UNITED STATES AIR FORCE • DECEMBER 1972

Aerospace SAFETY

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UNITED STATES AIR FORCE **DECEMBER 1972**

Aerospace SAFETY

FOR AIRCREWS, MAINTENANCE & SUPPORT TECHNICIANS

SPECIAL FEATURES

REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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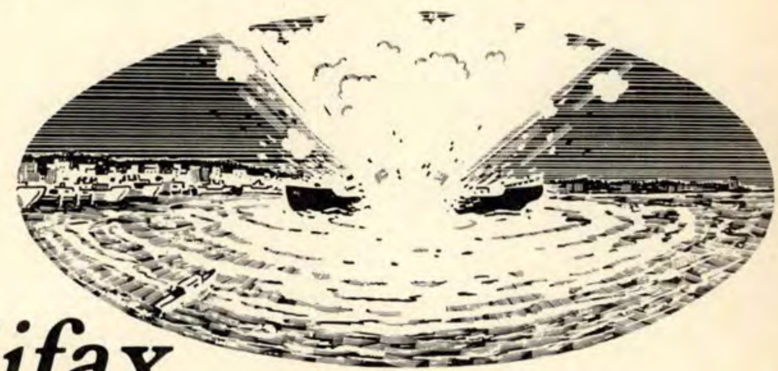
DECEMBER 1972 AFRP 127-2 VOLUME 28 NUMBER 11

HISTORIC HOLOCAUST

HY BOSCH
Directorate of Aerospace Safety



When Halifax Was Destroyed

Miraculously one telegraph line was left. Over its wire sang the message that shocked the world. An explosion had destroyed Halifax.

During World War I North America was both the breadbasket and arsenal that sustained the conflict in Europe. Ships would take on cargoes at the east coast ports and head for Halifax, Nova Scotia. At that port convoys were formed for the perilous Atlantic crossing. It was Halifax's strategic location that led to its downfall.

On December 1, 1917, in New York, 5 million pounds of explosives were poured into the holds of the steamer *Mont Blanc*. Almost as an afterthought an additional urgently needed 488 thousand pounds of benzol in drums were lashed to its decks. On December 6, this mixture of explosives and volatile liquid was heading into Halifax. At the same time a Belgian relief ship, the *Imo*, was heading out. Harbor traffic prevented the *Imo* from taking a track that would allow the ships to pass port to port. Instead, they were on a collision course. At the last moment the ships' masters attempted evasive action but they were too late. The *Imo* rammed the explosives carrier. Immediately the decks were aflame with burning benzol. Realizing they were riding a time bomb, the Captain and crew of the *Mont Blanc* abandoned ship. Now uncontrolled, the burning vessel drifted toward the docks and city. Hundreds watched in awe as two naval longboats raced to secure the ship and change its course. The quick and deadly benzol won the race. It reached the explosives and the thunderous explosion destroyed long boats, docks, ships and town.

The quantity of explosives and its proximity to the city caused unprecedented death and destruction. There were 1800 fatalities and 8000 injuries. Hundreds of the injuries resulted in blindness when people rushing to their windows upon hearing the explosions were caught by shattering glass caused by the following shock wave.

Buildings were severely damaged for a distance of 1¼ miles while missiles were thrown up to four miles. Fires caused by overturned stoves contributed to the havoc. As if that were not sufficient, that night a blinding blizzard disrupted rescue efforts.

Halifax was destroyed 55 years ago; yet today each Air Force base with combat aircraft has the ingredients for such a calamity. Military aircraft require both explosives and combustible fuels to perform their mission. To prevent another such holocaust we must insure the compatibility of explosives with aircraft, train our people to conform with technical data and adhere strictly to prudent safety practices.

The frequent incidents involving explosives are warnings that we cannot ignore. Too often we see the results of improper procedures, careless handling, failure to follow tech data and deficient supervision. Must we have another Halifax to teach the seriousness of these deficiencies? ★

REFLECTIONS

Ok guys, sit back, prop your feet up, adjust your glasses (if required), loosen your belt (again, if required) and let's do a little soul searching about 1972. Just about everybody thought '71 was a banner year in the safety business. We crept a little closer to that magic figure of a zero accident rate, so there was no reason to think that '72 might reach up and bite us where we least expected it! In 1970 a rate of three accidents per 100,000 hours was a record, but in 1971 we edged down to 2.5. Unfortunately, Lady Luck's smile was a bit thinner in 1972.

For openers on this ponderous subject there are a couple of things that we're just going to have to buy. First of all, it's you and I who cause accidents. We haven't had one single flying machine crank itself up, taxi out and take off without some kind of help. Not one airplane forgot to put its gear down or failed to follow the checklist, nor can I think of a single nut that over- or under-torqued itself. Maybe we'd better face the mirror and stand up while we talk about this, just to be sure that the right guy gets the straight skinny.

Of course somebody is going to say, "well there was nothing that could be done to prevent that one—the widget just broke." In the first place the widget broke because it was either (1) underengineered or (2) overstressed. Get the picture? *Somebody* caused the failure.

Maybe we were just lucky last year but it sure seems like '72 has provided us with some real "dumbs." We have found that the best way to prevent a repeat accident is to learn from the original. It's much, much less painful to learn from the mistakes of others than to go through the same exercise just to make *sure* that was the best way to goof it up. The head shrinkers tell us that a guy who forgets to put the gear down and slides to a stop is very unlikely to do that little trick again. Yet, the next day somebody else goes out and proves again that the gear won't come down all by itself. (Kinda like reinventing the wheel, isn't it?)

So sit back down, get a good grip on the chair and let's see how we managed this year to break some machines that should still be doing their duty.

For some reason airplanes continue to surprise us. We fly a bird for years and suddenly find that there were some things missing from the instruction book that should have been put there when the machine was first built. An after-the-fact investigation revealed that "accurate take off acceleration check-speed data or abort criteria are not available in the T.O." And that "a partial power loss can occur which may not be detected from existing instruments." Wonder who and how many people overlooked that one? It cost us an airplane and a pilot.

Here's another one. Ever seen a JP-4 truck parked in front of a recip? Somebody must have, because we managed to do it twice in a row at the same place. Just one airplane crashed—but only because just one took off. It's speculation as to how many gimmicks we have devised to prevent this most obvious event from occurring, but they must number in the hundreds. Yet we still manage, somehow, to beat the system and pump kerosene into gas tanks.

We know that mistakes are going to be made or we wouldn't put erasers on pencils or emergency procedures in a prominent place in the -1. One thing we can't legislate is that, when the time comes, the guy who has to cope with an emergency will follow this advice. One report says "Pilot Factor in that the pilot failed to use correct procedures during an inflight emergency and lost control of the aircraft" Sure, we know that common sense often dictates an alteration in the preplanned response, but remember too that these emergency procedures were worked out in the comfort of an air conditioned office and not under the pressure of a disintegrating airplane. Give them a chance. This one cost us a machine and lives.

Most of us who fly airplanes with two (or more) engines take it for granted that the warning lights won't lie to us . . . and in most cases this is true. But let's mix things up a bit: How about a little touch of carelessness in hooking up the fire warning loops, like wiring No. 1 fire circuit to No. 2 engine and vice versa? Now add one more ingredient . . . a fire. By the time the crew figured out that they had shut down a good engine and added power to the sick one we lost an aircraft. Just pure maintenance personnel error.

Many words have flowed across the pages of all the safety mags over the years stressing the dangers involved in various optical illusions. We talked about fog, rain on the windshield, sloping runways, snow, etc., and yet we still have pilots who land short and wipe out the aircraft. We felt so strongly about the subject that most of our runways now have VASI lights that will help you anytime you are on an approach. Pilots still land short on a 10,000 foot runway because they misjudge their approaches. *Pilot technique*. Use all the aids available to you every time you land your bird and we'll eliminate this kind of loss.

"The cause of the fatalities was pilot factor in that ejection was not initiated even though conditions were favorable for approximately 30 seconds." Look at the sweep second hand of your watch. Let it tick off thirty seconds. Long time isn't it? How long does it take to make the decision to wash your hands of the whole mess and pull the handle? Every year we have pilots who delay making this decision until it's just too late. We almost wish we had the reverse problem . . . pilots who decide to leave when there is a good possibility the bird could be recovered. But this is not the case. Because of the reluctance of a pilot to admit that the situation is beyond his control, we lose good men. The time to make this decision is NOW —not when you are running out of altitude, airspeed and ideas. It may be cold outside the cockpit but not nearly as cold as that permanent wooden overcoat.

We mentioned earlier that people are going to make errors. We *know* that. Admit it when you do and perhaps we could prevent a few accidents. Did you hear the one about the troop who was taking an oil sample and let the plastic bottle slip? It went smartly down the filler neck. Not a very nice thing to have to trot back and tell your supervisor about . . . so he didn't. We lost an airplane because somebody was afraid to tell his boss. Wonder how he felt when he heard the airplane had crashed? About the same as the supervisor who signs his name that he has inspected work performed but when, in fact, he never left the maintenance shack, I guess.

The list is almost endless. Poor planning by aircrew, lack of knowledge, shoddy work by technicians performing maintenance, lack of professionalism—all these are going to cost us dearly. I said the list is almost endless. There should be an end somewhere because we just haven't found many new ways to break flying machines over the past seventy years. The same basic cause factors can always be found. We just repeat the same ones with variations. When do we start learning to profit by the mistakes?

The picture is not all bleak, however. We still managed to cope with more than 15,000 incidents, many of which, by a whisker either way, could have ended up in a smoking hole. We still manage to get the mission off on time and fly many more uneventful missions than those comprised primarily of stark terror. So our hats are off to those who perform their task as perfectly as possible.

If you're still looking into that mirror you must be one of this group. If you can't look that reflection in the eye . . . well, January One is rolling around, and maybe it's time for some new resolutions. ★

THE IFC APPROACH

By the USAF INSTRUMENT FLIGHT CENTER
Randolph AFB, Texas, 78148

RUNWAY ENVIRONMENT

AFM 55-9, TERPS, defines runway environment as "the runway threshold or approved light aids or other markings identifiable with the runway." The USAFIFC is frequently asked to amplify this definition, particularly with respect to "other markings." To fully understand the terminology one must apply it to many situations. Consider the following examples:

1. You are flying a night precision approach in near minimum visibility. Visual references will be very limited in this situation. Total instrument flight must be maintained until sufficient visual cues remain in view to determine the aircraft's vertical and horizontal position in relation to the runway. The visual cues will probably be limited to the approach lights, the runway outline lights, touchdown zone and center line lights, if available, and the runway markings.

2. You are flying a non-precision approach to circle for landing. The ceiling is cloud based with two miles prevailing visibility. In this situation there should be numerous visual references available. Runways, taxiways, ramp areas, hangars, runway markings, overruns, and lights associated with the runway of intended landing will assist you in maneuvering to a position from which a safe landing can be made.

The total situation during the time of approach will determine what visual references can be used for descent below DH and MDA. Lighted advertising signs, buildings, houses, and other landmarks far from the end of the runway **should not** be used to determine aircraft position in relation to the runway. These features could be confusing and easily misinterpreted in the absence of additional supporting visual cues. Also, they are not under the control of airfield management.

Other markings identifiable with the approach end of the runway should be reliable pilot references and features that can be previewed and anticipated prior to the approach. The most accurate information available is the airfield diagram on the instrument procedure.

USAFIFC GREETINGS

This month marks the eighth year of continuous monthly articles from the Instrument Flight Center. Hopefully, the information in these articles has enhanced your knowledge of instrument flight directives, procedures and techniques. Our purpose has not been to provide flight examiners with tricky questions, but rather to satisfy your needs for more information on instrument flying. Questions and answers, techniques for accomplishing instrument procedures, and discussions on the basic procedures have been presented to promote safety through education.

In our attempt to develop and perfect an instrument procedure, the user has the most important role in the communications loop. If you are interested enough in your profession, ask a question. Since the USAFIFC was established to serve you, why not let us know when you either don't understand, or think a condition can be improved. We welcome your inquiries. USAFIFC/FSD, Randolph AFB TX 78184, AUTOVON 487-4884/3092.

The USAF Instrument Flight Center extends best wishes to you and your families for a Merry Christmas and a safe New Year.

DESIGN DEFICIENCY

The design of an instrument approach procedure, from conception to publication, requires many hours of planning, calculating, and coordinating. From the myriad considerations evolves an approach that will provide a safe means of using terminal airspace if flown as depicted.

Occasionally, printing or design errors occur in spite of the efforts to avoid them. If a mistake is known or suspected, attempt to contact the operations personnel at the aerodrome responsible for the approach procedure, or consult any FLIP publication for correction guidance. Official pre-addressed cards are available at base operations. You, the jock, can assess the approach procedure through actual use, and your comments are solicited. Your inquiries will be investigated thoroughly.

RESTRICTED AIRSPACE

Flights through restricted airspace are prohibited during published time periods, unless permission is obtained from the *controlling authority*. Recently, an unsuspecting jock verified this in a rather embarrassing way when he deviated from his cleared route of flight to avoid thunderstorms. Luckily, the unauthorized penetration was uneventful even though the area was extremely hazardous to aircraft and aircrews.

Air Route Traffic Control *may* act as the clearing authority, but not in all instances. (Refer to R-1507B, Holloman AFB, NM. Also, see Special Notice, New Mexico, FLIP II.) If you intend to fly through or near restricted airspace, the USAFIFC recommends that your preflight planning include an alternate route clear of the restricted area in case of inclement weather or other unforeseen circumstances.

POINTS TO PONDER

When checking the IFR Supplement for your destination, note the listing of RADAR frequencies. You may find the symbol (EX), which indicates that the emergency frequencies will be available *only on request*. Since GUARD frequency is not being monitored continuously, don't expect immediate RADAR vectoring by GCA should your emergency situation warrant a GUARD transmission. ★

by the book--later

"The cause of this accident is that the Dash 1 is not clear."

or

"The cause of the accident is that the loading checklist sequences are in error."

Those are valid findings, as recorded time and again in accident reports. At least they *could* be valid, if the Dash 1 or checklist is new, and the required action has never been done before.

On the other hand, consider the munitions loading checklist that has been in daily use for months, with no accidents or incidents. Suddenly, a loading error occurs and the checklist is found deficient.

Real life wondering leads to the question: "Why no earlier errors?" Was it *really* the checklist, or had load crews recognized the problem, and adjusted their own procedures, without telling anyone? What happened during munitions standardization evaluations? Was the real problem the checklist?

Aircraft accidents bring forth similar findings, often pointing out that Sections II and III, I and VI, or III and VII don't agree. Who should be considering this? Certainly this type of book review is not of the type reserved solely for accident investigating boards.

Want a pointed example? After an ancient C-47 departed the runway on takeoff, it was alleged that the "book" was deficient! We wonder how many million times the "book" was used, and the words applied, before this accident!

Though that example is gross, it seems to lead to the point of our story. The time to consider adequacy of tech data, whether of the flying, maintaining, or supporting type, is when it is first put to use.

This evaluation should continue, with errors reported promptly, as they are identified.

After-the-fact is too late for accident prevention! ★

PRIMARY

It has been my own observation that when an aircraft accident occurs, most aircrews have two questions: "How is the crew?" and "Who/What caused it?"

I recently had the unfortunate experience of being forced to ask a third question: *"What could I, as a supervisor, have done to either prevent the accident or to prevent the death of two young outstanding Air Force Officers?"* This last question hit me especially hard as the supervision aspect was two sided; I was both the leader of the flight and Operations Officer of the squadron.

Our squadron mission is typical of that of many TAC fighter squadrons: We train aircrews to deliver conventional ordnance accurately. These aircrews range in experience from recent graduates from Undergraduate Pilot Training to the experienced fighter pilot. Our graduates go to SEA, overseas units, Air National Guard and the Air Force Reserves.

The flight on this particular day was to be a Ground Attack Tactics mission with practice ordnance. We were scheduled as a flight of two to the tactics range to work with a Forward Air Controller. As the Instructor Pilot in the lead aircraft, I briefed the mission and concentrated on the techniques and possible problem areas that generally occur on this type mission at this particular stage in the program.

My student was a Captain in the Air Force Reserve and had never flown fighter-type aircraft before. I was very pleased with his progress to this point and was sure that the "lightbulb" was about to illuminate so that his delivery accuracy would start to come down to where it belonged. John, the Instructor Pilot in the other aircraft, had a young pilot who had just graduated from UPT as his student and this young jock was having no trouble that a few more bomb passes wouldn't cure.

Start, check-in, and taxi were normal except that the tower changed the active runway after we started to taxi. This meant we had to reverse our taxi route to the new runway and it took longer than usual to get to the arming area. In addition, the quick-check crew and gunplumbers had to move and it took them a few minutes after we arrived to get into position.

We took off with fifteen seconds spacing and I noticed that we had an unsafe indication on the gear after retraction. I told my student to maintain below gear limit speed and to recycle the gear. This unsafe indication is not an uncommon occurrence in our type aircraft since a low-time pilot will allow the airspeed to accelerate too fast on takeoff which will prevent the gear doors from closing after the wheels are in the well. I also called John that we were slowing up to recycle the gear and he answered "Roger."

The gear went down o.k. but still indicated unsafe on retraction. I took control of the aircraft and could feel a slight buzz or buffet in the controls, so I asked John to come up to look me over and I started a gentle right turn. I looked back at my five o'clock position and noticed John in a normal formation join-up with the speed brakes de-

CAUSE

MAJ JACK DRUMMOND, 23d Tactical Fighter Wing
England AFB, Louisiana

ployed. He seemed to be overshooting slightly and I lost sight of him as he passed to my six o'clock position when I looked back to the front to scan for other traffic.

At the time that I expected John to advise me if anything was wrong with my aircraft, he made a transmission that was calm, cool, and garbled. The only thing I understood was the word *engine* somewhere in his statement. Both my student and I looked at our engine indicators as we felt that John had reported something about our engines. We saw nothing wrong so I asked John to repeat his statement. We received no answer so I reversed the turn back to the left and saw a column of black smoke coming up through the trees. At this time I looked at my altimeter and we were climbing through 1600′ AGL.

The investigation revealed the following facts that are important to my question of *"What could I, as a supervisor, have done to either prevent the accident or to prevent the death of two young outstanding Air Force Officers?"*

1. John's calm, cool, and garbled radio transmission was: "(——) tower, (call sign) has had a double flameout. We are starting number one."

2. John and his student ejected so low that the risers did not get out of the bag.

From my supervisory standpoint of the flight lead, why didn't I:

1. Stress to John and his student in the briefing that if both torches quit below 2000′ AGL, get out? I had told my student this many times but not on this specific day.

2. Ask John immediately to repeat the radio call that I had not understood?

3. Tell John and his stud to get the hell out of that airplane?

You may add to this list.

From my supervisory standpoint of Squadron Operations Officers, why didn't I:

1. Monitor the progress of John's student more closely?

2. Notice if John had been upset or overworked lately?

3. Punch up the Squadron stan/eval guy to keep the jocks on their toes about ejection parameters?

4. Talk to all the jocks about my own feelings of ejection versus the attempt at winning the TAC Aircrew Achievement Award or the USAF Well Done Award?

5. Pay more attention to the last check ride on John that I had signed off as Reviewing Official?

You may add to this list.

From your supervisory standpoint as Flight Commander, Squadron Commander, Flying Safety Officer, Stan/Eval, Quality Control, Maintenance Officer, Line Chief, Crew Chief, etc., *what could you have done to prevent the death of two young outstanding Air Force Officers?* To put things in the proper perspective, *what can you do to prevent the next one?* Each of us is a supervisor in some way, form, or fashion. Think about accident prevention from the standpoint of a supervisor and perhaps your attitudes about Flying Safety will be in for a big change. I know that mine have. ★

Inadequate Tech Data

LT COL RICHARD H. WOOD
Directorate of Aerospace Safety

A lecturer, seeking to demonstrate how poorly we communicate, dragged a volunteer from the audience and defied him to explain a simple procedure like how to open a pack of cigarettes and light one.

To prove his point, the lecturer stood behind his victim and took a fresh pack of cigarettes and a pack of matches from his pocket. As the victim described each step, the lecturer followed his instructions exactly. Very Exactly. Within minutes the stage was littered with cigarettes, the lecturer had a mouthful of tobacco, and the class was doubled over with laughter. If you need a few laughs at your next party, you might give this a try.

The poor victim never has a chance. Some things are just too simple to need instructions. We just naturally assume that anyone would know which end of the pack to open, which end of the cigarette to put in his mouth, and that you're not supposed to put it all the way in and close your mouth after it. Worse, the victim can't see what's going on behind him and doesn't know what results his instructions are producing. He has no feedback.

IT OCCURS TO US that writers of tech data are in pretty much the same boat. What seems perfectly clear and simple to them doesn't always come out that way. Occasionally, some helpful soul will stick in an AFTO 22 and point out that things are neither clear nor simple, but this system doesn't work as well as it should. Sometimes the first feedback the tech writer gets is when the plane crashes and the accident board klonks him with "Supervisory Factor, i.e., Inadequate Tech Data"! Man, what a way to get feedback! That's worse than a mouthful of tobacco!

Occasionally (on weekends and lunch hours) we in the Maintenance and Engineering Branch sit around with our feet on the table and philosophize about accident cause factors. There seems to be a tendency to get extremely nit-picky on tech order deficiencies, and we're not too sure that this is leading us in the right direction. The operative logic seems to be: if the tech data is required, and it is used, and it is wrong, then the tech data is at fault, and not the user. Put another way, if we are going to require that tech data be used and beat people over the head if they don't use it, then we're going to have to bite the bullet ourselves on any imperfections in the tech data when it is used.

There is probably an element of truth to this, but only if the tech data is absolutely, totally, and completely wrong—so wrong that Thomas Edison himself would have reversed the wires on his light bulb. In the real world, though, things are seldom totally right or totally wrong. They fall somewhere in between and the rightness or wrongness of tech orders are shaded by words like inadequate, misleading, incomplete, confusing or obsolete.

The tech order is a form of communication and it is stuck with all the inherent problems of the English language. Written perfection is largely in the mind of the writer and tech orders are fairly easy to criticize.

Aside from the problem of transferring information via the English language, there is another problem confronting the tech writer. Where does he start? What can we assume the reader of this tech order already knows? Nothing? Impossible. He must read English, understand page numbers, and recognize airplanes. If we tell him to "tighten" a nut will he understand? Or must we tell him which wrench; which end of the wrench, and how? Is it enough to tell him what needs to be done? Or must we think up all the things that must not be done and tell him those, too? Can we say, "assemble this bolt with one washer under the nut," and leave it at that? Or must we also say, "Don't put the washer under the head of the bolt, don't put more than one washer under the nut, and for heaven's sake don't leave the washer out!" Damn! The problem is worse than we thought!

What we have is an exercise in line-drawing. Where do you draw the line between common sense, basic maintenance knowledge, and tech data requirements? We don't know, but we're consoled by the fact that the

Gooney Bird Tech Orders are still under revision and that some of the "improvements" to other TOs recommended by accident boards are not themselves models of clarity. Obviously, tech order adequacy is a matter of opinion and clarity depends on who's reading it.

ANY COMMUNICATION SYSTEM worthy of the name requires a transmitter, a receiver and a feedback loop. If you're listening to someone talk and you don't understand him, you say, "What?" (or possibly, "What, Sir?" as the case may be) and all necessary elements of a comm system are present: transmitter, receiver and feedback. When the transmitter is in the form of a tech order, though, the opportunity to say, "What?" just isn't there. In a way, you could consider an AFTO 22 the equivalent of a "What?" but that's not much

help to someone who has to have the plane fixed by noon tomorrow. Anyway, in our tech order comm system we never find fault with anything but the transmitter. We never blame the mechanic (receiver) for not reading the thing carefully or for not complaining (feedback) and seeking clarification on an obviously confusing or inadequate paragraph. We rarely, if ever, say something like, "Yeah, the TO isn't too clear on that point, but we don't expect everybody to do their jobs by merely reading the directions on the package. We sent you to widget school and you are now a seven-level widget specialist. We really think that between you and the tech order, we ought to be getting some widgets that work around here. Furthermore, if the TO isn't adequate, who, but you, will notice it and tell us about it?" We rarely say that, because tech orders, people and airplanes just aren't that simple. They don't fit into nice neat statements like that.

All in all, this is a complex problem, this problem of tech order deficiencies, and we do not, repeat, do not have the answer. For what they're worth, here are a few thoughts on the subject that might be good for some discussion among the troops.

• Our tech data should be as good as we can humanly make it. That's the goal and we should never give up trying to improve our system, but . . .

• . . . if we let progress in maintenance and safety await perfection in tech data, we may have a long wait.

• Even when we attain perfection, that perfect tech order is going to be a compromise between the minimum a trained mechanic needs and the maximum he could be told. Somehow, somewhere, someone is going to have to establish that compromise position.

UNTIL THAT HAPPENS, though, we should not credit our existing tech orders with an aura of perfection that really isn't there. This isn't hard to understand, as the tech order is an inanimate thing that absorbs blame readily. It's a lot easier to point the finger at the tech order than the man and this seems to be what some accident boards are doing. Carried to extremes, the only crime will be to not use tech data; there will be no penalty for not using common sense, good judgment or maintenance training. When that happens, we will have sold out our professional competence in favor of a bunch of cook books.

Ideally, the climate should exist where tech orders are put in their proper perspective and the maintenance troops are given full credit for their professional abilities and a full share of the responsibility for exercising those professional abilities.

Most, we think, would prefer it that way. Most people respond well to the opportunity to exercise their knowledge and are willing to accept the responsibility that goes with it.

Don't get us wrong. We need tech data, we need good tech data, and we need to use it. As far as we know, though, a tech order has yet to turn a wrench, pack a drag chute, or start an engine. Planes are fixed by people and we should not put ourselves in the position where we deny ourselves their professional competence, good judgment and common sense. ★

A TWO-ENGINE GLIDER

"Now," said the IP, "I will demonstrate an engine out." He retarded power on the left engine and punched the feathering button.

"Feel the yaw? Now we correct with rudder, hold airspeed by lowering the nose, trim. Simple. Now, we'll do the same with the other one."

"But, sir, do we shut them both down in the traffic pattern?"

It didn't happen quite that way, but it might as well have . . . it was just as stupid.

The aircraft: A C-47

The crew: An IP, two 2/Lt students, a Tech Sgt flight mechanic

The mission: Transition (VFR)

Apparently all was proceeding normally during the mission, which consisted of a number of touch and go landings at both home base and another field. After nearly two hours of flight, as they were turning out of traffic after a touch and go at home base, the left engine quit.

An immediate right turn was made for entry onto base leg for another runway, the engine was shut down and the crew declared an emergency.

But their troubles weren't over. The right engine began to overspeed and it too was caged, turning the Gooney Bird into a glider. Fortunately, they had the runway made and the landing was completed without further incident.

Okay, so it was only an incident . . . a hairy story to be told at the bar. Not so, it was an incident that tried awfully hard to be an accident. Just alter the circumstances slightly and we could be talking about a fatal accident at worst, and a bashed airplane at best. But what really happened? Why two engine failures? The answers point out some glaring human errors, a carload of complacency, and procedures that invite such an event.

First, there was the IP who failed to monitor the fuel and fed both engines off the same tank to starvation. Next were the student pilot and flight mechanic who failed to monitor the fuel quantity.

Finally there was a procedure in force that, since the aircraft was remaining in closed traffic, the cruise and descent checklist need not be performed. It wasn't!

Needless to say, the unit submitted an AF Form 847 to insert a fuel quantity/selector check in the before landing checklist and a fuel system/status check by the flight mechanic every 30 minutes during all missions.

Considering the fact that the C-47 has been around for some 30 years plus, and we've been making touch and goes out of closed patterns all that time, isn't it about time we learned? ★

REX RILEY'S CROSS COUNTRY NOTES

WHAT LIST: In case you're wondering what has happened to the format on this page we've decided to publish the list of Rex bases just once per quarter. Since the list changes so slowly we see no real advantage in running the same group each month. However, rest assured that if your base is selected it will appear in a space of honor all by itself until the regular quarterly list is published.

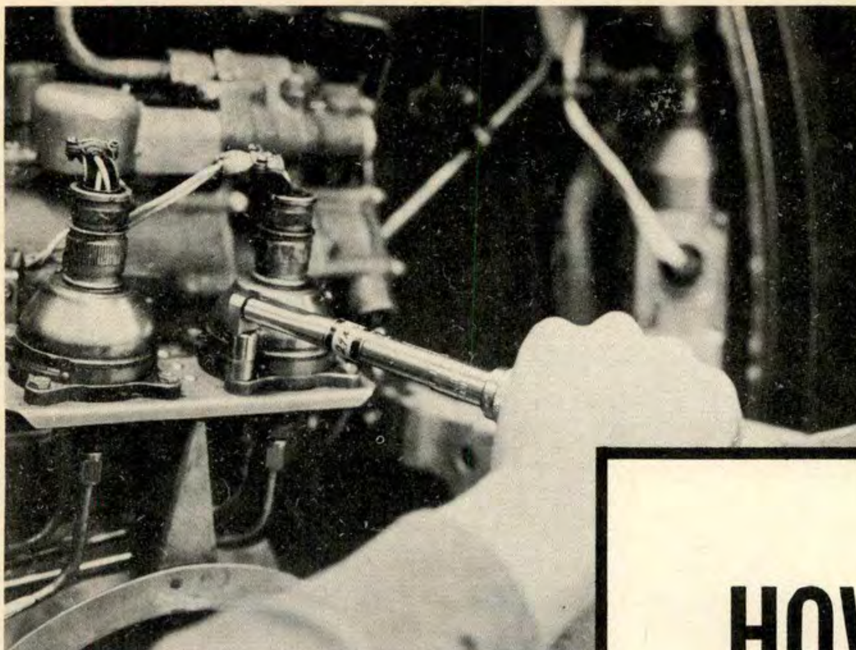
WATCH OUT: If you are like me, chances are that you feel fairly secure after you climb into the positive control traffic structure. That's when you finally relax and leave the clearance to the fellows on the scope. However, after reading a recent near miss report I'm going to keep my personal eyeballs going all the time. Seems that this military bird was at FL 330, in and out of the cirrus when a passenger jet was seen heading his way on a collision course. Evasive action resulted in about a fifty foot near miss. Traffic Control reported that they had no such traffic on their board. We still don't know the outcome of that one. So you see it is most important that you look out. It doesn't really matter who's at fault when you cross wings with another aircraft.

LOST ARTICLES: Any one had a problem with articles disappearing out of the cockpit, like gloves, checklist, helmet bags, etc? ? ? I've had a couple of recent complaints about losses. Best you let the base ops know so they can arrange better security.

SID Sense: When we first devised the Standard Instrument Departure system and published one for each base they served a very useful purpose. The radar coverage at that time was not as complete as it is now and this provided the traffic controller with a planned departure which was a definite advantage in routing traffic. Now, we have progressed to the point that almost every departure is radar monitored and in most cases we're surprised if we don't get a radar climb on course. As a result of this non-use it appears that too little attention has been given to insuring that should it become necessary to follow the SID it is clear and concise in format. I suggest that each base ops should take a critical look at their SIDs and decide if they could follow them if they were in a single seat aircraft, in weather, at night. That's the test. If not, change them.

AN EXTRA service that our tower and approach control personnel provide is recommendation that you "recheck your gear", or "squawk emergency and we'll try and locate you." Believe it or not, we still have pilots who become disoriented and need some assistance from radar to find the field, or need a reminder about the gear. We usually hear about these secondhand but we know they do happen. How about letting us know about these unsung "saves" so we can give a well-deserved pat on the back.

WEATHER CROSS TELL: One of the most reliable bits of weather information is one we call PIREP. When you ask about a destination and the forecaster has a current report such as this we tend to listen because we know that this is a personal evaluation by another pilot. Now, that the bad weather is here make sure that you keep the next guy in mind and give the forecaster a good analysis of what you have experienced. It's a big help. If you take the time to do this maybe everybody will get on the band wagon.



HOW TIGHT ?

How tight is too tight? How right is about right? How important is all of this to you?

It ought to be darned important! Because the Air Force lost a bundle last year due to over- and undertorquing of assorted bolts, B-nuts and other hardware. Take a look:

In FY72, *as a direct result of improper torquing procedures,* six people died; one man was seriously injured; one aircraft was destroyed; two more aircraft suffered major damage; and more than 70 almost-accidents were reported!

These losses are inexcusable. Even if the aircraft were expendable (and they were not), the people inside them certainly weren't. So, since it *is* an important subject, let's talk torque.

When a common wrench is used to tighten a nut, it acts only as a lever to multiply the force exerted. There is no way *anyone* can accurately guess the amount of force placed on the nut. However, by using a torque wrench correctly, the amount of force applied can be measured.

We know that if a one-pound weight is hung on the end of a light steel bar which is supported at the other end, the bar will bend a slight amount. If the weight is doubled the bend of the bar will be doubled. If the weight stays the same but the length of the bar is doubled, the amount of deflection will again be doubled.

All torque wrenches use this principle. They differ only in the way the manufacturer has designed around the principle.

WHY MEASURE TORQUE AT ALL?

Simply this: As modern machinery gets more complex it is designed to narrower and narrower tolerances. There is no room in a modern fighter aircraft, for example, for any component which is too weak *or* too strong. A weak component is subject to failure: a too-strong component, as a rule, is too heavy. The modern machine is a carefully-engineered whole which is the product of carefully-engineered parts.

The parts are frequently held together by fasteners, and many fasteners have one thing in common: SCREW THREADS. And a threaded fastener is always designed to be tightened.

The question is, HOW MUCH? A bolt which is *under*torqued will be subject to cyclic stress (which torquing is designed to relieve) and thus becomes subject to failure; *over*torquing a bolt may increase tension to the point where the bolt fails and no longer carries its share of the load—and this, in turn, subjects adjacent fasteners to increased likelihood of failure.

The first step in finding out how much torque should be applied to a nut, bolt or fitting is to check the Dash Two for the aircraft/system you're working on. More and more, the Dash Two series is becoming increasingly explicit concerning the tightening of specific hardware. If the torque requirement for the particular fitting isn't covered in the appropriate Dash Two, the next step is to check TO 1-1A-8, which gives torque values for general hardware. *The Dash Two is primary, but if the values aren't given in the Dash Two, it is assumed that those in the Dash Eight apply.*

Once you know how much to tighten a piece of hardware, the next step is to select the best tool for the job. It's obvious that the wrench selected must fit the nut to be tightened, and that there must be ample clearance to turn the wrench, but there's more to it than that.

Each torque wrench is designed to measure torque value, but only within certain limits. These limits are known as the RANGE of the wrench.

Most torque wrenches are not as accurate on the extreme ends of the range as they are in the middle of the range. A pretty safe general rule to follow is this: pick a wrench where the torque value you want to measure is about the ¾ point of the range. For example, if you want to measure 750 inch/pounds of torque, a wrench with a range of 0 to 1000 inch/pounds would be a good choice.

Next, check the wrench for calibration. A torque wrench is a precision instrument and, like most precision tools, is quite sensitive to mishandling. Rough use, improper storage or even long periods of disuse can affect the calibration. To be sure your torque reading is accurate, make sure your wrench has been recently calibrated. All maintenance activities are required to have a system to check all torque wrenches periodically, in accordance with TO 32B14-3-1-101.

The manner in which a torque wrench is used often affects the torque reading obtained. The wrench should be turned only with a slow, regular, steady push or pull. A quick, rapid or jerky movement will always give jumpy readings which are not likely to be accurate.

Dirt, chips or damaged threads will also affect torque readings. Where possible, it's a good idea to replace all damaged threaded parts and to clean all threads before torquing. Generally, torque values are specified with the threads clean and dry (although in some cases the threads must be lubricated). Either way, if the thread condition is not correct, the torque reading will be wrong. It is good practice, especially when torquing new hardware, to first tighten the hardware to the desired torque value, back off approximately one-half turn, then retorque to the prescribed limit. This aids in cleaning and smoothing the threads and results in more accurate torque application.

It isn't always possible to torque the nut end of the fastener. Where the bolt head must be turned, the bolt shank friction should be considered. Torquing to the high limit of the specified range will generally take care of this.

Handle the torque wrench like the precision instrument it is. When you are through using it, return it to the point of issue for inspection, test and recalibration if necessary, and safe storage. The next time you or someone else wants to use it, it will be ready for use—and it will be correct and reliable. ★

WHICH WAY DID HE GO?

As you read this story you are sure to say "Did that really happen?" or "Is this a reprint from a 1948 issue?"

With our assurance that it is both modern and true, read on!

The story begins with a flight of two, planning a recovery at *Somewhere* Air Base, where poor, but not really bad weather prevailed—scattered at 500 and 1200 feet, and a 3000 foot ceiling, with 5 to 6 miles visibility. Sounds like a no-sweat situation. The flight leader asked for a radar approach, which was denied due to congested traffic. There is some debate about how congested it *really* was, but it was congestion that led the flight leader to decide on a TACAN-assisted VFR approach.

Though it may be hard to find such a procedure listed in the Air Traffic Control manuals, it might have worked—except that the *wrong* TACAN station was tuned! As a result, the approach was made to *Elsewhere* Air Base, one of the busier airdromes of the world, where the weather was decidedly worse—4/8 at 500 feet, ceiling 1200, visibility 1 mile in heavy rain!

The weather may have been even worse during the TACAN-assisted VFR approach, because the wingman lost sight of lead while in the clouds at 300 to 400 feet.

The flight leader landed safely, but not so Number 2. When he lost visual on lead, he made a go around, and a bad situation became decidedly worse. His TACAN didn't work. He didn't know where he was. He asked for radar assistance, but no one could pick up his beacon. (He apparently failed to turn on his Mode III Selector Switch.) With less than 10 minutes fuel remaining, he was lost.

At this point a phenomenon we've all "heard" about came into play. He sighted a runway through a break in the clouds, which looked to be about 4500 feet long. It looked that long only because it was extremely narrow—60 feet! !

He decided that the best course of action was to land with an alternative of flame out and ejection. The approach was good and touchdown was on speed, but the runway was actually only 2900 feet long!

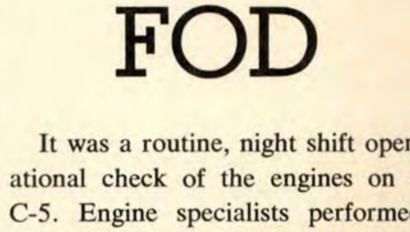
The resulting damage will be repairable, though the work and parts will cost nearly a million dollars. No one was seriously injured! The crew—and all of us—lived to learn from their mistakes. And there *are* things to learn! Traffic control, flight supervision, crew coordination, equipment use, visual reliability!

No, this isn't a hairy tale from the past—it just sounds that way! ! ★

control tools... fight FOD

It was a routine, night shift operational check of the engines on a C-5. Engine specialists performed a walkaround and verified that the intake inspection was signed off. Everything appeared normal.

All four engines were started and held at idle while checklist items were completed, then power was advanced. After about 10 minutes it was necessary to return to idle power while a specialist trouble shot a wing overheat condition. That

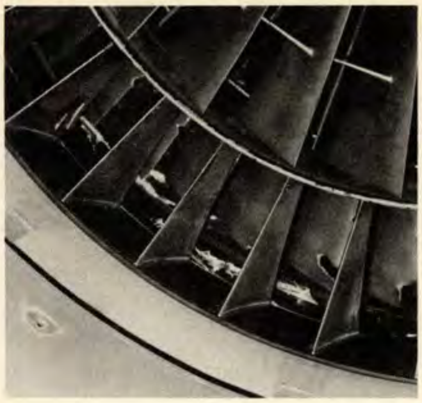


job completed, the crew again advanced power on all four. Suddenly there was a loud thump followed by severe vibration. The engines were shut down and MADAR indicated the trouble in Nr. 3.

Thus alerted, it didn't take the engine crew long to locate the 5-inch bucking bar that had been left in the intake and sucked into the fan.

Some detective work then revealed several discrepancies that added up to sure trouble. Our story really began several days before this event when some rivets were replaced in the Nr. 3 engine cowling.

The bucking bar might have been found if the job had been entered as a Red Cross, as required, instead of as a Red diagonal. The Red Cross would have required a supervisory inspection. The Red diagonal didn't.



Furthermore, the rivet repairman did not use a tool inventory checklist.

Finally, the FOD inspection just prior to the engine run apparently was not very thorough. ★

it shouldn't take an accident

The time: night. The place: a rainy part of the world. The situation: the F-4 was returning from a night combat mission.

The pilot returned to home base via radar vectors to a GCA final—everything ops normal. Touchdown occurred at 160 knots, 1000-1300 feet down the runway. The pilot deployed the drag chute and let the aircraft roll out on centerline, engaging nosewheel steering at 100-110 knots. As the airspeed bled off through 80 knots, he began applying brakes; at this point there were 2000-3000 feet of runway remaining.

At 20-30 knots everything appeared normal—the aircraft was still on centerline—and the pilot turned off the anti-skid. The aircraft began a slight drift to the left. The pilot reapplied brakes evenly and attempted to correct the drift with nosewheel steering. The drift continued. After approximately 280 feet the aircraft departed the left side of the runway—180 degrees from runway heading. The right main gear collapsed, damaging the right main spar.

Ouch! That hurt! ! Everything going so well, and all of a sudden we have a major accident on our hands! ! ! What in the world went wrong? ? ?

Well, a lot of little things went wrong:

• The pilot was very slow about starting braking action. In fact, he waited until he'd arrived at the very slickest part of a wet runway—the last 2000 feet, where rubber deposits are thickest.

• The pilot didn't bother following Dash-One procedures for landing on a wet runway. He didn't maintain full aft stick (in fact, he didn't maintain *any* aft stick) during any part of the landing roll.

• The guy in back didn't help much. He might have been calling off airspeeds during the landing roll to help the pilot better gage his deceleration.

• The 4000-feet-remaining and 3000-feet-remaining markers were missing. There has since been a hazard report submitted on their absence and, presumably, corrective action has been taken. But a hazard report submitted before the accident might have prevented it.

• The pilot had just returned from the second of two back-to-back night/weather/combat sorties, and there's no doubt that he was tired. Perhaps that kind of scheduling is necessary. But perhaps not, and supervisors should be constantly aware of the invitation to an accident represented by aircrew fatigue.

• The main tires were mismatched. The right main was a four-groove and the left main a three-groove. Studies in the past have indicated that four-groove tires are much more resistant to hydroplaning than are three-groove tires, and that directional control is degraded when tires are mismatched. On-going studies are expected to confirm this. In the meantime, if we must use three-groove tires, *both* tires should be three-groove.

• The base at which this occurred has doubled the frequency of cleaning the rubber deposits off the runway; deposits are cleared quarterly instead of semi-annually. Other units should analyze their incidents of hydroplaning to assure current practices are sufficient. *It shouldn't take an accident* to provide a clue. ★

THE AIRFRAME

The following story offers a good example of the way a concern for safety, coupled with an inventive mind, can lead to a better, more efficient operation. New and better solutions are constantly being found for the problems which plague us all; it is extremely important that each one be carefully evaluated, properly engineered and—once that is accomplished—ADVERTISED so that everyone can benefit.

"Sir, one of our cross-country F-5's is grounded for a gearbox change. The base has no AGE gear to do the job." The Chief of Maintenance has heard this story many times. He leans back and asks the Maintenance Control Chief if he has any ideas. He says, "Yes, sir, our people have made a pad (Figure 1) to take the place of the adapter shown in T.O. 1F-5A-2-2. If the base had a jack that would work on it, we'd be in business, but they don't." So the Chief of Maintenance concludes that with help from the transient crew our mechanic can manhandle the gear box change. The job gets done while the Chief of Maintenance worries about the safety of it. The bird gets back and all is well.

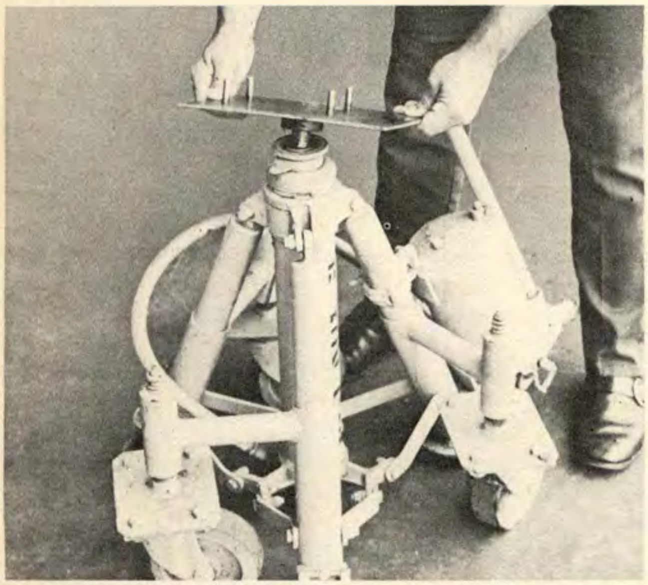


Figure 1. Generator Pad for Use on Standard Jack.

About two or three weeks later, the same mechanic walks into the office of the Chief of Maintenance carrying a survival kit container. He opens the lid and says, "Sir, I'd like you to consider a safer way to change a gearbox when we don't have the authorized AGE gear and sometimes not any help." The mechanic picks up the canvas bag from the container, zips it open, and proceeds to build up a flyaway gearbox adapter—jack, plate, base on rollers—the whole works! He says, "Sir, we can stow this as you saw and fly it anywhere. We can remove and replace the gearbox with one man and it's safe!" The Chief asks about the strength of the base. The mechanic says, "I don't know sir, but since it's quarter-inch aluminum plate, it does the job and is light for the flyaway kit."

The assembly continues by the mechanic taking an ordinary automobile bumper jack base out of the bag and bolting it in the center of the baseplate, using four quarter-inch 28-thread screws long enough to secure it. The mechanic took the jack shaft. The Chief of Maintenance says, "What did you do to that?" (seeing it was modified by shortening and welding a guide on one end). The mechanic responded with, "Well, sir, it was too long, so we cut it off and welded the guide on the end that wasn't made to fit in the jack base. This guide is for guiding the main cylinder tubing."

The mechanic installed the jack mechanism on the jack shaft and installed the jack shaft in the jack base. The jack mechanism has a cup-shaped fitting welded to the top of it through which the jack shaft runs. The Chief wanted to know why it was threaded. The mechanic explained, "Sir, I used an old T-33 canopy remover cartridge for the main cylinder, but any tube would work. It doesn't have to be threaded as long as it fits snugly in the bottom cap and the guide fits snugly in the tube." He screwed in the adaptor and said, "We threaded this, too, because it was handy. It needs to be attached to the main cylinder in a firm manner so the unit is stable when supporting the gearbox." The mechanic took the extension out, inserted it into the adapter, and pinned the inner tube with a steel pin. He inserted the shaft of the upper plate assembly into the extension and said, "That's it, sir; let's take the gearbox out."

The Chief of Maintenance noticed he did the whole job with one No. 10 Torq-set screwdriver. He said, "Looks good and feels sturdy—how long does it take you to assemble it when I'm not bothering you?" The mechanic said, "About 10 minutes, sir."

They rolled the unit under the F-5, jacked it up to position, and Airloc fastened the upper plate to the cross members of the gear box. The gearbox removal was completed, the unit was jacked down and rolled out. The mechanic said, "There you are, sir."

This story depicts the conditions surrounding the solution of a real problem. Ingenuity on the part of Mr. Farrel F. Stiles, Vance AFB, and an interested Chief of Maintenance are the ingredients of that solution. See photos on page 17.

Units interested in locally producing this item should consult AFM 66-1, Vol II, para 2-117 and 2-118, which covers the local manufacture of nonstandard or specially designed tools.—Ed.

—F-5 Service News
Northrop Corporation

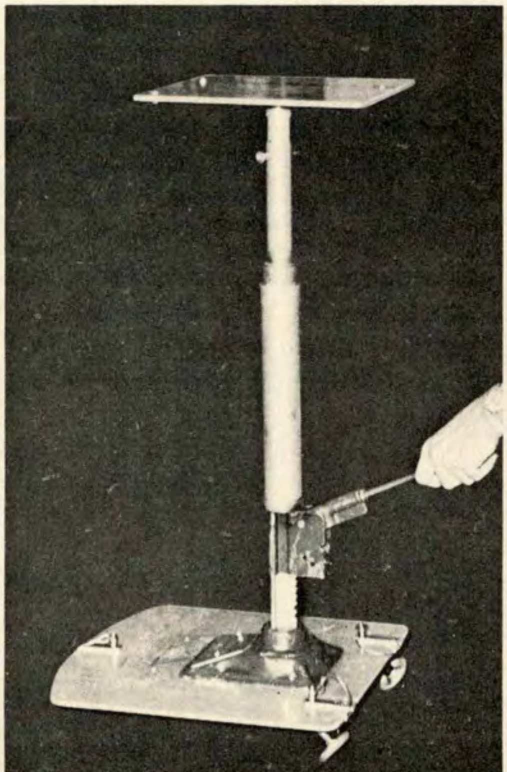
GEARBOX DILEMMA

Pieces Unstowed.

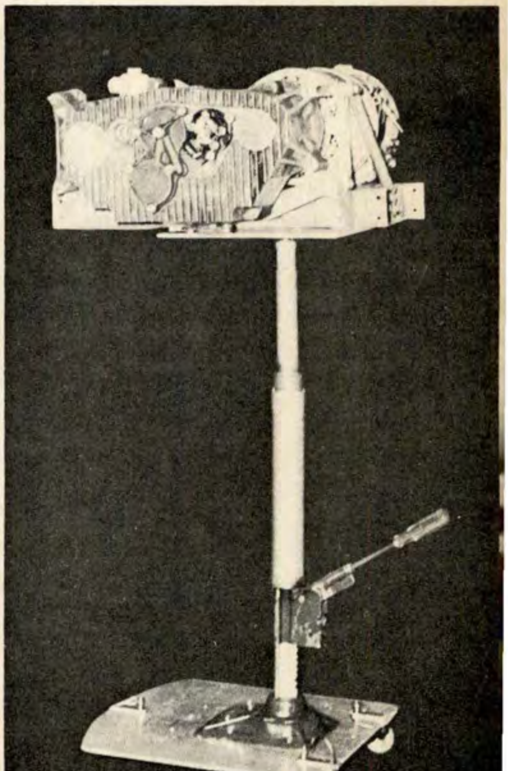
Base Plate and Jack Base.

Jack Shaft Tube and Adapter.

Extension and Upper Plate Assembly.



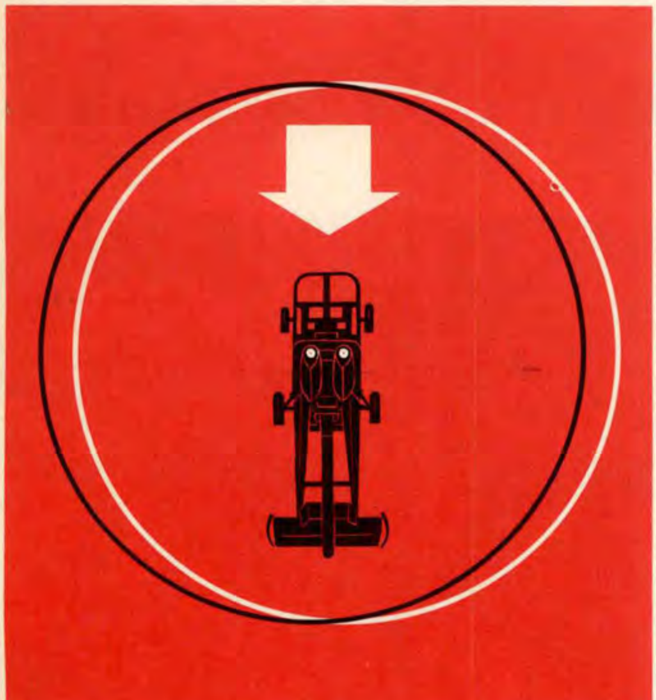
Assembled for Use.



Gearbox Loaded.

OPS TOPICS

approach pedro from the front



A USAF HH-43B "Husky" was scrambled recently to pick up a pilot who had successfully ejected from his crippled airplane. The downed pilot was located in a heavily timbered area, but the pilot of the helicopter was able to locate a clear area nearby. The spot selected was surrounded by trees, but sufficient clearance existed to allow a safe landing.

As the rescue pilot initiated the landing, the downed pilot ran toward the front of the helicopter—which is the recommended approach path for the HH-43. But just as the helicopter was touching down, the downed pilot suddenly changed his approach direction and started to enter from the right side.

To prevent injury to the man on the ground, the helicopter pilot immediately brought the aircraft to a hover, turning 45 degrees right for added clearance. As he did so, the left hand blades made contact with branches of a tree, seriously damaging both left hand blades. Fortunately, the pilot was able to accomplish a landing and a normal shutdown; there were no injuries.

"Pedro," "Husky," HH-43B—whatever you call it, it is used worldwide as a rescue helicopter. Everyone who might have occasion to be a guest on one—and that means you!—should be aware of the proper approach zone. Fortunately it's easy to remember—because there's only one. Check the accompanying illustration.

cleared visual approach

Recently one of our newest tactical aircraft was returning to base following a night VFR training mission. Destination weather was good, although isolated patches of blowing dust existed in the area due to high winds. Approach Control sequenced the aircraft for a visual approach behind other traffic and released him to Tower at a VFR fix several miles southwest of the field. The tower controller acknowledged the pilot's report over the fix and cleared him for a straight-in approach with a request to report on final.

Shortly thereafter, the pilot reported on final for a full stop. Tower issued a gear check, winds, landing clearance and advised the pilot he was not in sight.

A rapid visual search by the tower crew finally spotted the aircraft—descending smartly and lined up with a highway a mile or two away from and parallel to the runway! Tower advised an immediate go-around, and the pilot quickly complied. An increase of runway lights intensity solved the immediate problem, and the landing was accomplished without further incident.

The use of visual approaches and vectors from either Stage II or Stage III radar service is a valuable tool for expediting the flow of traffic in terminal areas. However, good operating practices require pilots to keep themselves oriented with respect to the landing runway by using all available NAVAIDS. This is particularly important when operating in high density areas, into unfamiliar airfields and during periods of reduced visibility.

—*AFCS*

where'd that tree come from?

The weather wasn't really good enough for a flyby, but it was forecast to improve, so the nine aircraft launched IFR (in two-mile visibility) to hold VFR on top and await their cue.

While descending from the holding pattern to 1000 AGL, the number three element leader lost sight of the leading elements. He continued to descend anyway, and entered a low cloud deck.

He suddenly realized he was too low, and called for the flight to pull up. The flight rejoined on top and went on about their business, rejoining the formation and completing the flyby.

It wasn't until the maintenance postflight that they discovered that the right wing man's aircraft had sustained minor damage from hitting a tree.

Shudder! ! !

That must have been a darned important flyby—important enough to launch in the face of weather below AFR 60-6 criteria—and important enough to divert the element leader's attention from the task at hand: keeping himself and his wingman healthy!

a normal mission—to preflight

The UH-1P preflight checklist requirements are brief and simple. There are only three major areas: the first is "Tiedown—REMOVED". Recently a Huey driver attempted to get into the blue without taking care of that little item. Needless to say, he failed.

To paraphrase the incident report, "The pilot was making a *normal* preflight in preparation for a range support mission. As he approached the tail boom, his preflight was diverted to check the loading. He then resumed and completed the preflight, but without noticing the rotor tiedown strap still securing the tail rotor to the aft-positioned main rotor blade. An engine start was subsequently initiated with the blades tied down, but discontinued when the pilot noted the main rotor was not turning. As the throttle was closed, the tiedown strap broke and the main rotor made two revolutions, during which the tail rotor blades contacted the drive shaft housing."

It is hard to visualize how a major and obvious discrepancy such as this could be overlooked during even a cursory preflight. There are many lessons implicit in this incident, the most obvious being—follow the checklist and do not interrupt the sequence.

FLIP CHANGES

FSS Radio Frequencies: To reduce frequency congestion and its related problems of interference within the FSS system, the use of standard VHF frequencies at FSS's has been discontinued. FSS UHF frequencies are not affected. Each FSS will now have available one or two enroute VHF frequencies, each protected for the service volume of the facility. In addition, 122.2 will be available at all FSS's to provide a common enroute frequency. The Enroute Low Altitude Charts will be revised to eliminate the shadow box which is now used to indicate the availability of standard FSS frequencies. In place of the shadow box, the frequencies available at that site will be listed above the NAVAID identification box. FSS's designated as Enroute Weather Advisory Service (EWAS) stations are indicated by two solid triangles within the top corners of the identification box. The EWAS frequency 122.0 is common throughout and will be identified in the legend only.

fooled ya!

The mission was barely airborne when the KC-135 was diverted into a different airfield to pick up another crew. GCA to the runway was routine; VASI confirmed a good glide path, with 400-500 fpm rate of descent. Unfortunately, the aircraft contacted the runway without any appreciable arresting of the descent, and bounced back into the air. The second and final touchdown was a four-pointer—the right main and nose gear, and numbers 3 and 4 engines.

The runway was about one-third narrower than the ones the pilot was used to. The IP on board (but not at the controls) was so concerned that he briefed the pilot on possible perceptual errors prior to the approach. Apparently the briefing wasn't enough, for the pilot still failed to perceive the proper point at which to arrest the descent. (He also used improper procedures while recovering from the bounce.)

The IP had not familiarized himself with the pilot's recent experience. The pilot had received his aircraft commander checkout, then flown right seat missions for about six weeks before going on leave. This was his first mission after ten days of leave and his initial "operational" mission as aircraft commander. Had the IP considered this, he most likely would have occupied the right seat for the approach and landing—just in case.

Prudence somewhere along the line would surely have nipped this blossoming accident in the bud.

keep it up

While most USAF flights are conducted under IFR, there is still a small coterie of VF and R pilots in our group who should be interested in FAA's recently-adopted "High Flyer" program. The idea is to keep the noise to ourselves, and there are three basic operating rules:

- Pilots operating aircraft over outdoor assemblies of persons, recreational and park areas, churches, hospitals, schools, wildlife areas and other such noise sensitive areas should fly at least 2000 feet above the surface, weather permitting, even though flight at a lower level may be "legal."
- Circumventing noise-sensitive areas is preferable to flying over them at low altitude.
- Climb after takeoff and descent for landing should be made so as to avoid prolonged flight at low altitude.

Of course, these procedures in no way conflict with such things as ATC instructions or other situations in which safety of flight might be compromised.

weather advisories

For all the jawing that's done about it, there's still an apparent misconception among pilots regarding the responsibilities and capabilities of Air Traffic Controllers, particularly when the pilot is trying to navigate in and around weather buildups.

For the record: The Controller can't "see" lightning, turbulence and most other weather. All the radar will pick up is precipitation, and if the Controller is using the circular polarization function on his scope, he won't pick up the precip either.

Further: The Controller's primary job is traffic separation *between IFR aircraft*. Anything else falls into the nice-to-have category, depending on the Controller's workload.

Now, let's say you're in and among the thunderbumpers—we won't ask how you happened to get there—and you want some help getting out. Can you get it? Sure—unless you're in the middle of the Chicago-O'Hare TCA or fifteen other guys have made the same mistake.

The point is: Air Traffic Controllers are justifiably proud of the service they render. As a matter of course, they do far more than the minimum required. But weather avoidance *is* an extra, and advisories may not be available under certain conditions. The best advisory is not to get into anything you can't get out of.

checklist ignorance

The F-4 was at another base for Mod when the ten-day parachute inspection came due. While inspecting the back seat, the technician discovered that the parachute safety pin lanyard was not routed through the alignment ring. Searching further, he found that the safety pin was installed backwards and not safetied. The important factor here is that if some backseater had had occasion to use the chute, he would have been sorely disappointed.

The F-4 is unique in one respect: there is a rather comprehensive preflight inspection of the ejection system required of the aircrew—step-by-step procedures are contained in the aircrew checklist.

Also unusual is the frequency of inspection by the Life Support section—a ten-day interval.

In this case, the misrigged parachute had been missed on no fewer than *five* successive ten-day inspections AND on every aircrew preflight over a two-month period. As an example of across-the-board lack of checklist discipline, that's hard to beat. ★

MORE ON IRAN

LT COL RICHARD H. WOOD, Directorate of Aerospace Safety

In June of 1972, we published an article by Mr. George E. Kammerer of SMAMA titled, "IRAN versus IRAP." The substance of the article was that the term IRAN (Inspect and Repair as Necessary) is misleading in that we don't do that anymore. We program our depot-level maintenance around what needs to be done and those who do not understand this concept are in for a career's worth of temper tantrums and high blood pressure.

The article generated a few letters and comments and it became apparent that there is still plenty of room for discussion of IRAN—what it is and what it is not.

We at the Directorate of Aerospace Safety are in no position to jump into the depot-level maintenance business and argue specifics, but we do see several areas that are contributing to misunderstandings and ill feelings.

First, the term "IRAN" has officially been changed to "PDM," Programmed Depot Maintenance. Those of us who still think the phonetic alphabet begins with Able, Baker, and Charlie will probably continue to call it IRAN for a generation or two, but we should at least acknowledge the change in definition.

Next, the annual Maintenance Manager Review (MMR) for each weapon system has not, in all cases, received the attention it deserves. Aside from being a technical review of maintenance techniques, it is also where AFLC and the senior maintenance managers of the using commands are supposed to get together and assess depot-level maintenance requirements. Here, AFLC will present its proposed PDM plan and discuss such determinants as the Analytical Condition Inspection (ACI) Program, the Aircraft Structural Integrity Program (ASIP), and other data sources. Presumably, the commands point out other work that is essential, but beyond the commands' resources, and work that can best be done concurrently with the PDM when the bird is opened up. Hopefully, everyone comes to some sort of agreement on PDM and AFLC develops its PDM work package on that basis. If the using commands didn't make their position known at the MMR, the score is AFLC 4, visitors, 0. (5 - 0 is a skunk and the game is over.)

Finally, the importance of the PDM work package itself gets overlooked. Frequently, we find that the firm published work package is not available at the local level where the planes are. As a result, the locals can't possibly do a good job of notifying the depot of specific conditions on specific aircraft which are outside of the work package (AFTO Form 103); nor can they reasonably evaluate the depot's work (AFTO Form 64) when they get the plane back. Small wonder that the mere mention of IRAN—oops—PDM tends to raise blood pressure and melt earwax.

"Yeah," you say, "that may be the way things look from up there in the ivory tower, but that's not the way they are in the real world where we have real airplanes and real people!"

We know, we know, we know. The whole problem of depot maintenance is far more complex than we've described here, and the procedures for some weapon systems don't seem to fit anything we've said so far.

Help is on the way. The recent Air Force-wide LGM conference was helpful in thrashing out these problems and revised directives are now in coordination. If it's not too late, you can cancel your correspondence course in clairvoyance, because the PDM work package should no longer be a surprise to anybody. ★

Tech topics

wrong fuel

How much JP-4 pumped into an avgas burning O-2 would it take to cause problems? Any amount would be too much.

After all that has been said and the precautions that have been taken, one would think it would be impossible to pump the wrong fuel into any bird, but it has happened again. In fact, it happened to two O-2s in the same outfit.

The crew chief was preparing to refuel the O-2s but the normal avgas tank was empty so he called for a truck. Not noticing the JP-4 markings on the truck, he serviced the two aircraft.

Next morning when the aircraft were prepared for flight, the crew chief did not notice any abnormalities during fuel sampling. The pilot arrived and after strapping in, could not get the engine started. He aborted the first aircraft and proceeded with the second. This one started okay but during runup at the runway, the front engine was erratic at 2300 rpm. The pilot aborted and the mixed fuel was discovered.

Both the pilot and crew chief were cited for not detecting the mixed fuel during their preflight.

To go a bit further—some responsibility should be placed on POL and the flightline supervisor. POL supervision was deficient in allowing a JP-4 truck to be dispatched to an O-2 aircraft, and flightline supervision was deficient in not detecting the JP-4 truck.

garbage can

During pre-taxi checks of an F-105, control stick movement was limited to two inches left of neutral. The crew chief reported the left aileron full down with the right streamlined. The mission was aborted and the bird turned back to maintenance.

During troubleshooting, when panel W-7 was removed to inspect the aileron components, 17 Jo bolt stems were found, one of which was lodged in the control end of the actuator restricting its movement.

Review of the aircraft records indicated previous replacement of nine Jo bolts in this area.

As a result of this incident, the unit decided to take a look at more assigned aircraft. Inspection of 15 aircraft revealed seven with foreign objects in the same area. The debris ranged from one rivet to 19 separate items, including nuts, washers, broken clamps, even a rubber bulkhead cable guide. That bird was a real garbage can.

How about your aircraft? Are they FOF (foreign object free)? Would you stake your life on it? The pilot does each time he straps in!

crossed wires

Approximately three minutes after takeoff the Nr 4 **generator-out** light came on. The generator was turned off, and it was noted that both voltage and frequency inputs monitored zero. Attempts to reset the generator were unsuccessful. The Nr 4 disconnect switch was actuated and a few seconds later Nr 3 **generator-out** light and Nr 3 **disconnect-fired** light came on. No further attempts were made to disconnect Nr 4 generator. The mission was aborted and the C-130 returned to base.

Maintenance found the wires crossed: The Nr 3 generator disconnect wire was connected to Nr 4 switch, and, of course, Nr 4 to Nr 3. The place and individual who performed this incorrect wiring job could not be determined, but one thing is sure—whoever he was, he didn't follow the TO.

improper installation

A C-131 was cruising at 11,000 feet when the pilot noticed something move outside the pilot's window. Shortly thereafter the rank holder fell off the aircraft.

Improper installation was the cause. Although the C-131 series TO does not give instructions for installation of the rank holder, TO 1-1A-8 describes the proper method for installing cherry rivets which were used during this installation.

Lesson: if the specific aircraft tech order does not cover the job, consult the general tech order.

the goon deserves better

The Goony Bird, as old as it is, still shows up in the incident reports. Here's a maintenance goof that never should have happened.

Just after takeoff the cockpit filled with smoke and the flight mechanic reported heavy smoke and flames coming from number two engine cowl flap area. A closed pattern was flown and single engine landing accomplished.

The cause: the cowl flap actuator had been installed upside-down. This allowed the hydraulic line to be rubbed by the cowl flap. The line wore through and hydraulic fluid sprayed on the hot exhaust. During inspection of other aircraft in this unit three additional actuators were found installed upside-down. There must be a guy named Murphy working in this outfit.

inspect the work

As the C-141 passed through approximately 1000 feet on takeoff, the number two emergency escape hatch departed and cabin pressure was lost. The mission was aborted. It didn't take long to discover why the hatch departed. The hinge pin had been left out during prior maintenance. Even though an entry had been cleared in the 781 concerning the hatch, the inspector failed to detect the missing hinge pin.

TO 00-20-1 clearly states that the use of a red x symbol has been established to insure **inspection of the work performed.** In other words, just signing the forms won't hack it. The inspector is directed by tech data to conduct a complete and thorough inspection which includes all access panels which have been removed to perform maintenance.

murphy strikes again

Transient Alert Section had borrowed an MC-1 compressor from the base shops to service a tire on a visiting Talon. The low pressure air chuck had been accidentally attached to the high pressure air hose. The air chuck was connected to the T-38A main landing gear tire and the low air pressure gage was set at 185 psi. Failing to obtain any air pressure from the low pressure regulator, the technician opened the high pressure valve.

The servicing of the T-38 tire with the high pressure air resulted in the tire and wheel being blown from the axle. Disintegrating parts severely damaged the main landing gear door, brake assembly, and strut door. Nearly 30 manhours were required to replace the damaged parts. Fortunately, no one was injured.

The availability of high pressure air and its inadvertent use in low pressure air systems is a continuing problem. The very nature of working around lethal equipment on the flight line provides a fertile ground for gruesome accidents. Add complacency or unfamiliarity to this environment, and you have the vital ingredients which can wreck the best planned safety program.

(Northrop Talon Service News)

$142,411.00 pair of pliers

A J-75 engine was delivered to the test cell following maintenance. The inlet covers were removed, inlet inspection completed and covers reinstalled. The engine was placed on the test cell and prepared for run. Again the inlet cover was removed and the inlet inspected. The bellmouth screen was installed and the engine started. It was run up to military power twice for trim adjustments, then a third runup was made for final test readings. After about two minutes of the final run, sparks were seen coming from the compressor bleed ports. The engine was shut down.

A pair of needle nose pliers had been left in the bellmouth area and was ingested by the engine.

finish the job

When power was applied, during preflight of a C-130, the Nr 3 nacelle overheat light came on. Maintenance soon found the problem: Water in a cannon plug in the engine compartment. After the water was drained and the cannon plug dried, the system operationally checked okay, preflight was completed and the bird released for flight.

Just after liftoff, as the gear was retracting, the Nr 3 nacelle overheat light came on again. The engine was shut down and the light went out. Return to base was uneventful.

Maintenance went back to work on the system and completed the job they had started during the earlier troubleshooting. **They cleaned the rust from the cannon plug.** Had these troops cleaned the plug after it was dried, this inflight abort would have been prevented.

Tech topics

murphy at work

After takeoff, when "gear up" was selected, the right main and nose gear of the F-4D failed to go to the up and locked position. When the gear selector was placed down, the right main and nose still indicated unsafe and utility pressure was zero. Emergency extension was selected and all three showed down and locked. Fuel was dumped, the flaps blown down and an approach end barrier engagement successfully accomplished.

Maintenance found that the right inboard gear door and linkage assembly had come in contact with the inboard door hydraulic actuator line during retraction, which caused the line to fail, depleting the utility system.

Examination of the line revealed a true Murphy.

The line installation is such that access to the DZUZ fastener that secures the refueling control panel is limited. Photo Nr 1 shows the correct way to disconnect the fastener, but, as you can see, this can be a "knuckle buster". Photo Nr 2 shows the more common method of gaining access to the DZUZ. This method is easier on the knuckles but tends to reform the line to a forward position after a period of time. Repeated binding of the line can also lead to looseness of the B nut.

Photo Nr 3 shows the end result of bending the line. It will eventually come in contact with the inner door linkage, as was the case in this incident. Photo Nr 4 shows the normal undisturbed position of the line as the door closes.

The unit in which this incident occurred has recommended to the AMA that wing nut DZUZ fasteners replace the screw type on the refueling control panel.

Photo One

Photo Two

Photo Three

Photo Four

oops

Failure to comply with established directives has been the prime cause of many an accident and incident. Here's a recent example.

The load crew was dispatched to upload an F-4. Upon arrival at the aircraft they found it completely armed. They dearmed it but failed to remove the centerline cartridges. Then the jettison function test was started on the left outboard pylon. Everything progressed normally and both left pylon checks were completed. The crew moved to the centerline station. The crew chief pulled the safety pin, number three man connected the PSM-6, the signal was given that all was ready. **Number two man actuated the centerline jettison switch. The station jettisoned as designed.**

Compliance with each step of the checklist (which includes removal of all impulse cartridges) would have prevented this incident and a lot of red faces.

a classic example

A classic example of not documenting maintenance in the A/C forms comes to light in this incident.

The preflight, engine start and before taxi checks appeared normal. During initial taxi the chopper began veering to the right. Normal control inputs would not stop the turning movement. The aircraft was stopped and the right brake checked for possible dragging. The brake was found ok but the nose gear was cocked 90 degrees to the right. Suspecting that a cocked nose gear was causing the directional control problem the pilot proceeded to raise the nose gear off the ramp for re-centering. As cyclic and collective pitch were increased the aircraft rotated to the right and began a horizontal movement.

The chopper was placed firmly on the ramp and the engine shut down. During engine shut down the pilot discovered that he had no tail rotor control.

During investigation it was discovered that prior to this incident three automatic flight control specialists were dispatched to replace a trim sensor switch. After removing a bolt that connects the yaw servo to the tail rotor control rod the bolt was placed in a tool kit. At this time the specialist discovered that the yaw servo would have to be removed to replace the sensor. The maintenance superintendent made the decision to delay replacement of the sensor due to mission requirements. Neither the superintendent nor the crew chief was aware that the linkage bolt had been removed. The specialist forgot about the bolt (it had not been entered in the 781 as required by Tech Order) and buttoned up the bird.

TO 00-20-5, para 9-1 clearly describes the requirement for entering the Red X whenever maintenance is performed on aircraft flight controls.

The prime time to enter this Red X would be at the start of maintenance when the system is disturbed. (When the bolt was removed the Red X entry should have been made.)

age is important too

A KC-135 was in the hangar on jacks for a retraction test. After the test was completed and the crew was down jacking, the tail jack extension screw separated from the jack ram. This allowed the aircraft to rock back on its tail and strike a mechanic's tool kit. This was followed by a forward rocking motion but the forward right inboard jack missed the jack point and went through the wing skin. The stabilizer and number two engine cowl were also damaged during this movement.

Once the aircraft was safely on all three gear the investigation started. It didn't take long to determine that the extension screw stop was badly worn and the screw had been extended to the point where less than one thread was holding in the ram. This part of the thread failed during the down jacking. (The tech order limits extension of this screw to 15 inches.)

There are two lessons to be learned from this accident:

- Never extend the extension screw beyond TO limit—do not depend on the screw stop.
- Thorough and timely inspection and maintenance on all age equipment is essential.

no cotter pin

As the KC-135 was taxiing to the runway, number one engine flamed out. The aircraft was returned to the parking spot and turned over to maintenance.

It didn't take long to discover the problem once the cowling was open. The throttle to fuel control linkage was disconnected. The bolt that makes this connection had come out, allowing the linkage to separate and the fuel control to go to the cut off position.

This bolt is normally secured with a cotter pin, but no trace of the cotter pin could be found.

Suppose that this linkage had separated just after the bird became airborne. Things can get pretty hairy at this stage of flight when you suddenly lose an engine.

tech data slip

Sometimes the tech order doesn't give the mechanic all he needs to know to do a job. Tech Order 1T-38A-2-6 is a good example. It gives detailed information on removal and installation of the engine bay throttle cable quadrant assembly, but there are no specific instructions for disassembly or reassembly of the quadrant.

During maintenance on one bird, the quadrant pulleys were installed in reverse. In this reverse configuration, the throttle control cut off cam can only be installed backwards. With the cam in this position the 90-degree face of the cam will strike the throttle control fuel switch striker bolt, rather than the 32-degree angle face as designed. In this case rapid or firm movement of the throttle to the idle position will actuate the fuel flow control valve shutting off fuel to the engine.

When this was discovered, the unit immediately prepared an AFTO 22 and instructed every man working on this assembly on its proper maintenance. ★

What happens when a Minuteman missile guidance and control (G&C) coolant system springs a leak? Two things of primary significance—loss of internal G&C cooling and corrosion damage to components. The leaks have been both internal (inside the G&C) and external (associated with the exterior "plumbing" of the cooling system).

Cooling is essential to the proper functioning of the interior electronic components in the guidance package which are in constant 24-hour operation on all alert ready Minuteman missiles. Loss of coolant leads to overheating and ultimately causes extensive damage to micro-miniature electronic components, requiring complex repair or complete replacement.

Loss of the component cooling function is not the only problem which develops as a result of a coolant leak. When liquid coolant (powdered sodium chromate mixed with water) escapes from the G&C cooling system and is exposed to the atmosphere it becomes highly corrosive. As a result, any cooling system leak can lead to substantial damage in the G&C unit, the missile, or any number of the many cable and accessory systems which make up the fully configured weapon system.

A NUMBER OF LEAKS have been caused by material deficiencies such as: a manufacturing flaw in the machinery of a plug used internally in the G&C; failure of an umbilical (connector which provides ground power and cooling to the missile) coolant port to automatically align during mating; failure of an epoxy seam in the computer case of the G&C.

Still other leaks have been caused by personnel errors: failure to connect coolant lines prior to applying electrical power; mismating of the G&C umbilical connector to the guidance unit; failure to follow technical order procedures.

TO ISOLATE the materiel failures and reduce the potential for personnel error, Materiel Improvement Projects have been established and are being conducted by AFLC. In addition, new procedures and tests have been developed and implemented to aid in identifying leaks in their earliest stages. One of these procedures is accomplished by the specialized repair activity at Newark Air Force Station, as a portion of the final check-out for the guidance systems. The checkout involves pressurizing the internal coolant system using dry nitrogen to test its ability to retain pressure within specified limits. A similar type of test, to be accomplished at unit level, either at the launch facility or on the base, recently has been included in field level technical orders along with distribution of newly designed portable test equipment.

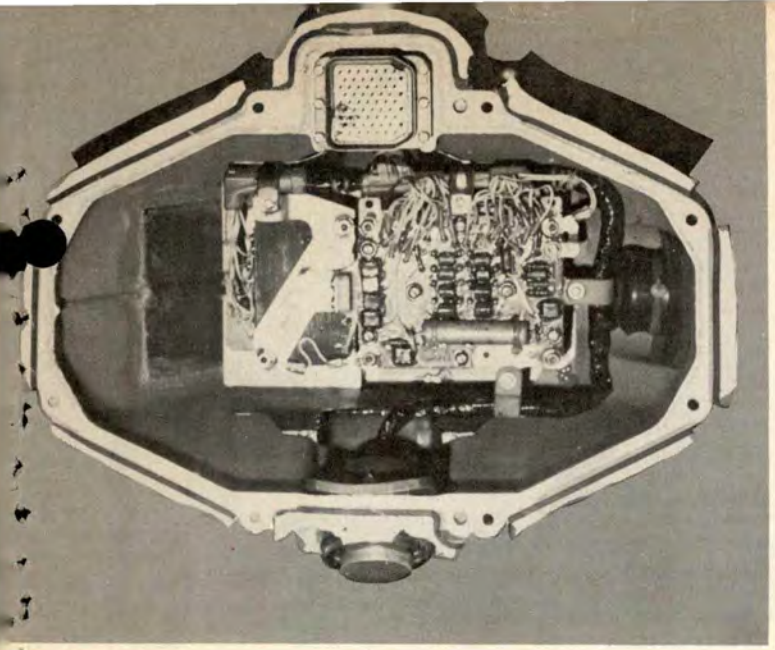
Along with these actions, increased attention and emphasis by maintenance technicians contribute to early identification of G&C leakers. For example:

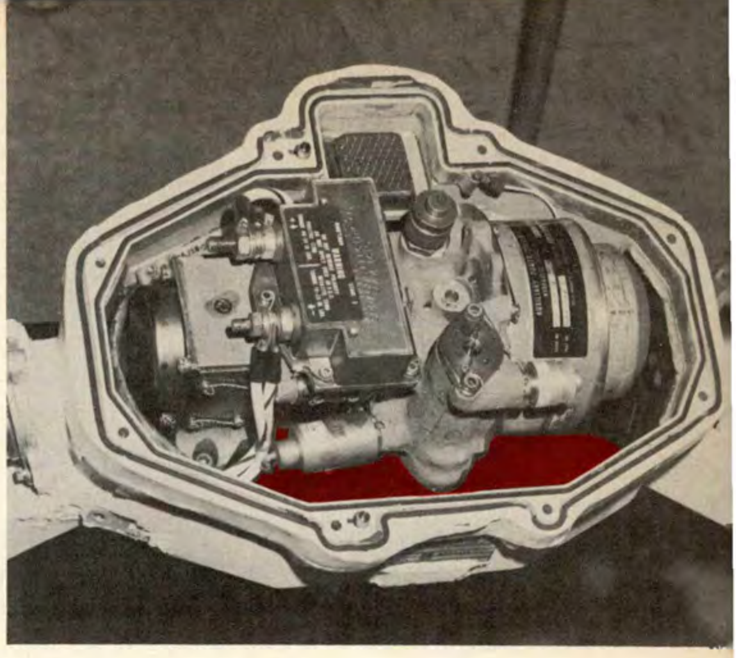
By looking for tell-tale traces (greenish-yellow stains) of pooled or dry sodium chromate on the ground adjacent to the sump discharge pipe and in the drainage ditches at the LFs.

By being aware of which hoses contain sodium chromate and looking for leaks primarily at connectors

MINUTEMAN "LEAKERS"

LT COL ROBERT E. WALKER, Directorate of Aerospace Safety





At left is a Minuteman Third Stage Nozzle Control Unit opened to expose the complexity of the internal components and circuitry so highly susceptible to sodium chromate damage. On the right is a Third Stage Nozzle Control Unit which was removed from an operational missile after a leak was discovered in the G&C cooling system. Sodium chromate is shown in red, although the substance actually is yellow.

for the chiller unit and storage tank(s).

Being suspicious of having to replenish the coolant storage tank with large quantities of coolant.

By inspecting the missile and G&C and looking for signs of coolant leakage (droplets, streams, or stains):

(1) Around the umbilical where it mates with the G&C.

(2) Around any vent holes on the missile.

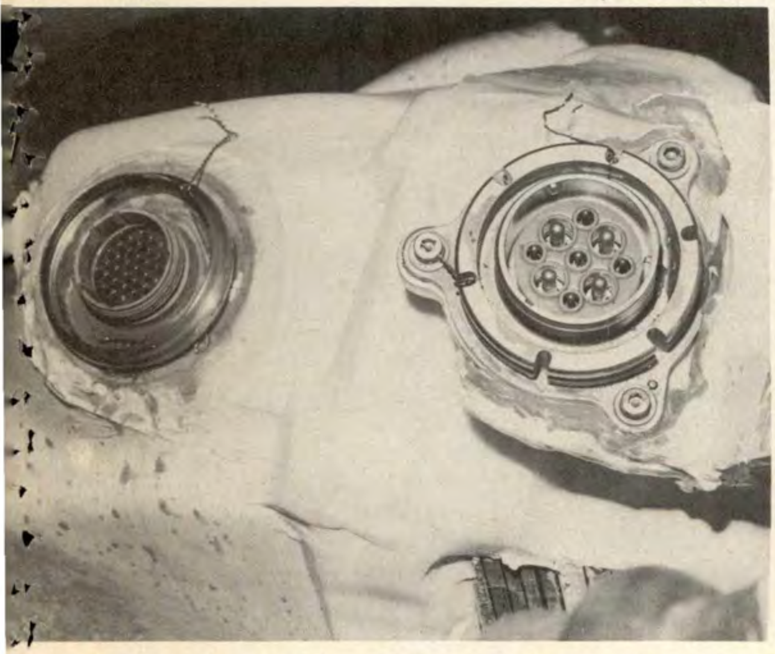
(3) At the interstages.

(4) At bolt holes where the G&C mates with the missile.

(5) Along the missile raceway.

By looking for deposits of wet or dried sodium chromate on the missile suspension system, on the floor, and in the sump at the bottom of the launch tube.

Early identification of a leaking G&C substantially limits the damage, reduces the manhours required for repair and assists specialists in isolating the faulty component. ★



Shown above are two male connectors on the outside of the Nozzle Control Unit which was removed from an operational missile. Note the obvious stains around the connector bases.

During initial inspection of a missile exposed to a leaking G&C cooling system, chromate is discovered at the base of the third stage. The coolant has seeped into the missile raceway and the cabling. Continuity checks will be performed on the cabling. Failure of the continuity check requires replacement of the entire cable.

KEEPING YOU HIGH

If you fly a turbojet aircraft, expect FAA to keep you high as long as possible when you enter a terminal area, and get you to altitude as soon as possible on departure. The primary reasons are safety and noise abatement.

These procedures resulted from the findings of an FAA near midair collision study in 1968. It showed that a high percentage of terminal near collisions occurred below 8,000 feet and within 30 miles of tower-controlled airports.

The procedures (CSAF/X00FA message, 282100Z Sep 72 and FAA Order 7110.22A, 28 Feb 72) are as follows:

• **Arrivals:** Enter terminal area at or above 10,000 feet, remaining there until 30 flight path miles from the touchdown point (if feasible).

• **Departures:** Use uninterrupted climbs to the extent possible. Avoid assigning altitudes below 5000 feet.

• **Visual Approaches:** Aircraft restricted to at least 5000 feet above airport elevation until entering descent area (approximately 20 miles from the end of the runway). ★

new for the crew

Like the knight of old who wanted a "horse I can ride," the first requirement of a pilot is an "airplane I can fly." By that we mean the bird should be in reasonably good shape, with no major squawks and capable of performing whatever is called for.

Usually our airplanes fit into this category but there are those times when one doesn't perform. Something fails within that intricate maze of wiring and plumbing, sheet metal, rubber, plastic, and the white hot heat of the engine, and we need those other items designed to get us safely to the ground, found and rescued, as the case may be. Consequently, we take a certain amount of interest in our survival equipment and are quite vociferous about any inadequacies that come to light during the moment of truth.

Hence this report on some survival items that will be of interest to the involved aircrews.

• IMPROVED PERSONAL LOCATOR BEACON—This improvement involves the PLB in the F-4 and OV-10 and is the first to be installed in the A-7D. The hardware is a small package that fits into the seat pack survival kit with a control switch in the left front thigh support. The good things about it are that it provides the aircrew with inflight control, virtually eliminates inadvertent actuation and provides a timed battery. Production delivery is scheduled for this month (December).

• PRC-90 SURVIVAL RADIO—This has been a good radio but there were a couple of problems. The quarter wave antenna did not broadcast a desirable radiation pattern and the required range was not achieved; also the antenna was very sensitive to position (vertical) and body proximity. The improved radio will have a better range, and the sensitivity of the antenna to position and closeness to the body have been eliminated. TCTO and Kit release are pending contract award.

• T-37 SEQUENCED EJECTION CAPABILITY AND DUAL TRIGGER INSTALLATION—This modification was designed to protect the crew from severe windblast prior to ejection, assist in helmet retention and prevent disorientation due to windblast. The system incorporates a single motion canopy jettison and ejection with either hand. Kits are being delivered with completion scheduled for this month (December).

There are a number of other items in the works and as they approach reality we'll try to keep you informed. ★

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UNITED STATES AIR FORCE

Well Done Award

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

Major CHARLES E. BAERTL

16th Special Operations Squadron, APO San Francisco 96304

Major Baertl, aircraft commander, and his crew were on a night armed reconnaissance mission over heavily defended hostile supply routes in Laos. The *Spectre 21* crew had acquired a moving vehicle over an area of concentrated enemy activity. Approximately 20 seconds after rolling the aircraft into the firing orbit, a muffled explosion and bright flash were observed near the gunship's Nrs. three and four engines. The aircraft immediately pitched down and left. While the pilots were trying to regain control, the navigator provided heading and altitude information to exit the area and the flight engineer checked the aircraft systems. The two forward gunners rushed to assist the right scanner, who had been thrown from his position by the force of the blast. The remaining crewmembers reported to the aircraft commander regarding their status and that of the aircraft near their positions. After losing 2500 feet, the crew regained control and learned that the explosion had caused the immediate separation of the propellers and forward halves of Nrs. 3 and 4 engines. There appeared to be a fire around Nr. 3, so necessary precautions were taken. A controllability check determined a constant and gradual altitude loss, so all crewmembers not required at their stations began jettisoning 7460 pounds of ammunition and equipment, a task accomplished in less than 5 minutes. Proper facilities were notified of *Spectre 21's* situation once the gunship was over safe territory. The plane was configured for landing with no difficulty; however, at 12 miles from the base, the Nr. 2 engine instruments indicated the possibility of a turbine failure with imminent power loss. Therefore, careful throttle advancements were required to prevent the loss of a third engine. With the added problems of gusty winds on landing, only delicate, skillful manipulation of trim, power, and flight controls enabled the crew of *Spectre 21* to recover their aircraft safely and avoid almost certain personal egress injuries over the rugged Laotian terrain and the loss of a $6 million aircraft. The professionalism shown by every crew member of *Spectre 21* is deserving of the highest acclaim. WELL DONE. ★


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