properly accomplished. *Did* he inspect it? Or was he in a hurry and signed off the form somebody brought him without actually looking at the hinge bolt?

How about the guy who did the job? He was properly trained and he had a tech order to tell him exactly how to replace that hinge bolt. Did he check his tech data to insure that the job was complete before he signed it off?

I am afraid that too many times we have a tendency to shrug off these facts and minimize our lack of responsible conduct with the statement, "It was just one of those things. . . ."

I fail to see, however, how the supervisor and mechanic involved can look at themselves in the shaving mirror each morning without thinking, "If I had done the job right, that wife wouldn't be a widow; those kids would still have a father. . . ."

We have inspection criteria, Quality Control activities, MSET evaluations and a wealth of technical data available to us, all designed to insure that when a crewmember straps himself into a flying machine that it is a good machine, as good and as safe as we can humanly make it. Every technician who touches that aircraft, from the guy who builds it, to the guy at the depot who does the IRAN, to the airman on the flightline, has the *responsibility* to do the job right and, considering what is at stake, he must certainly *want* to do the job right.

I am certain that, if every man in the maintenance complex will keep in mind at all times that the work he does is vital, that lives depend upon his skill and integrity, no man would fail to take this responsibility seriously.

The emphasis on the "Responsibility Factor" must be exercised by *every* level of supervision from the Wing Commander through his Deputy Commander for Maintenance, down to and including the aircraft crew chief. It must be expressed in every positive way possible by all concerned so that *no man* will fail to recognize his responsibility or the importance attached to his particular task.

It is only by this means that we can achieve our objective of quality maintenance. The success of our effort depends upon the acceptance, recognition and discharge of responsibilities by each and every man in the maintenance complex. ★

Capt Dennis Michels
USAF Dispensary
Norton AFB, CA

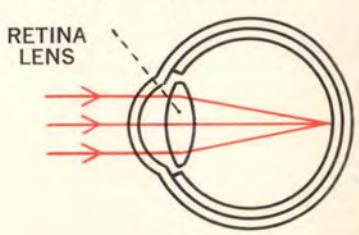
eye-deas about vision

CAPTAIN JOHN DOE, golfing archrival of Lieutenant Oscar Nini, approached his tee shot on the par four 18th with all the anxiety everpresent in the weekly "Lemonade Open." Two things were against him—twilight had set in and they were playing a strange golf course. After extensive deliberation, Captain Doe played his second shot with a four iron. He struck it squarely and waited intently only to be shocked by the uniquely aggravating sound of his ball splashing in the small pond just in front of the green. Needless to say, Lieutenant Nini won the "Lemonade Open" that week. *More important, however, is the possibility that the same circumstances of strange terrain and twilight could have resulted in a short landing instead of just a short four iron shot.* Let us explore some possible explanations for Captain Doe's error in judgment.

Eyes fall into three general categories according to the position of the image formed by the eye's optical system relative to the eye's sensitive layer, the retina. *Emmetropia* (normal vision) exists when the image is formed directly on the retina, *hyperopia* (farsightedness) when the image is behind the retina, and *myopia* (nearsightedness) when it is in front. (Fig. 1)

The emmetropic and moderately hyperopic eye, barring abnormal physical characteristics, can distinguish an acuity level of at least 20/20. On the other hand, the uncorrected myopic eye suffers from subnormal visual acuity commensurate with the amount of myopia present.

Before going further, you should know that the eye is not a static



EMMETROPIA

organ and undergoes significant functional changes in different illumination levels and for different visual stimuli.

During daytime (photopic) vision, the eye is said to be in a state of light adaptation. The acquisition of this state is a rapid process. In fact, from a state of total dark adaptation, the change is usually complete in about one minute. Photopic adaptation is characterized by an eye maximally sensitive to yellow-green light, with maximum visual acuity, depth perception, stereopsis (binocular depth perception), and depth of field and focus (flexibility). In addition, the light adapted eye is more far sighted (or less nearsighted) than at any other state of light adaptation.

Dark adaptation occurs in the transition from daytime (photopic) to twilight (mesopic) to night (scotopic) vision. This process is much slower than light adaptation even if darkness is encountered suddenly. Total dark adaptation requires approximately one hour. Under night conditions the eye is most sensitive to blue-green light, is more nearsighted (or less farsighted), and exhibits less depth of field and focus than the daylight conditioned eye. Too, some eyes suffer from diminished acuity, depth perception, and stereopsis in scotopic illumination.

A normal or slightly farsighted eye in daylight will often become nearsighted at night. The degree of change is individually variant, but often sufficient to reduce 20/20 daytime vision to 20/30 or 20/40 at night. Obviously, there will be a corresponding decrease in depth perception. Fortunately, with application of appropriate corrective lenses for this night myopia, visual acuity and depth perception can be brought back to normal.

During routine eye examinations I almost daily encounter a pilot with a night myopia problem. Most of these patients seek my services because they have become aware of decreased vision when driving at night. They are able to detect this problem more readily when driving than flying because road signs serve as an indicator. Unfortunately, many cases of night myopia go undetected since routine screening procedures presently employed provide only acuity material with contrast equivalent to daytime vision.

An incidental point of interest concerns the similarity between night myopia and empty field vision (encountered when staring into space). In both cases the eyes are focused at a point closer than 20 feet. For years pilots have been told that an occasional focus on the ground or other distant object will allow the eyes to remain focused at a distance when they return their visual direction to the empty space ahead. The advantage would be quicker detection of distant aircraft. But accommodation (focusing) cannot be voluntarily regulated and is therefore almost entirely reflex in nature. When the gaze direction is returned from a point of reference to empty space, the focus point in space almost instantaneously returns to a point within 20 feet. The primary difference between night myopia and empty space myopia is that night myopia can be corrected and empty space myopia cannot.

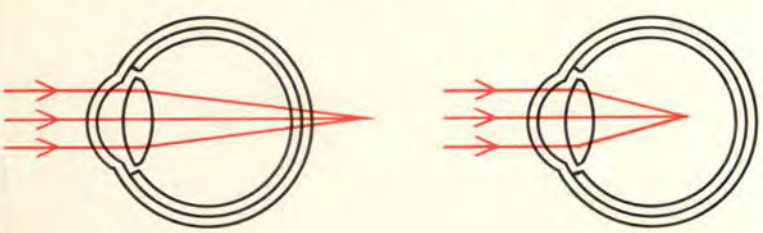
As mentioned earlier, scotopic (dark) adaptation manifests a predictable shift in maximal light sensitivity from yellow-green to blue-green (short wavelengths). Why, then, does the Air Force use red (very long wavelength) rotating beacons as anticollision aircraft lighting? The practical implications are debatable, but theoretically a beacon of shorter wavelength should be employed.

The nature of the preadapting illumination level severely affects eye sensitivity during night vision. After several hours of exposure to sunlight, a whole night of dark adaptation is not sufficient to bring sensitivity back to its previous level. However, the daytime use of dark sunglasses obliterates the adverse effect of high light intensity on night visual sensitivity.

From what has been said we can formulate the following recommendations:

- Routine yearly eye examination for all pilots to replace present screening techniques.
- Application of sunglasses during all daytime flying and during preflight exposure to high illumination levels.
- Review of the present anticollision aircraft lighting systems.
- Awareness by pilots that while the eyes may be 20/20 during the day, night vision can often be much less.

Capt Michels is an optometrist who became interested in the special vision problems of pilots. Opinions expressed in this article are his own and do not necessarily reflect Air Force policy. ★

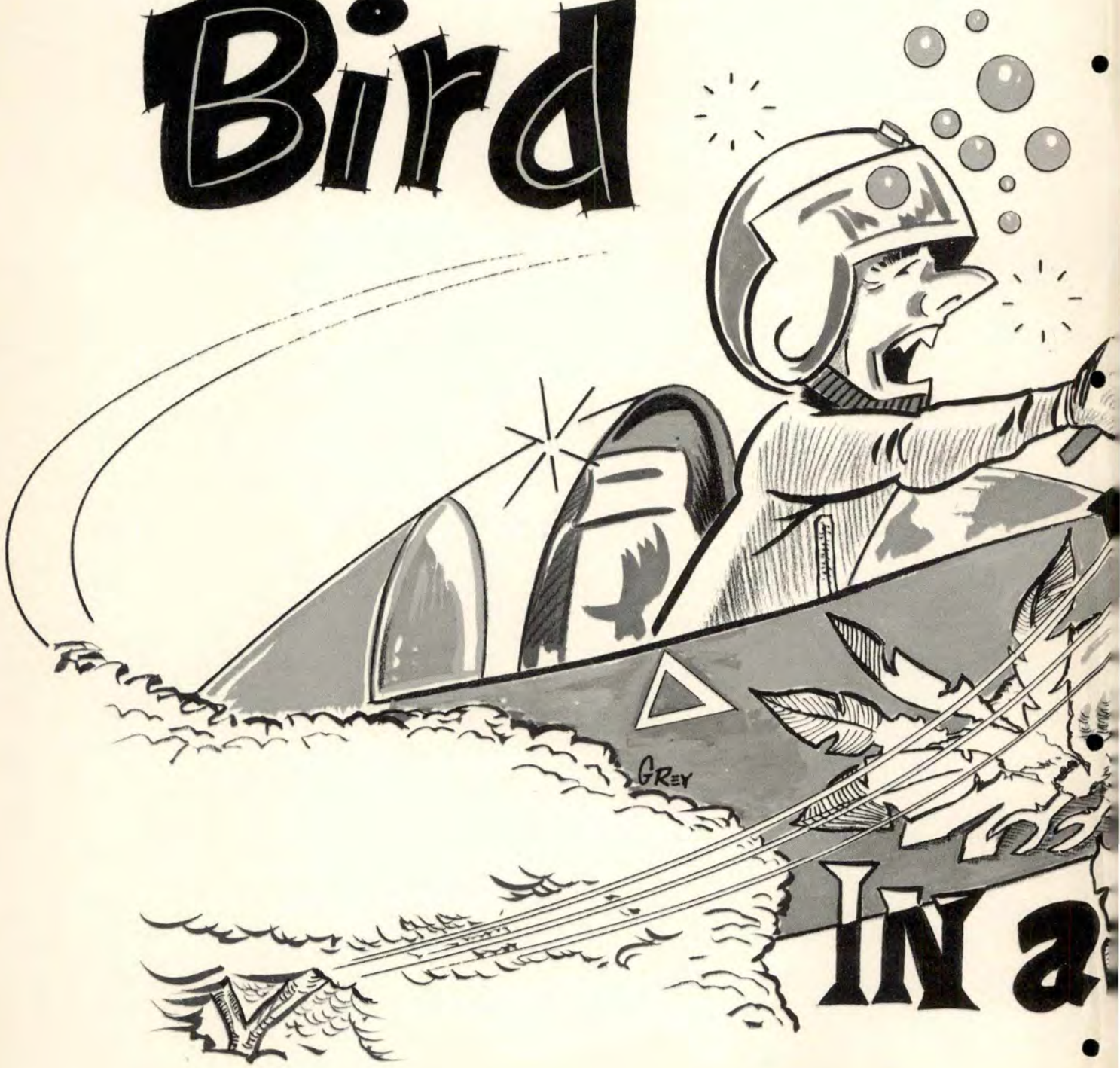


HYPEROPIA MYOPIA

I Hit a Bird

We never really take aim at a bird, but in this case, the bird was probably a bit more surprised than usual when he got zapped.

"Of course I've got wing damage, stupid, I hit a tree." How about that for a reply when you tell your leader he's got a crinkled wingtip? The average jock is usually puffin' and



IN a

sweatin' after an incident that results in bent aluminum while in flight. In this case, though, the jock didn't seem the least bit upset by his brush with death; in fact, he seemed and felt quite casual.

The mission began routinely that morning—at least at first. A standard air/ground combat sortie. Preflight and engine start didn't hint of a malfunction anywhere. Shortly after start the pilot noticed heavy fumes in the cockpit. Heavy enough to cause his eyes to smart and water. Oxygen to 100 per cent solved this problem since the gages indicated green across the board, and also since fumes in this particular bird are not unusual. Five minutes after takeoff the pilot selected "normal" oxygen. The fumes were still strong but not enough to warrant an abort, he thought, so he pressed on to the target. He stated that the severity of the fume irritation seemed to diminish and the flight of two continued to the target area at about 16,000'. About this time another minor malfunction cropped up—Lead's mike button had to be depressed toward the side to transmit.

Arriving at the target, the flight made contact with the FAC and after receiving their instructions the flight began making strafing passes. However, Lead was unable to acquire the target and made several dry passes. He finally reasoned that his visor was obscuring his vision so he raised it but this didn't seem to help. On a later pass he noticed a tree in his flight path but took no evasive action, although there was ample time. His left wingtip clipped the tree. He visually noticed the damage and didn't consider it serious so he continued making passes.

Bingo fuel was reached and his wingman joined up for a routine battle damage check. Two notified Lead that he had probably taken a hit and asked if Lead wanted to divert to a closer base. This is when Lead recalled thinking, "Of course I've got battle damage, stupid, I hit a tree." Lead decided to return to his base instead of diverting.

About this time something clicked in Lead's mind—he realized that his actions were not rational so he again selected 100 per cent oxygen. Lead estimated that in about five minutes he became starkly aware of his near fatal accident. Throughout the flight there had been little contact with his wingman due to Lead's inability to manipulate the mike button. However, now that things had cleared up he could easily communicate with everyone.

Approaching home plate, Lead contacted the command post and reported he had "Hit a bird in a tree." Deciding on a straight-in approach, Lead made an uneventful landing.

The SOF was on hand to meet the aircraft and he immediately took the pilot to the flight surgeon.

A physical examination revealed that he was moderately anxious with responses somewhat slower than normal for this individual. Blood samples were taken but were somewhat invalid due to 30 minutes on 100 per cent oxygen.

By now you have probably guessed what happened to this pilot —the Docs feel that a combination of exposure to carbon monoxide combined with high "G" forces on the first few passes were sufficient to cause hypoxia of a degree that would produce these symptoms.

It's too bad that, after all these years, pilots flying a particular model aircraft have come to feel that fumes in the cockpit are "routine." Now we begin to wonder if some losses that were previously considered battle casualties might not have been caused by the same combination of events.

We offer this true story in hope that *you* as the pilot won't treat fumes in the cockpit lightly in the future and that *you,* the maintenance troops, won't be satisfied to simply tighten a few lines in hopes of clearing a "fumes in the cockpit" write-up. ★

what are you worth?

MANY OF THE PROBLEMS besetting young adults and about-to-be adults revolve around what they describe as a search for identity. Psychologists and psychiatrists tell us that a person's happiness, adjustment to society and performance depend to a great extent upon the worth a person places on himself. If he feels that he is doing a worthwhile job and doing it well, then presumably he will perform well. And in the Air Force performance is of the essence.

How about this need for personal identity and worth? Undoubtedly we all have moments of doubt about ourselves, so let's examine the opportunities the Air Force presents for a person to really be *somebody*. For that is what this all boils down to.

The Air Force encompasses just about all walks of life. And each person has a job that contributes toward the success of the Air Force mission. While this article will deal primarily with aircrews and people working in support of flight operations, no slight is intended to the many who perform the hundreds of other necessary tasks to keep this huge machine purring smoothly.

As the saying goes the pilot's job is to "fly and fight." He is the epicenter of the USAF mission and without him the Air Force would cease to be. Conversely, he cannot function alone, and without the myriad of support personnel, his would be a hopeless task. So starting from him let's look at his job and some of the others that make it possible for him to perform effectively.

A pilot is not necessarily a towering giant among men, although he should never take a back seat to anyone. He comes in all sizes and shapes, must be smarter than the average but is not required to be a genius. Once he is trained and qualified he becomes part of a vast, complex team. Take, for example, an interceptor pilot. Like all pilots, his life rides on the skills and dedication of the men who maintain his aircraft. The mechanics must assure that the engine and airframe are in peak condition.

A specialist in electronics, whom he may never have seen, must have serviced and maintained equipment designed and built thousands of miles away by people about whom he knows nothing. To a great extent he works on faith that all of those people did their jobs correctly.

He is vectored to his target by the voice of an unseen controller in whom he must have complete faith; or an automatic system comprised of crystals, diodes, transistors, tubes, and a thousand other things, about which he may know very little, guides him to a spot hundreds of miles distant at the proper time to intersect the flight path of a speeding target. As for himself, he must be an expert at flying this machine under exacting conditions. He must be tuned to the aircraft to detect any abnormality; he must compute fuel requirements and have alternate plans in case of trouble. He may never see his target, depending instead on a synthesis presented on a screen in front of him. If the electronics man made a mistake, if a glitch of some sort sneaks into the system he may miss the target completely—or collide with it.

Once the intercept is made and the target identified and/or destroyed, his job becomes one of getting safely back to base. Again he is dependent upon himself, those who service his equipment, and voices whose owners he doesn't know and will never see. He may have to land on a wet or icy runway in the middle of a storm. Again his own flying skills and those unseen voices combine to get him safely on the ground. The tires squish on the pavement—good

landing—but it's not over yet. Someone else packed the drag chute that may mean the difference between stopping and going off the end. And there's the barrier—a sort of last chance if brakes fail or are inadequate and the drag chute doesn't do the job. People who know about barriers provide the servicing and a failure on their part could cost him his life.

Other pilots have other jobs in that they fly different types of aircraft on other missions, but they are equally dependent upon people with the same skills. The MAC transport pilot flies an entirely different mission from that of his brothers in interceptors, tactical fighters, bombers and rescue helicopters. Take a C-5 pilot, for example. His is a bird of superlatives: three-quarters of a million pounds, an incomprehensible cost in dollars, engines whose power can hardly be imagined.

Every man on his crew is a VIP: the engineer, navigator, loadmasters, not to mention his alter ego in the right seat. Do you think this man should have any trouble with his identity or worth? Since he is human there will be times.

Perhaps you think your job is menial. Maybe you drive a snow plow. Admittedly that is not the most glamorous job in the world, but to the Air Force—and the crews that will land on your runway—it is vitally important. A fireman's job may be boring for 364 days running. Then on the 365th a bomber crashes on landing and he suddenly must lay his life on the line to save other lives and base facilities. A hero? Perhaps. A man of worth, certainly.

Air traffic controllers have jobs that are nerve-racking, exhausting and, at times, fraught with the potential for a catastrophic mistake. Most are civilians but many wear Air Force blue. Pilots whose assignments take them to many parts of the world find that, while they speak a common language, controllers enunciate with many different accents. Nevertheless, even when they are a bit hard for the untuned ear to understand, they must be depended upon. They are the voices that live in a pilot's earphones and guide him through fair skies and foul, who can steady a pilot, a bit nervous, trying to land with one hundred and a half in turbulence and wind with their calm "you are on glide path, on centerline," "if the field is in sight take over visually, you are cleared to land." Or who gages an approach on an electronic tube, decides a landing attempt would be dangerous and tells the pilot to make a missed approach.

WEATHERMEN get more than their share of joshing but theirs is an exacting job that demands high intelligence and mature judgment. Their work is loaded with frustrations. Winds change direction and speed, temperatures rise and fall, precipitation forms or fails to form—all under exact conditions. The weatherman is trained to know what these conditions are but the tools he works with are limited. Therefore, forecasting the weather is not an exact science. Nevertheless, the men of Air Weather Service do an outstanding job of assisting the pilot.

The Air Force, in essence, is a community of skills. And every person in the Air Force possesses one or more of those skills. There are doctors, nurses and life support technicians ministering to the physical needs of all others. There are some who teach and some who sweep. If you don't think sweeping is important take a look at a jet engine that has ingested a foreign object to the tune of $30,000 worth of damage. Or which failed at a crucial moment and cost an aircraft and a pilot his life.

So far we have talked about people with specific skills. Now how about those who have risen to jobs that are harder to define: commanders and supervisors whose task skills must be complemented by that intangible, almost undefinable quality called leadership? It is common to assume that these people have risen to positions that leave them little doubt of their worth and identity. This may be a wrong assumption, for the leader must make decisions that affect numbers of people, the accomplishment of the mission, and that often are infinitely more complex than those that are made daily by the people under him. Few great leaders who have written of their experiences fail to mention the emotional demands on them during the time when important decisions had to be made. And most freely express the doubts that beset them during such moments.

The Air Force is comprised of people and things, each dependent upon the other. Just as each piece of equipment in the inventory has its purpose, so has each person. Your job may seem to you more, or less, glamorous than another. But you were trained for it and you are provided the tools with which to do it.

Formal recognition may be infrequent and your accomplishments seemingly may go unnoticed. But this is true in all walks of life. It is up to the individual to determine in his own mind who he is and what he is worth.

Not that a word of praise or a pat on the back won't help. The maintenance man, for example, expects to hear about anything that goes wrong with the aircraft he worked on. But when the bird performs like a million he wouldn't mind the pilot telling him so, even if it's only a couple of words, like "good bird today, Sarge."

Such simple forms of recognition along with the knowledge that your job is important to the Air Force mission should remove any doubts that you are someone who is worth a great deal to your country. ★

Aircraft Structures

Richard J. Pennoni, Directorate of Aerospace Safety

This month's article discusses airframe strength and life for two categories or types of aluminum alloys used in the construction of Air Force aircraft. In order to simplify the subject, the figures presented are approximate rather than precise.

Airframe strength and fatigue life depend on the designer and manufacturer in addition to Air Force procurement and operations people, but it is the pilot who uses up the constructed life of the airframe. For example, the Dash 1 VG data permits the pilot to pull limit load of 7.33G on a fighter airplane. This corresponds to the 40,000 psi yield strength shown in Fig. 1 for low strength aluminum alloys such as 2024 series alclad sheet and 2014 series extrusions

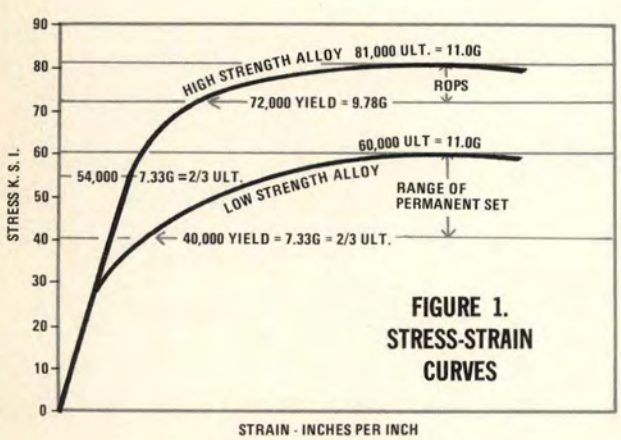


FIGURE 1. STRESS-STRAIN CURVES

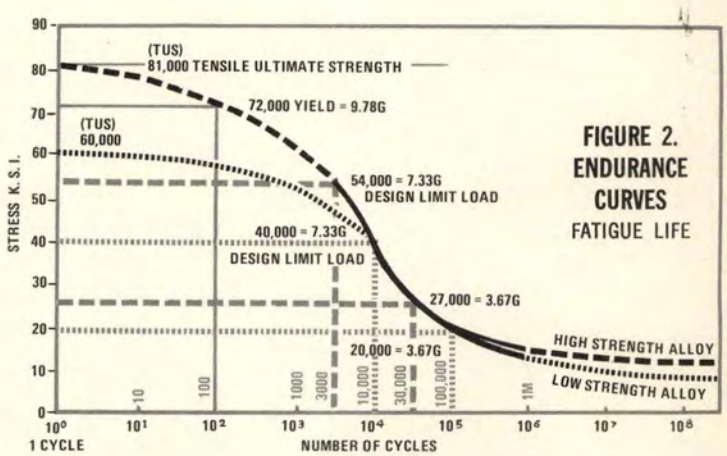


FIGURE 2. ENDURANCE CURVES FATIGUE LIFE

that were used extensively in the 1940-1950 era. Airplanes in that category were the P-38, P-40, P-47, P-51, F-80, T-33A, etc.

Of course, you could "overstress" those airplanes to 1.5 times 7.33G (11.0G) which is comparable to 60,000 psi ultimate allowable of the material, as shown in Fig. 1. In such cases, the primary components (wing, fuselage, etc.) would incur permanent stretch, bend and wrinkle, and perhaps even crack as the 11.0G loading was approached, but catastrophic separation would not occur unless the 11.0G stress level was exceeded.

Now we have higher strength aluminum alloys such as the 7075 and 7178 series, for which the yield strength could be almost twice as high. Logically, it would appear that if the yield strength were doubled, we could use material half as thick, and thus save one-half the weight. Unfortunately, we cannot attain this total benefit, even in pure tension, because of the ultimate strength ceiling. For example, a typical high strength aluminum alloy such as 7075-T6 that is used extensively to save structural weight, is indicated by the upper curve in Fig. 1. This curve shows that we can design to 54,000 psi instead of the earlier 40,000 psi allowable, or a 1.35 strength gain ratio; thus, we can achieve a weight saving in the ratio of 1.35 for parts that are critical in tension such as the wing lower skin and stringers and spar caps.

We cannot take advantage of the total 1.80 ratio provided by the 72,000 psi higher yield strength, however, because we must stay within ⅔ of the ultimate strength ceiling to provide for that one pullup of one and one-half times the 7.33G without catastrophic failure. Nevertheless, use of the high strength alloy is advantageous because it saves weight and increases performance; in addition, the fighter aircraft now must exceed 9.78G before incurring permanent stretch or cracking of material. However, pullup to the 9.78G which is equivalent to the 72,000 psi yield allowable, becomes detrimental by creating a severe reduction in fatigue life.

Fig. 2 shows that perhaps only 100 cycles are attainable at 9.78G versus 3000 cycles at the 7.33G design allowable. Also, the imposition of stresses between the 7.33 and 9.78G pullup could go undetected because they are *below* the range of permanent set (ROPS) as shown in Fig 1 for the high strength alloy. In such cases, the aircraft fatigue life is used up at an accelerated rate without detection, unless the pilot writes up his "overstressing," or if we install and monitor recording G meters as discussed later in this paper.

Last month's article, "Metal Fatigue in Aircraft," carried the low strength alloy endurance curve which showed that the life of a part conceivably could be 10 times greater if the stress level were reduced to one-half. Values tabulated below from the endurance curves of Fig. 2 indicate that the same general relationship could hold for the high strength aluminum alloy; however, its fatigue life in the operating range of 3.67 to 7.33G would be reduced to approximately 30 per cent. In summary, we save structural weight by accepting a reduction in fatigue life in order to increase performance.

Now, let's relate these stresses and cycles to Air Force operations and aircraft mishaps. You probably have heard the terms fracture toughness, rate of crack propagation, and critical crack length which are pertinent to the prevention of wing separations. These physical aspects vary (even for the same material or component) as has been shown through numerous fatigue tests of simple specimens, composite test panels, and full scale components such as an entire wing structure. Because of this variance or scatter in fatigue data, we cyclic test a fighter airplane to 16,000 equivalent flight hours in order to provide a service life of 4000 operating hours in service. (The load spectra used is based on the mission profile and correlated with recorded service data from earlier fighter aircraft. For example, F-86 or F-102 data used for

	LOW STRENGTH ALLOY		HIGH STRENGTH ALLOY	
PULLUP	PSI	NO. OF CYCLES	PSI	NO. OF CYCLES
7.33G	40,000	10,000	54,000	3,000
3.67G	20,000	100,000	27,000	30,000

F-4C and T-38 load spectra.) And the 4000 hours isn't attained safely if the airplanes are flown more severely than provided for in the initial design!

There are several service examples of this problem in fighter aircraft used for combat type training. Two recent cases involved the loss of a wing during air-to-ground gunnery as shown in Figs. 3 and 4. The fatigue life of the wing lower surface structure had been used up more rapidly because these airplanes were subjected to about 10 passes in each one hour training mission. In addition, the established 4G pull-up was exceeded by overshoot to 5 or perhaps 6G, which, *although permissible in magnitude became disastrous in frequency.*

This is better understood by reference again to the endurance curves of Fig. 2 which show the large reduction in number of cycles to failure as the G load increases. It is possible for the fatigue life to be three times shorter at 6G than at 4G, which would be a triple reduction in flight hours to failure.

Air Force actions to prevent such mishaps involve monitoring of the airplane's usage. Procedures were outlined in the Aeronautical Systems Division Technical Report (TR66-57) published January 1968, and subsequently issued as Air Force Regulation 80-13, dated 31 Jul 69. As explained in this AFR, "The Aircraft Structural Integrity Program (ASIP) is a systematic procedure applied to an aircraft system to enhance design, diagnose potential or impending structural failure, provide a basis for corrective action, and predict operational life expectancy of the airframe."

The program provides for installation of flight recorders in approximately 20 per cent of selected operational aircraft. Analysis of the recorded flight data then can be used to update the load spectra and fatigue analysis, and to evolve modifications of the aircraft to insure "structural safety."

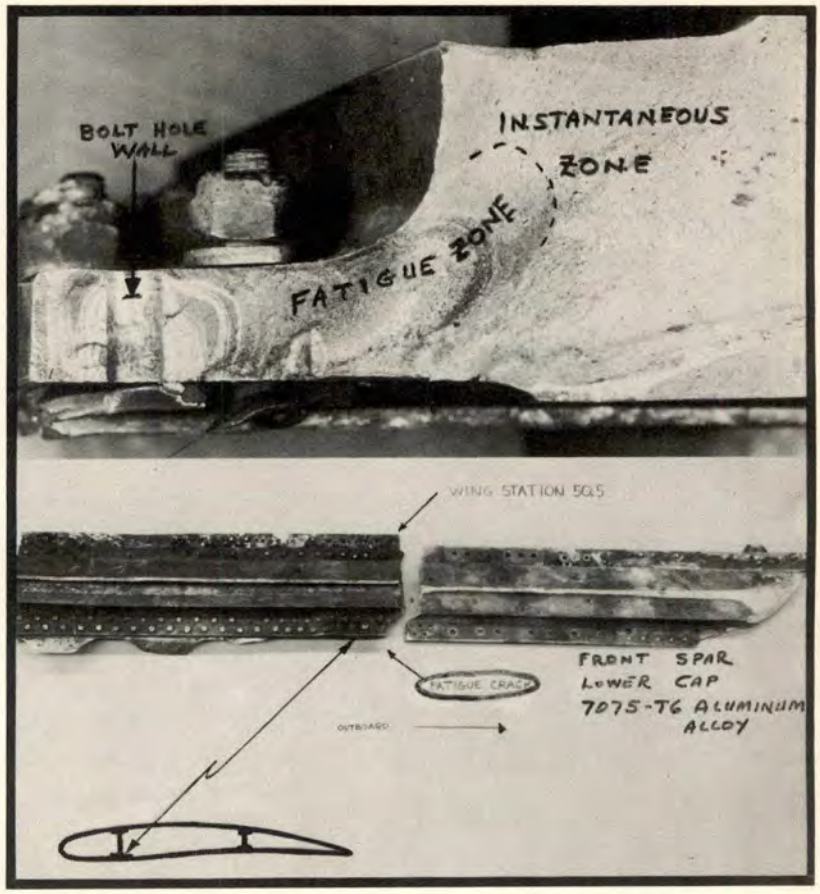


FIGURE 3

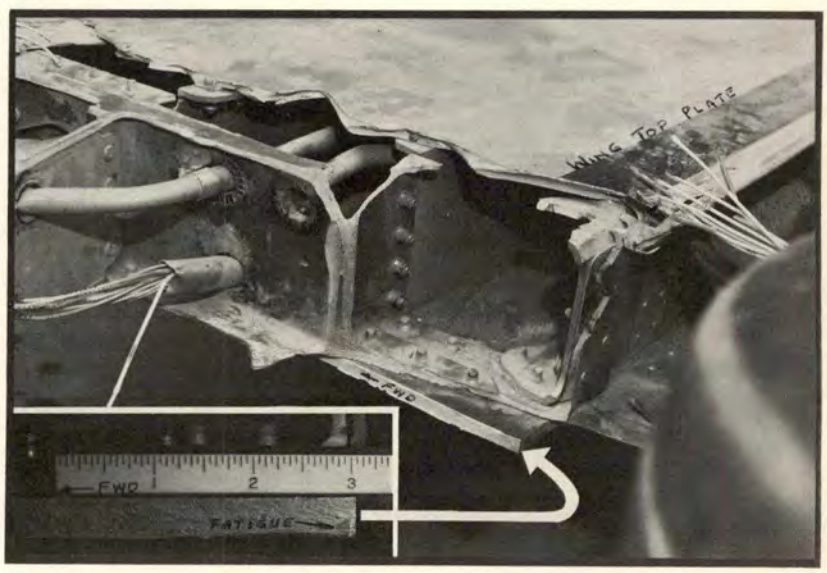


FIGURE 4

But let's get back to you, the pilot. Don't conclude that the airframe can withstand high stresses up to the 7.33G limit allowable indefinitely just because 7.33G is the operating limit shown in the Dash 1 handbook. Use what you need, but remember the endurance curves and fatigue life! ★

IF...

We all remember the story about the rabbit and the tortoise. *If* the rabbit had not stopped for a nap he would have won the race.

Accident reports don't use the word *if*. Instead they read, "The primary cause was (pilot factor)." Contributing causes may go something like this: "1. John Doe did sloppy work. 2. John Doe neglected to make proper entry in the forms. 3. John's supervisor neglected to properly supervise John." And the contributing causes go on and on. Yet, in the final analysis, the operator is very apt to be charged with the accident or incident. But they could say, *if* John had not done sloppy work, or *if* John's supervisor, etc., this accident would not have happened.

Then after all these *ifs* have been built in, along comes the unsuspecting pilot. He may uncover one *if* that by itself really means nothing, so he presses on. But before it's over the *ifs* have stacked up to a point of no return. So now what? The following case of *ifs* will better illustrate what we are trying to say.

The pilot of an F-105 while preflighting for an FCF noted the throttle binding while going into and coming out of AB. He discussed it with the crew chief, but since it was only a little stiff and the engine functioned okay, he decided to go with it. Takeoff and FCF checks went well until a point where the pilot tried to select AB and he found he could not move the throttle into the AB position. About this time he also noted what seemed to be higher than normal fuel consumption, also that some 1800 pounds of fuel in the forward tank was not feeding. Shortly thereafter the pilot declared an emergency and headed for home base. Approximately five miles from the runway the engine flamed out. The pilot ejected safely and the aircraft crashed just short of the runway.

Let's take a look at some of the *ifs* that contributed to this accident. Investigation revealed that there had been five previous write-ups for a binding or hard-to-move throttle. Also that the most probable cause of excessive fuel consumption was a throttle malfunction which inadvertently selected afterburner fuel flow without afterburner light off. *If* maintenance had reviewed the forms properly, they would have discovered the repeat write-ups on the throttle. Also they would have noted that, in each case, inadequate corrective action had been taken. Of course, *if* fuel had not been trapped in the forward tank for an undetermined reason, the pilot could have made it home okay. No doubt the biggest *if* belongs to the pilot. After all, he was charged with being the primary cause of the accident. But had maintenance eliminated any of their *ifs*, the accident would not have occurred. ★

REX RILEY'S CROSS COUNTRY NOTES

LITTLE THINGS DO MEAN A LOT...

LITTLE THINGS DO MEAN A LOT. On the plus and minus side of the ledger I have to give a big plus to the transient service that provides crews with a small but invaluable piece of information. A wallet sized card with a list of "likely to be used" phone numbers such as transient maintenance, O club, NCO club, transportation, weather, base ops, etc. Nothing is more exasperating than to have maintenance working on your broke flying machine and you can't find the phone number to call and confirm an ETIC. Having a number of these cards on hand costs very little yet eliminates one more frustration while in transient status.

CHOW TIME. Solving the problem of where to feed late transient arrivals has been a thorny one for years. I've dropped in on several bases that have no facilities handy after 1900. The automatic dispensers, though not the best system, look good when there is nothing else available. If you happen to

drop into Columbus AFB sometime you'll see, in base ops, neatly displayed, a rundown of all messing facilities on base complete with where to contact transportation to get you there. As a matter of fact, Columbus made us feel quite at home though unaware of who we were. Sure, this chow is a knotty problem, but put yourself in the position of having flown 15 hours until 0300 and when the turbine at last winds down, you find out that there is no chow anywhere until 0600.

IS THIS YOU? Believe it or not we still have pilots driving airplanes around the sky who don't understand about PCA—Positive Control Area. I actually had a pilot complain to me about the failure of a radar facility to advise him of traffic while on an IFR flight plan in VMC. He was at FL 190 (below the PCA). He just couldn't understand why center didn't have this guy. Sure everybody is supposed to squawk, if they have IFF, but don't count on it. If you're in VFR conditions, below PCA, you better get your head out 'cause your other end may depend on it.

BY A QUIRK OF FATE Rex found himself as a "Space A" traveler the other day. After this experience it may be that we need to take a closer look at what goes on in some of the passenger terminals. This particular one was neat enough until you ventured into the latrine. It was nothing short of a mess. This is one little irritant that our passenger force should not have to put up with. Believe me, realizing that there is no toilet paper at a critical time can be a very irritating experience. It makes me think that we need a checklist before going to the john.

My mail call has been very gratifying the past few months. Both from our traveling Air Force with complaints and kudos about various bases and from base commanders and transient services NCOs wondering what they can do to improve service. For you troops who write Rex personally with complaints, you may rest assured your letters get attention. Many comments are such that they can be resolved by direct contact with the unit involved. However, well documented deficiencies generate a letter to the base commander or a visit by Rex. Make sure you are on firm ground when you criticize. On the other hand, let me know about good treatment as well. Nothing gives me more delight than sending a copy of some jock's letter asking why this base doesn't have Rex's award, to a deserving transient service.

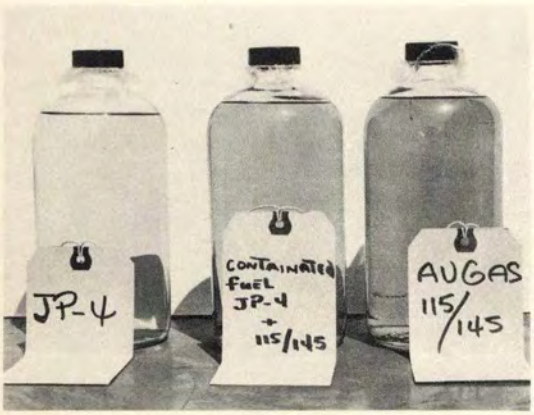
COMPOSITE FLIGHT PLANS were designed to expedite the traveling Air Force in the completion of their business. Ideally, I think that unless some extenuating circumstances rear their heads, a transient pilot should be able to quick-turn in about forty minutes. The most important factors that affect how long it takes to get you airborne again are fuel and clearance. I recently had a pleasant experience along these lines. The 175 indicated that a quick-turn was desired. After landing and clearing the runway, I was informed by ground control that my clearance was available if I was ready to copy. To a pilot in a hurry this is super service. The only thing that made us happier was to see the fuel truck ready to swing into position as soon as we departed the bird. Needless to say, our ground time was something on the order of 18 minutes. All we had to do when we returned to the aircraft was to preflight, crank up and ask for taxi information. What this tells me is that somebody at this base is doing his level best to insure that transients receive good service. Sure it takes a little effort, but this is something I think all bases should strive for. ★

THE

REX RILEY
Transient Services Award

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

DOES MURPHY PUMP YOUR FUEL?



See back cover.

Single point nozzle for JP-4 **will not** connect to avgas.

(Bottom) With the key to the padlock on the avgas fill stand attached to the avgas truck, how can you miss?

IF YOUR SERVICE STATION attendant were to fill your car's gas tank with kerosene, how do you think the car would run? About as well as an aircraft recip engine will run on JP-4.

Key to avgas padlock is attached to top of avgas tanker.

JP-4 must be bottom loaded.

Most of us are familiar with Murphy's Law: "If there is a way to do something wrong, somebody will do it." With this in mind, the Air Force has taken steps to keep old Murph from getting his hands in certain critical areas. One of these is covered by TO 42B-1-1 which has to do with the handling of aircraft fuels—avgas and JP.

To keep Murphy out of the picture some Air Force bases have modified their servicing trucks so that it is almost, get that, *almost,* impossible to service a JP-4 truck with avgas, or an avgas truck with JP-4. For example, the JP-4 truck is serviced from the bottom—that is, a fitting the same as that used on aircraft single point refuelings is attached to the bottom of the JP-4 truck and fuel is pumped into the truck from the *bottom* up.

The avgas truck, however, is serviced through the *top* of the truck. In addition, a measure known as the lock and key method is used to insure that only avgas goes into avgas trucks. The avgas fill stand valve is secured with a padlock and the key is secured to a chain that is attached to the top of the avgas truck.

These are but a few of the precautions taken at various bases to keep Ol' Murph from getting the wrong fuel in the wrong truck. Even with all the precautions, Murphy somehow manages to get into the act. Not long ago a 5000 gallon 115/145 avgas truck was serviced with 3458 gallons of JP-4. The truck was then dispatched to the flightline where the contents were used to service three aircraft: two T-29s and a C-54.

One T-29 aborted on takeoff for lack of power; the C-54 lost power after takeoff, crashed and burned. Fortunately, the crew and passengers escaped without injury. The other T-29 was being serviced while the above events were going on; therefore, the pilot did not get a chance to try his luck at flying a recip on JP-4 fuel.

From 1965 until this latest accident, there have been three major accidents and four incidents attributed to the wrong type fuel. Sixteen lives were lost and two aircraft destroyed. The reasons are varied as to why the aircraft were serviced with the wrong fuel. In one case, the POL dispatcher, receiving a request for fuel for an O-2, thought the requestor was using a short term for F-102 so he sent a JP-4 truck to service the O-2. This resulted in the O-2 making an emergency landing for lack of power.

There are many different ways to prevent an aircraft from being serviced with the wrong fuel. (1) Before servicing the aircraft, the crew chief should ascertain that the truck actually does contain the right kind of fuel. (2) After servicing, ground personnel are required to drain fuel sumps and check for contamination. At this time an alert maintenance man *could* detect a mixture of fuels. However, experiments indicate that this detection would be hard to make except, possibly by smell (if you have a good smeller) or by feel. If it is avgas that has been contaminated with JP-4, the first impression you would get on feel would be okay. (It would feel like avgas.) However, after the avgas evaporates you should be able to detect an oily feel from the JP-4.

Our experiments also indicate that the purple dye in avgas will color JP-4 almost to the point where it would be impossible to detect by sight, unless you had a good clear sample to compare it with. So what we are saying is that once avgas has been contaminated with JP-4, it would take a sharp individual who knows what he is looking for to be able to detect the contamination.

How much JP-4 inadvertently dumped into avgas would it take to make the difference between a catastrophe or just a damaged engine? A large amount would likely keep the recip from running well enough to leave the hard stand. On the other hand, a small amount of JP-4 might allow the engine to run well enough to get the craft airborne and then quit. Jet engines, however, will run well enough on avgas to get you back on the ground.

So what's the answer? How do we keep Murphy from mixing JP-4 with avgas? The answer would seem to lie in well trained, conscientious people and first-class supervision. ★

Tech topics

briefs for maintenance techs

the danger of being a good guy

A minor accident brings to mind an incident that took place several years back in which I was the bad guy. I had been in the organization less than a month. One evening just before shift change I was asked to inspect a C-135 main wheel and tire installation. When I arrived at the aircraft, I found the wheel installed and the jack removed. The crew chief said, "Sarge, all you have to do is sign the forms and she's ready to go."

Well, this crew chief was just a bit unhappy when I insisted on having the job reaccomplished so I could watch the proceedings and check the inner bearing. This was not only a lot of extra work, but it ran way over into the next shift. Needless to say, it didn't take long for the word to pass through the squadron that the old Sarge would not sign off a red cross unless he was sure of what he was signing.

Following is what happened when a *good guy* signed off a red X:

A B-66 pilot was advised by the last chance crew that his right antiskid cover was missing. On the basis of that information the pilot aborted the mission. He was cleared down the active for return to the ramp. The pilot said the aircraft handled as if it had a brake dragging. Because of this he exited the runway at the first turn off and stopped so the fire department personnel could inspect his brakes to see if they were overheating. Everything seemed okay so he proceeded. A short distance later the maintenance people stopped the aircraft to check the missing antiskid cover. They decided it would take too long to replace it as some of the bolts were sheared off, so they waved him on to the parking ramp.

However, this time when he started to taxi, sparks were observed coming from the right wheel. Before he could be stopped the sparks turned to fire which engulfed the wheel well before being extinguished by maintenance personnel and the fire department.

To fill in the missing details, the right wheel had been replaced just prior to the flight crew's arrival and the middle wheel bearing had been left out. This allowed the wheel to shift during taxi, causing friction and overheat. NOTE: No in-progress inspection had been made; the red X for the installation had been signed off after the job was completed. Several people had a hand in this boo-boo; the tire shop for leaving the bearing out and maintenance for not checking to be sure it was installed. But the ultimate responsibility rested on the inspector's shoulders. He signed off the red X indicating he had inspected the installation and found it satisfactory. Yet there was no way he could have known if the bearing was in place unless he had inspected the wheel prior to and during installation.

CMSgt Lloyd Thompson
Directorate of Aerospace Safety

haste makes waste

The crew chief, while performing a "thru-flight" inspection on his F-4, noted that the front cockpit bailout bottle pressure was low. PE personnel were called and they serviced the bottle. About three and a half hours later, just prior to flight crew arrival, the crew chief again noted the same bottle pressure low. So he again called PE. He also reinstalled the front seat pins and the canopy jury strut.

The flight crew arrived shortly and proceeded with the exterior preflight. Then PE arrived and reserviced the bottle, but they did not complete the job until two minutes after scheduled start time. To save time the pilot removed the canopy jury strut and was unpinning the seat when the crew chief took over this task.

Engines were started and the aircraft began to taxi when the maintenance expediter noted sparks coming from the exhaust area. He relayed this to the pilot who shut down on the taxiway. They found the front cockpit canopy jury strut wedged between the left engine intake duct and the fuselage. The pin and streamer were missing. Inspection revealed they had been ingested by the left engine.

Don't cut corners or deviate from the checklist to save time.

missed check

During an FCF, the O-2 pilot shut down the rear engine. When he attempted a restart the prop would not unfeather so he made a single engine landing. A check of the system revealed the prop accumulator preload pressure was low. A leaking filler valve went undetected during preflight, at which time the accumulator had been recharged. A proper check in accordance with the Dash Two would have revealed the leak.

bar fod

Shortly after takeoff on an FCF a T-33 pilot pulled one negative G for three or four seconds to check out the fuel vent warning system. Approximately five minutes later, right aileron was applied to roll level from a left turn but the stick would move only one-half inch to the right of center. The pilot said it felt as though the stick was bumping against a solid object. The pilot elected to make a downwind landing with the wind on the left wing. With the left wing low, right aileron application would not be required. The landing was accomplished without further incident.

An inspection turned up a sheet metal type bucking bar between wing station 137.45 and 148.65 of the right wing. The bar had wedged into the control cables in such a way as to restrict movement of the aileron surface past neutral.

T-38 engine fire

After a landing necessitated by a stuck nozzle in the right engine, a loud noise was heard from the engine. The crew shut down but both fire lights came on. Firemen rapidly extinguished the ensuing fire.

The pilots reported a fuel imbalance that began with the right system 150 pounds low just prior to landing and progressed to 400 pounds after engine shutdown. The major problem was a ruptured hose from the governor to the AB fuel control. There was a smaller leak in the flexible portion of the AB control to AB pilot burner manifold line.

The cause of the rupture was identified as insufficient clearance between the engine and firewall. The engine had been reinstalled during periodic 30 hours before this incident, but clearance between firewall and engine was not in accordance with the Dash 6.

shade tree mechanic

A jet engine might be likened to a baby, either one will try to eat anything given it.

Take the case of the J-57 engine being run in the test cell for the purpose of carbo-blast, in accordance with the TO. Within 48 seconds after engine start, idle RPM had been reached. For warm-up purposes, the engine was allowed to idle for five minutes. The speed was then accelerated to 85 per cent for another five minutes, then advanced to 95 per cent and apricot pits were introduced.

The test cell operator said that approximately five minutes later the RPM was retarded to 85 per cent and at this time it was noted the grass around the blast fence and near the test cell was on fire. He also said that engine operation was normal, but he couldn't remember what the engine temp was. He then shut the engine down abruptly in emergency.

Investigation revealed extensive damage to the engine to the tune of more than $9000. What was the cause factor? A locally fabricated pit dispenser being used for the carbo-blast had no regulator controls. Therefore, the amount of pits introduced within a given time could not be determined and, since the engine will try to take any and everything it is given, it over-ingested. Locally fabricated equipment should follow mil standards if they are available. In this case, they were.

CB is not a cleaning agent

Bromo-Chloromethane Tech (CB) is a fire fighting agent and is highly toxic. Almost as toxic under certain conditions as Carbon Tetrachloride.

It is not a cleaning agent!

An incident involving the unauthorized use of CB as a degreasing agent points up the potential hazards involved. An automotive hobby shop facility was being cleaned and renovated on a self-help basis. One problem encountered was the grime and oil-soaked floor which had resisted several cleaning attempts. Fire Department personnel were asked for suggestions on how to clean the floor. CB was recommended.

Later one of the volunteer workers was found slumped unconscious in a corner of the hobby shop. An open five gallon can of CB was found nearby. He was alone at the time and apparently had been cleaning the floor using the CB and a small hand brush. By simulating the conditions existing prior to his death, it was determined that he was exposed to an average of 6000 ppm of CB vapor over a 2-3 hour period. This is more than 1000 times greater than the threshold limit value.

No specific directives forbidding the use of CB have been published as is the case with carbon tet. The investigators in this case questioned many people who should be knowledgeable of the hazards of CB, but got several different answers. Obviously, the fire department personnel who recommended CB were not aware of the potential danger and did not understand that the absence of CB on the approved cleaning list in TO 42A1-1-3 indicates prohibition of its use. AFR 161-10 directs that personnel must have written certification from medical personnel before being issued CB.

(Mission Safety-70 Newsletter #3)

UEIs VS explosives Safety

John H. Kawka
Directorate of Aerospace Safety

During recent unit effectiveness inspections, command inspectors found some serious explosives safety deficiencies. Some units did not have an explosives safety program (AFR 127-100), while others had only partially complied. In addition, they found such common deficiencies as:

- Commander had no personnel assigned to explosives safety or, if assigned, the people were not familiar with their responsibilities.
- An explosives accident prevention program had not been developed.
- A program for conducting explosives safety surveys had not been established.
- Personnel who cannot discipline themselves to follow good safety practices were not being observed for elimination.
- Hot cargo handling points violated quantity-distance criteria with respect to taxiways, operational aircraft, etc.
- Personnel assigned explosives safety duties had not received training in management of an explosives accident prevention program.
- The explosives accident prevention program did not include the basic elements of engineering, promotion, education, training, analysis and evaluation.
- Monthly explosives safety surveys were not being performed by qualified personnel.
- All areas involving explosives were not included in the survey report.
- Approved waivers were not on file covering all violations of mandatory explosives safety distance requirements.
- Adequate programming or other actions had not been taken to correct safety distance violations within the waiver period.

Safe handling of ammunition and explosives is one of the most serious explosives safety problems that confronts an organization or installation commander.

To insure that their activities measure up to current Air Force explosives safety standards, commanders must familiarize themselves with operations which involve explosives and be able to recognize potential hazards and problem areas. Maximum use should be made of the services and technical capabilities of assigned explosives safety officers, and munitions and armament personnel to insure that explosives material is properly handled.

Explosives operations must be under the direct supervision of a qualified supervisor who is competent and understands thoroughly the hazards and risks involved. Formal training is a basic requirement.

The cardinal rule is to expose the minimum number of personnel and materiel to the minimum quantity of explosives for the minimum length of time. To comply with this rule supervisors must:

- Properly plan explosives operations.
- Provide adequate shielding and barricading to protect personnel and equipment when operational hazards require this protection.
- Use prescribed separation distances between explosives operations and personnel, buildings, runways, aircraft areas, and equipment.
- Minimize concentration of explosives to prevent area saturation.
- Limit the number of personnel to that required for efficient accomplishment of the operation.
- Require personnel to work strictly in conformity with complete and properly approved checklists and standing operating procedures.
- Minimize unnecessary rehandling.

Some operating officials are hard to convince that their operations are governed by AFM 127-100 and other pertinent publications. It would be a good thing if everyone would read or re-read AFM 127-100 which establishes the standards for safe explosives operations. Then they would know the correct actions to take in order to eliminate the deficiencies listed earlier.

We have a pretty good explosives safety record now, but it can and should be constantly improved by knowledgeable operating officials being constantly on the alert and regularly reviewing their operations. ★

Toots

is interested in your problems. She spends her time researching questions about Tech Orders and directives. Write her c/o Editor (IGDSEA), Dep IG for Insp & Safety, Norton AFB CA 92409

Toots receives many queries concerning the AFTO 781 series forms and the material contained in TO 00-20-5. The latter was rewritten and the latest revision was published last July. Nevertheless, the questions are still coming in.

In order to end some of the confusion and assist you fellows in the field who must work with these forms and the applicable tech orders, here are several questions with answers provided to make it easy. Answers are based on material contained in TOs 00-20-5, 1 July 70, and 00-20-1, 1 June 70.

QUESTIONS

1. Who normally puts the symbol in the AFTO 781 forms?

2. Who is authorized to downgrade a red X?

3. Is a red X symbol necessary for a safety of flight discrepancy if the discrepancy cannot be duplicated on the ground?

4. What does a red dash symbol indicate?

5. Is the transient pilot authorized to postpone a required routine inspection or minor maintenance for the purpose of expediting his departure, even when personnel and material are available?

6. What action must the transient pilot take in order to postpone minor repair or routine inspection items?

7. How long is an exceptional release good for when signed by the pilot?

8. How long is an exceptional release good for when signed by a maintenance officer?

9. What is the procedure for changing a red diagonal symbol to a red X?

10. What is the procedure for changing a red dash symbol to a red X?

11. Is the supervisor who participates in accomplishing the repair of a red X condition authorized to sign the "inspected by" block and place his initial over the red X?

12. What is the minimum signature authorized for maintenance record purposes?

13. Does an inoperative pitot static system constitute a red X?

14. When will a red diagonal entry be made for a SOAP sample?

15. The aircraft commander or pilot is required to review what forms prior to flight?

ANSWERS

1. Normally the symbol will be entered by the mechanic or flight engineer. (00-20-5, p 2-82)

2. The maintenance officer or chief of maintenance. (00-20-1, p 3-24)

3. Yes. (00-20-5, p 1-9G)

4. Condition unknown. (00-20-5, p 1-17)

5. Yes. (00-20-5, p 1-92)

6. A written request to such effect will be entered on the AFTO Form 781A by the pilot. (00-20-5, p 1-92)

7. When a release is signed by a pilot, it will be effective only for those flights in which the releasing pilot participates as an aircrew member. (00-20-5, p 2-62C)

8. An exceptional release when signed by a maintenance officer is good for that calendar day, unless additional uncleared red symbol discrepancies are encountered. (00-20-5, p 2-62C)

9. Any individual of higher responsibility within the maintenance or repair activity may change the symbol. He should draw a line through the name of the individual who made the entry and enter his signature within parentheses above or beside the original signature. (00-20-1, p 3-24)

10. When a red dash symbol is upgraded to a red X symbol, the original red dash will be closed out by a remark "Symbol changed to a red X" in the corrective action block and the entry will be reopened in the next open discrepancy block. (00-20-1, p 3-26)

11. Yes, provided he has another member sign the "corrected by" block. (00-20-2, p 3-10)

12. First name initial and last name. (00-20-1, p 6-61)

13. Yes. (00-20-5, p 1-9r)

14. A red diagonal entry will be made on applicable forms when a second oil sample is taken to verify metallic contamination thresholds detected during the preceding oil sample analysis. (00-20-5, p 1-23)

15. AFTO Form 781A, 781H, 781J and 781K. (00-20-5, p 2-5) ★

Ops topics

PUDDLE PROBLEM

We've all had those kinds of mishaps that make us wish we'd "stood in bed." Here's one that no doubt affected a very experienced IP in the same way.

The weather was kind of stinky as he lined up his T-39 on final for an 8000-foot runway with only 5200 feet between the barriers. He couldn't get an RCR but figured a landing roll of about 3500 feet.

At one mile he saw the runway and put it down 100 feet past the approach end arresting gear. All was well until he drove into a big, 1500-foot long puddle. The bird started hydroplaning and drifting left. Just before leaving the runway the tires blew, the bird turned left and skidded sideways and the right wingtip scraped the surface.

Now to the crux of this fiasco. This was not an Air Force base and the last RCR had been taken the day before. Twenty minutes after the incident an updated RCR was provided; it averaged 20 for the entire runway. Hopefully, at a USAF base the aircrew would be told about the 1500-foot long puddle of water which was alleged to have been one to two inches deep. In this kind of puddle you hydroplane, get slush drag and aircraft control may become impossible. There is not now, and may never be, a method to measure your stopping ability in one to two inches of water. ★

THE SQUEAKING WHEEL

Most of us are pretty busy and probably a little bit lazy, which may account for our not squawking louder when we get shorted on something that requires us to expend extra effort. Like, for example, ground egress training for aircrews.

This is an old subject but the fact is that egress training is not as good in some units as in others. There may be one or several reasons for this, but the training probably is as good in any unit as the pilots demand it to be.

Aside from the fact that some people clutch more than others, there's not much excuse for events such as the following:

After a bad landing that ended in some rather severe aircraft gyrations, the student pilot attempted to get out and away from the aircraft. He

- Failed to shut down the engines.
- Took time to remove his helmet.
- Had trouble releasing his leg straps.
- Stood up in the seat, but was restrained by the G-suit hose.
- Went over the side but got hung up on the oxygen hose, still connected to the CRU-60 connector.

If this were an isolated case, that would be one thing. But it wasn't. Similar foul-ups continue to occur. It seems kind of ridiculous to spend all that money on equipment to get a jock out of the cockpit in a hurry in the air only to have him strung up by a strap or hose when the birds starts burning on the ground. ★

BROKEN RECORD

A T-37 was on a routine navigation mission through the mountains. After landing at their refueling base, the crew delayed takeoff due to a big thunderstorm moving northeast over the field. The pilot dutifully rechecked the weather and decided to take off (heading northeast) since the storm had passed by. His cruising altitude was FL 220. After becoming airborne the T-37 pilot evidently heard another aircraft on his route call Center about buildups in the area, and Center told them that there were none on his scope. With this info tucked safely away, the T-37 pilot continued on his way. Approximately 25 minutes after takeoff moderate turbulence was encountered, lasting about 45 seconds. At their next base the postflight revealed hail damage to the nose cap, cracked lenses and torn fiberglass inlet ducts.

At the risk of sounding like a broken record, we have to point out again, FAA radar is not required to relay enroute weather to aircraft in flight. Admittedly, they will be of service to you if at all possible, if you request it, but in many instances the controller will find it necessary to select the circular polarization mode which will eliminate echoes from thunderstorms. Many controllers will go out of their way to advise you of buildups in your path but remember, their primary function is traffic separation. ★

FLIP CHANGES

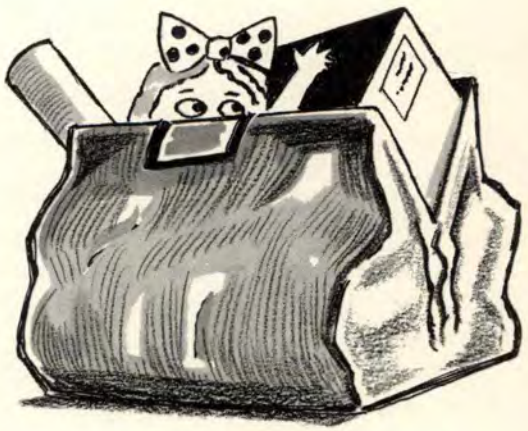
Stop Over Flight Plan: The hours of fuel on board the aircraft for second and subsequent legs of a stop over flight plan are to be shown in the "route of flight" section (Block 16). Fuel on board for the first leg is to be shown in Block 20. See FLIP Planning, Section II.

Hi-Jack: A discreet transponder code has been established to alert ARTC during attempted Hi-Jackings. See Special Notices in the 15 Oct issue of the IFR-S and FLIP Planning, Section II. ★

THE SCOUT AWARD

(Quote from an incident report:) "Pull-off from strafing pass. The aircraft was climbing through about 3800 feet when the pilot saw a bird. He broke left to avoid it, but broke into another bird. This one hit the right forward windscreen and created a ten-inch diameter hole in the plexiglas. Pilot and cockpit were littered with bird debris from some unidentifiable black bird. Pilot was flying with helmet visor down which undoubtedly prevented serious injury. Aircraft landed without further incident."

This pilot was prepared and it saved his eyes. Are you prepared to save yours? ★



MISUSE OF HELMET BAGS

Recently, a crewman received minor burns on his right cheek from acid which leaked from a flashlight battery onto his oxygen mask. He had used the helmet bag to store his flashlight between flights. Just before the last flight, the acid leaked from the flashlight batteries (marked "leakproof") onto the mask. He was unaware of what happened and experienced severe discomfort and burns after wearing the mask for a few hours. ★

(TIG Brief, No. 16)

Ops topics

CONTINUED

It is now being used as a drag strip. The strip was the former 17-35 runway 4100' X 60'. The place also has a 13-31 strip the same as Corpus Christi where it is NOTAMed closed for construction.

Perhaps by the time this appears in print the problem will be somehow solved. Anyway, if you should have to go to Corpus Christi, remember the drag strip. ★

HOW BIG?

A recent incident has activated the gears in our cranium toward passing on this warning note: Beware, if you are out of the norm sizewise (what a word!).

The incident involved a canopy loss by a T-37. The investigator was of the opinion that the student pilot's size was the critical factor. Being very short, he flew with the seat full up, which exposed the canopy handle to his left elbow.

Over the years there have been numerous incidents, and probably some accidents, due to pilots being either extra tall, extra short, or just plain big. So, if you fit into one of those categories, take stock and make sure your size won't adversely affect some system in your airplane. ★

DRAGGIN' IN A T-29

There are many old stories about pilots landing at the wrong place. We thought that was just about a thing of the past, what with modern communications, runway identifiers and all, but apparently we were wrong. It happened just a short time ago. We're not going to fault the pilot on this one because we weren't in the cockpit. Here's a brief of the report.

The T-29 was enroute to Corpus Christi, Texas, International Airport for a parts pickup and was vectored to a long final for runway 35. Weather was good with viz given at 15 miles; however, the crew said that haze made it more like five miles. The crew spotted a runway but, too late for a go-around, realized it wasn't the right one. Before they could stop, the right wing struck some poles alongside the "runway."

It turned out that where they landed was a closed airport 3.5 miles south of Corpus Christi International.

OHR

Approximately ten minutes after power was applied on a B-52, the crew noted a strong odor of burning paper and cut power immediately. Then they looked and found an Aldis lamp face down on some paper aircraft records. A load adjuster (slip stick) was on top of the Aldis lamp, depressing the switch and the heat of the illuminated lamp caused the paper to smolder.

It was suggested that since the Aldis lamp is used so infrequently, it should not be left plugged in. Also that personnel insure that the Aldis lamp is properly stowed when not in use. Good advice for all equipment. ★

HEADS UP FLYING

So many incident and accident reports contain examples of human failure that it's refreshing to see one that gives credit for a job well done. One of these rare ones showed up the other day and we're passing it along as an example of heads up flying by a guy who acted promptly in a very sticky situation and saved an airplane.

The flight of two F-100s had just got gear and flaps up after takeoff when the wingman advised Lead of a fire just aft of the eyelids. Just as Lead pulled the throttle out of A/B the aft section overheat light came on. He further reduced throttle and the light went out and Wing confirmed no fire. Lead declared an emergency, made a straight-in and landed. After clearing the runway, the pilot shut down and exited.

There had been a fire at the base of the spray bar extensions, hot enough to melt pieces of the eyelids which ignited grass fires near the departure end of the runway.

Both the alert wingman and Lead can take credit for saving an aircraft. ★

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UNITED STATES AIR FORCE

WELL DONE AWARD

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

(L to R)

Capt Paul Katsuki
Aircraft Commander

Capt James R. Misken
Copilot

Maj Donald M. Rieke
Navigator

TSgt George S. Thompson
Flight Engineer

TSgt Carl T. Kleusch
Loadmaster

314th Tactical Airlift Wing, APO San Francisco 96319

On 12 February 1970, the C-130 departed Da Nang with 69 passengers and a basic crew of five for Hue Phu Bai. Because of weather a GCA was made into Hue where the first 1000 feet of runway was closed for construction. The aircraft touched down on centerline approximately 2000 feet down the runway and the nose gear was lowered onto the runway. Captain Katsuki retarded the power to ground idle, paused and applied reverse thrust, but the Nr 4 prop hung up on the low pitch stop and did not enter the reverse range. As the propellers went into reverse, the aircraft swerved violently to the left and the left main gear went off the aluminum planking onto the asphalt at the left edge of the runway. Captain Katsuki immediately applied right rudder and brought the throttles out of reverse. The aircraft then swerved back to the right and the right main gear went off the aluminum and onto the asphalt on the right side of the runway.

The pilot judged that there was insufficient runway remaining and decided to go around. He applied max power on all engines, called for 50 per cent flaps and flew the aircraft off; however, directional control became extremely difficult. Captain Katsuki noted an increasingly loud, high pitched sound and established the fact that he had a runaway propeller. But when he called for emergency engine shutdown on Nr 4 engine, the propeller did not feather and the RPM continued to increase. After finding that the prop would not feather, the crew reset the fire handle to restore oil to the engine and Capt Katsuki elected to divert to Da Nang.

With the aircraft almost uncontrollable, maintaining a slow, flat, right turn, the pilots' main concern was to get enough airspeed to regain full control and to get enough altitude to clear the terrain. Unable to comply with Hue Approach vectors and climb instructions, the pilot depended entirely on the navigator for terrain avoidance and set-up a straight-in to Da Nang. At the start of the descent into Da Nang, he was able to reduce power on Nr 1 engine to enhance directional control and still maintain airspeed. He held 140 knots until just prior to touchdown and flew the aircraft onto the runway. When the propeller dome assembly was disassembled, a crack was found on the entire inner circumference of the propeller piston.

Captain Katsuki's superb pilot skills, supported by outstanding performance by each man on the crew, made it possible for investigators to determine the exact cause of the malfunction, and possibly saved many lives and an aircraft. WELL DONE! ★

know the difference

A MISTAKE COULD BE FATAL