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SAFETY NOVEMBER 1976

UNITED STATES AIR FORCE

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NOVEMBER 1976

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NOVEMBER 1976 AFPR 127-2 VOLUME 32 NUMBER 11

What's A Cubit?

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Those who are familiar with Bill Cosby's version of the story of Noah and the ark, will recall Noah's predicament after receiving a complete and rather detailed set of dimensions for building an ark. In order to interpret the instructions, he had to ask, "What's a cubit?" There was also some doubt as to just what an ark was, since not many had been built prior to the flood.

Noah's problem was nothing more than an early example of a lack of communication. Had he received a set of instructions on how to get the ark out of a whirlpool, his confusion factor might have gone even higher. Judging from the recent flood of stall and spin accidents, that same lack of communication is still with us. The authors of the various Dash Ones are quite explicit about what happens to aircraft when critical angles of attack are exceeded, but somehow, the dry language of a tech order does not impart to the pilots the dynamics of what can be a rather exciting trip, to say the least.

While pilots of the Fifties were busy breaking the sound barrier, and pilots of the Sixties were attacking the heat barrier, the pilots of the Seventies are faced with the problem of a language barrier. Consider the term "post stall gyration." From an engineer's point of view, this term refers to things that happen to an airplane while it's stalled, subsequent to the initial stall. This term was quite adequate for pilots 20 years ago, when wings were generally straight and the stall could be recognized by the sharp departure from controlled flight. At the onset of the stall, lift was lost and the nose fell rapidly through the horizon. Things that happened to the plane after this stall occurred, (like wild gyrations) were easily identified by pilot and engineer as post-stall events.

For today's pilot, things are not the way they were. For the highly swept, low aspect ratio wings that are characteristic of today's fighters, the stall is not a definite occurrence. It is a condition which may be entered by degrees, often without an initial loss of lift or altitude. It has been defined as "either the peaking of aerodynamic lift, or the occurrence of uncommanded aircraft motion about any axis, or the onset of intolerable buffet." What the engineer means is: Stalling a high performance aircraft can bring on some surprises. A pilot can get well into a stall—past the initial indications—without knowing it. If he does not know that a stall has occurred, the rapid (and readily recognizable) departure from controlled flight, that the engineer calls a post stall gyration, appears to be the stall itself. From a pilot's point of view, a more accurate term might

What's A Cubit?

continued

be simply "stall gyration." It refers to gyrations that occur *before recovery* from the stall.

Now, for those who are just now unscrewing their heads from the ceiling after reading that pilots may not recognize stalls: a few words of explanation. Recall first, that the departure, the stall gyration, can occur at any point after the stall. Now, review the definition of a stall. Notice that "wing rock" is nothing more than a specific case of "the occurrence of uncommanded aircraft motion" about the longitudinal axis. Does a pilot identify wing rock as a stall? No, dummy, he identifies it as wing rock. He has seen it many times. It happens when he pulls back on the stick. It seems to stop when he releases that back pressure. Wing rock, man, is E-Z! You don't even lose altitude. If you need to pull a little more, you have to put up with a little more wing rock, but you get your increase in lift, just like you wanted. Even the engineer will agree with that. He has curves to show that lift increases with angle of attack, despite the loss of longitudinal stability.

This article will not solve the stall/spin problem. It will not tell anyone how to avoid a

Here's the catch! Once the pilot has failed to identify wing rock as a stall, there is no warning between him and a sudden loss of control. And to make matters worse, one difference between wing rock and loss of control is the several thousand feet of altitude needed for recovery from loss of control.

Suppose a pilot is flying a circling approach at a strange field. Suppose he overshoots the turn to final, and pulls a little harder to bring it around. Suppose he gets some wing rock. Suppose he's seen wing rock before. Suppose he is surprised when the aircraft goes out of control. Do you suppose there is enough altitude for recovery? Do you suppose the surprise lasts long? (Editor's Note: Do you suppose the author made this up? Actually, two recent accidents exhibited this same pattern.)

If wing rock seems to be a primrose path, consider buffet. Buffet is not a stall—anymore. Intolerable buffet is. Beware of intolerable buffet! Be especially wary of anyone who tries to define it. Nonetheless, should intolerable buffet be reached, departure from controlled flight should be expected.

Teaching a pilot to recognize and identify a stall is like teaching a swimmer to recognize deep water; despite the dangers, he is still likely to play around the area.

There is really nothing wrong with this, for the swimmer or the pilot. It is important for a pilot to know his own limits as well as the limits of his aircraft. As a matter of fact, a contributing factor in at least one recent stall spin accident was a two year lapse in demonstrating proficiency in stall recognition and recovery.

The trouble with current stall recognition training is that pilots are required to recover at the first indication. This is not unlike having a swimmer practice cramp recovery in two feet of water. It may be even worse. In practicing these stall recoveries, a pilot inadvertently (and incorrectly) learns that he can recover without losing much altitude. He learns that he can do this whenever he wants to. He also learns that various check pilots require varying amounts of buffet and wing rock before initiating recovery. Recovery from an approach to a stall is a piece of cake. Most pilots could do it without practice, yet it is practiced, because it is required.

Recovery from a fully developed stall is not so easy. Recovery from an out-of-control condition can approach the impossible. Pilots do not practice these maneuvers. They are dangerous. Not all pilots know how dangerous, and some pilots find out the hard way. Some find out too late. Stall indications in most fighter aircraft do not provide warning of an impending departure from controlled flight. For this reason, any pilot can inadvertently put his plane in an out-of-control condition. There is a need to learn, through practice, the correct recovery procedure and the magnitude of altitude lost during this gyration.

It is not necessary to be stupid to stall an airplane. It may be stupid not to know how much altitude is required for a safe recovery. It is definitely stupid not to know how to recover. Like a MIG at 6 o'clock, an out-of-control maneuver tends to make one's IQ approach zero. Since (hopefully) no one reading this article is out-of-control right now, plant this seed in a fertile corner of your brain. Recovering an aircraft from a stall is not a memory exercise, nor a complex computational task. It is a precise motor skill. Like athletes, pilots must practice motor skills in order to develop proficiency.

Having gained one kernel of knowledge, let's return to an investigation of the language barrier. It is understandable to read in some tech order that "snap rolls" are prohibited. The authors might as well prohibit Danish Rolls, or diddle maneuvers. The average pilot does not know what a snap roll is. He has never done a snap roll because (1) it has always been prohibited, and (2) training restrictions have prevented him from learning the proper entry conditions and control movements. Since snap rolls are just not done, it is easy to see why snap roll recoveries are not taught or practiced. For all of the above reasons, it is often the case that the first snap roll a pilot ever sees occurs suddenly as the result of applying the wrong controls at the wrong time. The immediate result is that he is turned every way but loose in a violent, disorienting maneuver. At this time he either invents snap roll recovery procedures and applies them, or becomes another unpleasant statistic. In either case, it is unlikely that the pilot was concerned with the name of his particular stall gyration. (That's right, a snap roll is a stall gyration.) One alternative is to explain how to do a snap roll, with the attendant risk that somewhere there is a pilot who will go out and try one. Another possibility is to prohibit the general type of maneuver, without providing the unique name.

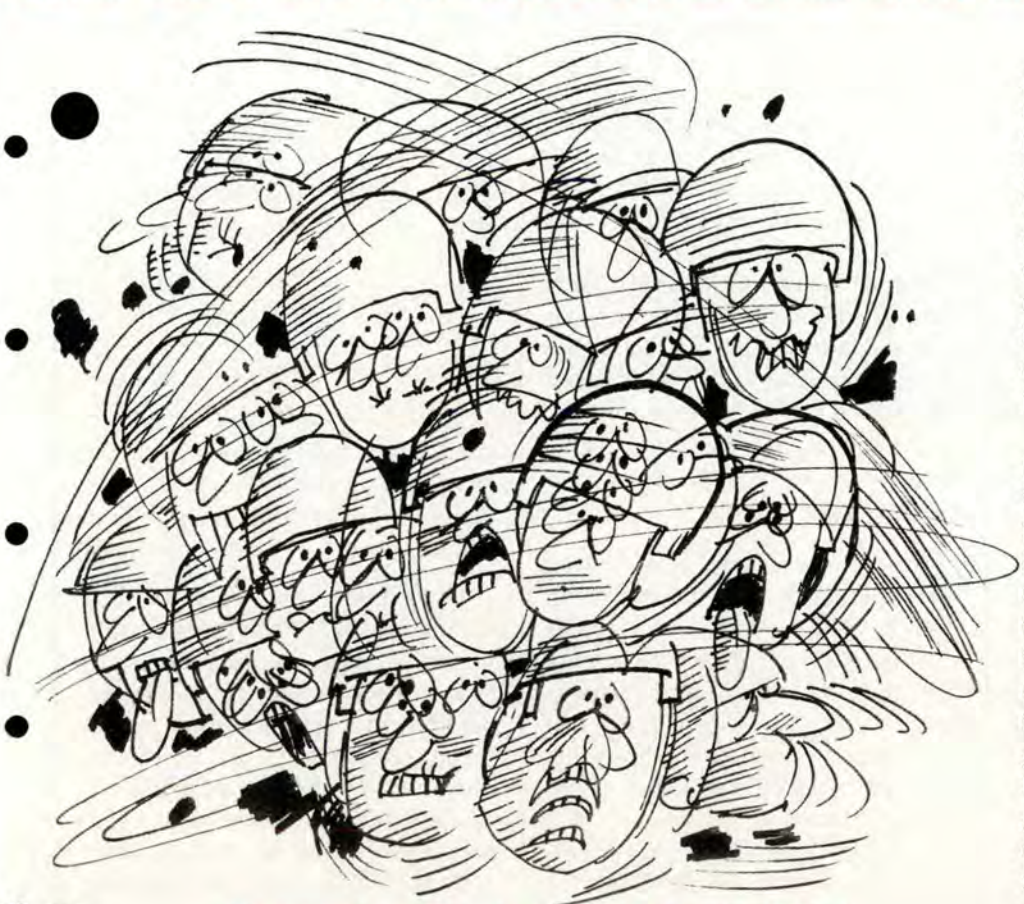
Returning to the language barrier, every pilot knows how to stall and spin an airplane. When a pilot reads that these maneuvers are prohibited in his airplane, he at least knows what the engineer is writing about. The professional pilot, prohibited from doing these maneuvers, will turn to his tech order to read about what *might* happen, should he ever encounter these conditions inadvertently. In most cases, he will run straight into the language barrier. Consider section six of what should be identified as the best tech order available when it comes to maximum performance maneuvers. The particular aircraft has some rather onery characteristics during departure from controlled flight. The aeronautical engineer is describing accelerated stalls:

> The approach to stall is characterized by heavy buffet and very frequently a high yaw rate at the stall.

The language is precise. The sentence is carefully worded. What the engineer means, Captain, is that yaw rate increases to over 125 degrees per second, as the nose yaws half way around the world, slams the canopy against your helmet with a 4.5 g *lateral* acceleration to get your attention and then wraps up the "departure from controlled flight" with pitch and roll oscillations that would make a sailor sick. Further, if you try to hang on to the stick (and the good Lord knows you need to hang on to something) you may make matters *worse*. ("Worse" is not defined. The reader is encouraged to use his own imagination.)

The information contained in the preceding paragraph may be gleaned from eight pages of description in the dash one. Not many jocks are inclined to memorize that much material. Those who do are likely to forget it about halfway through the first turn. Pilots who have experienced a full stall and departure in this aircraft are unlikely to ever forget the gyrations. Here is another kernel of information: In order to gain an appreciation of the consequences of stalling an airplane, it is necessary to actually stall the airplane. Approach to a stall is not enough. Reading about it is not enough.

stall or what to do if a stall occurs. It is an assault on the language barrier.



The approach to stall is characterized by heavy buffet and very frequently a high yaw rate at the stall.

What's A Cubit?

continued

Unfortunately, actually stalling an airplane is often too much. Accident reports on nearly 20 stall/spin accidents from 1974 to date provide ample evidence that stalls can be hazardous to your health. Breaking regulations by performing prohibited maneuvers can be hazardous to your career, and is not recommended.

So what is a poor pilot to do?

In March, 1971, NASA published a Technical Note (D-6117) titled "Utilization of a Fixed-Base Simulator to Study the Stall and Spin Characteristics of Fighter Airplanes." Available from NTIS, Springfield, VA 22151, for $3.00, it has not made the best seller lists among fighter pilots. As a result of this study, the authors concluded that ". . . fixed base simulators can be used for study of stall and spin characteristics of high performance airplanes . . ." providing the aerodynamic model includes the high alpha stall and spin region. Unfortunately, it is not easy to gather the data for the aerodynamic model, and so the model may not produce characteristics that are faithful or consistent.

Two aircraft configurations were used. The aerodynamic characteristics closely resemble the F-111 and the F-4, although the specific models were not identified. Quoting from the report:

> In the area of pilot training, the simulator could provide a means of training pilots for spin prevention and recovery. In this manner, pilots could (1) become familiar with the unusual flight motions . . . (2) learn . . . instrument and visual cues . . . (3) become familiar with proper control inputs. . . .

It should be emphasized that the simulator motions may vary, and that the correlation with exact aircraft gyration may not be good. Such a simulator would, however, provide procedures training, and some experience in stall characteristics.

In April, 1973, Air Force Flight Dynamics Laboratory published a study (TR 73-29) in which a fixed base simulator with an outside view display and a full instrument panel was used to study stalls and departures of a single seat fighter. In June, 1974, Air Force Flight Dynamics Laboratory published TR 74-61, a study which used a fixed base simulator and CRT visual display to portray flight characteristics at high angles of attack. It may not be possible to simulate every aircraft in the stall regime, but it is possible to produce reasonable approximations for some of them.

If it is possible to provide stall and spin trainers, complete with outside visual cues, it seems apparent that pilots can benefit from such training. The engineer in the laboratory knows that a simulator can sometimes be used to duplicate the stall and spin characteristics of an aircraft. He is apparently waiting for some pilot to ask for such a simulator. Of course, the pilots haven't asked for it yet. They don't know what to ask for! The language barrier strikes again.

Nearly 20 airplanes have been lost since 1974 because of a cubit. What's a cubit? The length of a man's forearm. Improper use of cubits by pilots, and lack of knowledge about what to do with cubits after departure from controlled flight keeps costing us airplanes.

This article will not solve the stall/spin problem. It will not tell anyone how to avoid a stall, or what to do if a stall occurs. It is an assault on the language barrier. Lest the message get lost in the literature, I say again:

1. The familiar onset of a stall is not useful as a warning of an out-of-control condition; therefore, it can be predicted that when pilo[illegible] maneuver in a maximum performance regime, out-of-control conditions will sometimes be encountered.

2. Reading about stalls, spins and recoveries is not an adequate substitute for experiencing them.

3. Since prohibited maneuvers cannot be practiced safely in flight, simulation of these maneuvers is an alternative whose benefits have been demonstrated for some aircraft.

Obviously, the operational commands do not have the elegant simulators needed for accurate stall/spin simulation. Has anyone ordered them or established an operational requirement? In the meantime, has anyone tried using the existing simulators for stall/spin training? Even if the simulation is not 100 percent accurate, the recovery procedures can be practiced. It's time we learned what to do with our cubits. ★

MODERN WEAPONS EMPLOYMENT

CAPTAIN ARTHUR FOWLER
Directorate of
Aerospace Safety

WAR! A situation we try not to become involved in but one we must always consider. It is imperative we conduct it as safely as we do our day-to-day training. In the early history of war, the caveman found safety to be a relatively simple task. His weapons, the rock and club, were simple and easy to employ and there were few problems with explosive accidents, target miss ID, or collateral damage. The cave safety officer simply piled his rocks in a corner and cautioned the warriors against ground accidents—like dropping a club on someone's foot.

The combination of the airplane and high explosives (bombs) in modern war caused the institution of a new safety concept. Ground safety, even though it is continually being improved, has been able to maintain the same basic concept of operation. Flying safety, especially in the area of weapons employment, is being forced to change its philosophy because of the sophistication of our modern weapons.

The original era was that of "The dumb bomb and the smart bomber." Let's use the arena of close air support to emphasize the need for the change in thinking. Anytime ordnance is being dropped in the area of friendly forces/people, we become very concerned about bombing accuracy and collateral damage (especially if the collateral damage is the 9th Infantry and your mother wears combat boots). As a result, we have established criteria for how close to friendlies we can drop ordnance. This is based on the frag envelope of the weapon plus the bombing accuracy of the aircrew. In the era of the dumb bomb (unguided), it was very easy to establish a small area where it was highly probable that the bomb would hit. Unfortunately (for the safety officer), we have advanced into the age of terminal guidance.

Let's call our new era that of "The smart bomb and the not-so-smart bomber." Those who thought I would say dumb bomber take two steps backwards. Terminal guidance uses laser energy, TV, or infrared as a means of guiding the bomb to the target. These weapons have proved to be much more accurate than the conventional dumb bomb. For example, the Maverick missile's design criteria was to be able to hit no further than a few feet from the target's center. It would seem a logical conclusion that we should therefore use these weapons in a close air support situation where accuracy is paramount.

The problem arises in the establishment of a weapon miss distance. The guided weapons incorporate big fins (some have wings) and even rocket motors to increase the accuracy and range of the weapon.

The weapon miss distance is graphically portrayed on what is called the weapon footprint (that area in which the weapon could hit after launch from the aircraft). This area can extend as far as 10-15 miles from launch and with some new weapons being developed, this distance will triple. Some terminal guided weapons can guarantee over a 90 percent probability of a direct hit on the target. If you require only to be within 200 meters, they can guarantee well over 95 percent.

The problem is the 1 or 2 percent remaining can fall anywhere within the footprint (an area as large as 60 sq. miles). To the staunch safety officer this might be too high a risk to be considered safe; but to the trooper on the ground who needs the accurate ordnance in order to stay alive, it is considered plenty safe enough. So, what is safe?

We are faced with a dilemma!! On the one hand we have a weapon that is surgically accurate and desirable; but, on the other hand it can malfunction and travel many miles from the target with a remote (less than .0025) probability of falling into the midst of friendly forces. The answer is in education, knowing what the weapons can and can't do and what risk is involved. As we move into the age of sophistication, airplanes will need to stand off from the battle line in order to survive and the Army will still need highly accurate bombing support. The answer is Terminal Guided Weapons! If we allow our archaic thinking in weapon employment to continue, we could eliminate the use of highly effective weapons in the protection of our ground forces. Let's open our minds and take a long look at our present policies. Times are changing and we mustn't fall behind. ★

General Aviation Fuel Which Is Right?

MAJOR PHILIP M. McATEE
Directorate of Aerospace Safety

During the past few years, several significant changes have occurred in the availability and lead content of general aviation aircraft fuels (figure 1). These changes have left many doubts and much controversy over what fuel should be used. Since many *Aerospace Safety* readers are operators of aircraft in this category, we felt it would be beneficial to pass on the recommendations of the major engine manufacturers on the subject of aviation fuel.

The controversy started when several oil companies ceased to manufacture 80/87 octane aviation fuel and in its place introduced a new 100 octane low lead (100LL) avgas. Many thousands of light aircraft currently flying were designed to use 80/87 fuel. However, several areas of the United States and some overseas areas no longer sell 80 octane fuel at all, leaving many pilots concerned about which fuel should now be used and what will be the consequences.

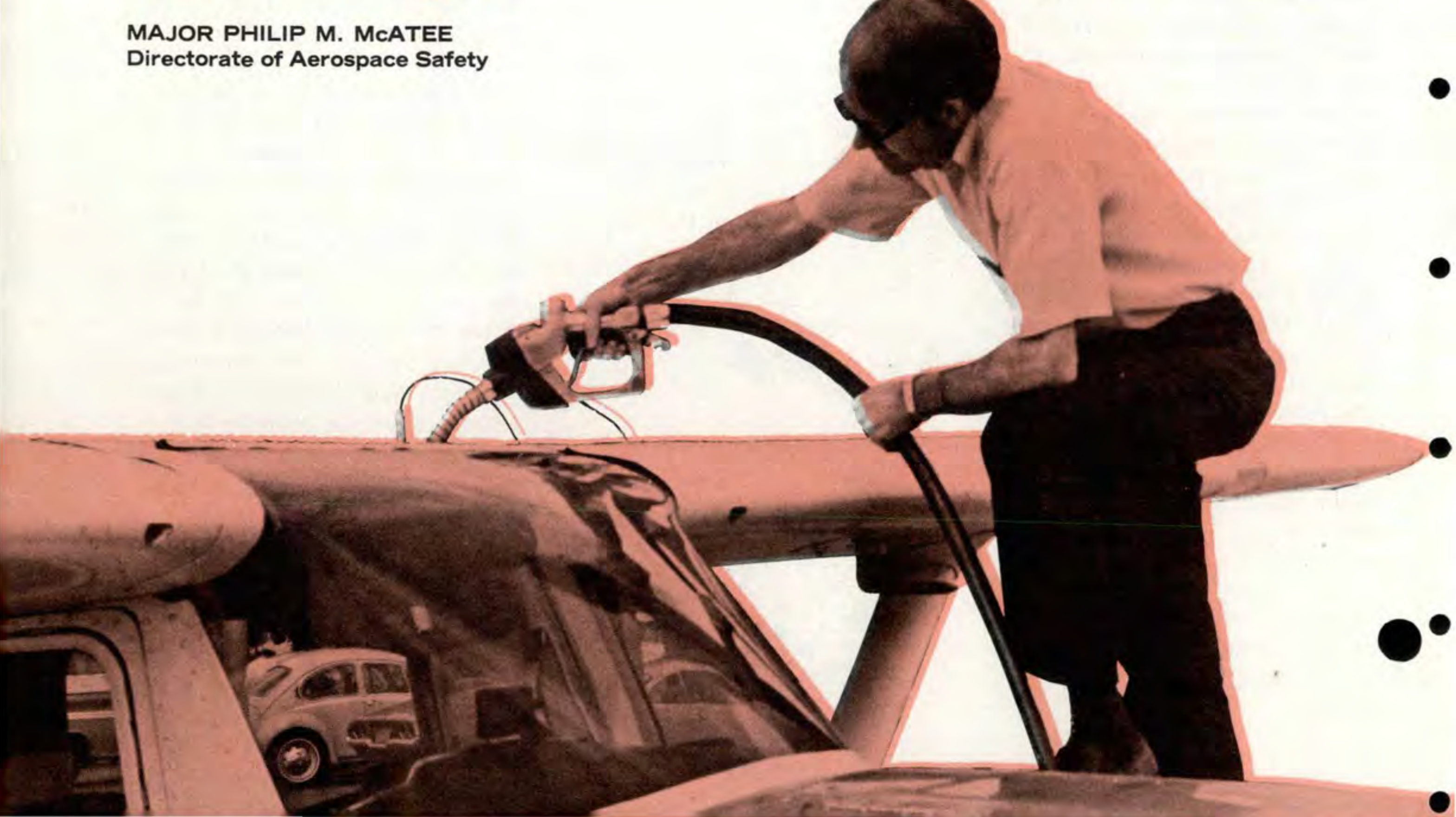
Before we begin, let me state emphatically that in *no instance* should any automotive fuel be used regardless of its advertised octane or features, because of the corrosive effect of its chlorine content and danger of vapor lock caused by its much higher vapor pressure.

Many engines are still designed for 80 octane fuel; and this fuel should be used when it is available. When it is not available, both Lycoming and Continental approve of the continuous use of 100LL in which the lead content is limited to 2 ml. TEL (tetra ethyl lead) in *all* of their engines with some recommendations to reduce problems.

The following recommendations are taken from Lycoming Service Letter No. L185 and are illustrative of those of all manufacturers:

FUEL MANAGEMENT

- Never lean the mixture from full rich during takeoff, climb or high performance cruise operatio unless the airplane owner's manual advises otherwise. During takeoff from high elevation airports or during climb at higher altitudes, roughness or reduction of power may occur at full rich mixture. In such a case the mixture may be adjusted only enough to obtain smooth engine operation.
- Operate the engine at maximum power mixture for performance cruise powers and at best economy mixture for economy cruise power, unless otherwise specified in the airplane owner's manual.
- Without exception, observe the red line cylinder head temperature limit during takeoff, climb and high performance cruise power operation.
- For maximum service life, maintain the cylinder head temperature below 435°F during high performance cruise operation and below 400°F for economy cruise powers.
- Always return the mixture to full rich before increasing power settings.



- During letdown and reduced power flight operations, it may be necessary to manually lean or leave mixture setting at cruise position prior to landing. During the landing sequence, the mixture control should then be placed in the full rich position, unless landing at high elevation fields where leaning may be necessary.

During cruise, follow the airplane owner's manual for the best method of manually setting maximum power or best economy cruise. Recommended fuel management, manual leaning, will not only result in fewer engine deposits and reduced maintenance cost, but will provide more economical operation and a fuel savings.

LUBRICATION

Many of the engine deposits formed by use of the higher leaded fuel are in suspension within the engine oil and are not removed by a full flow filter. When sufficient amounts of these contaminants in the oil reach high temperature areas of the engine they can be baked out, possibly resulting in malfunctions such as sticking exhaust valves.

For this reason, when you are using the higher leaded fuels, the recommended oil drain period of 50-hours should not be extended. If you encounter some valve sticking the oil change interval should be reduced.

SPARK PLUGS

Spark plugs should be rotated from top to bottom on a 50-hour basis and serviced every 100 hours. If excessive spark plug lead fouling occurs, the selection of either a hotter or colder plug, depending on type of lead deposit, from the approved list may resolve the problem. Your A and P mechanic can advise you on plug selection. Depending on the lead content of the fuel and the type of operation, more frequent cleaning of the spark plugs may be required.

VALVES

For Continental engines some further recommendations are made by the manufacturer. As an interim measure, Continental had previously recommended that on certain engines the valve seat angle be changed to 30°. This has now been superseded as a result of extended engine testing.

Extensive testing both in the laboratory and the field has shown that with the use of higher leaded fuels, service life of the intake valves can be significantly improved by introducing the following changes:

- Installing a new type valve with a new 60° seat angle for improved sealing.
- Installing a new valve seat of improved material to minimize erosion. Continental states that it is highly desirable to install these new components at the next top or major overhaul, whichever comes first. These new parts have been available since May of this year.

The models affected by this recommendation are: C75, C85, C90, O-200, O-300 and GO-300. Engines that were previously modified to the 30° seat angle should have the new components with the 60° seat angle installed in accordance with Continental Service Bulletin M76-8 at the next top or major overhaul.

So now what have we said? Although the new 100LL fuel is approved for all Lycoming and Continental engines when 80 octane fuel is not available, the continuous use of this higher leaded fuel *will* result in increased engine deposits both in the combustion chamber and the engine oil. This will mean reduced oil change intervals, more frequent spark plug maintenance and recommended valve changes on some engines. The frequency of plug servicing and oil drain periods will be governed by your type of flying. The longer operation requiring full rich mixture, the more frequent maintenance required.

All the above recommendations are for using 100 low lead fuel. If you must use regular 100 octane or 100/130 fuel with 3.0 ml. TEL/US gal then additional inspections, particularly exhaust valve inspections, may be required on all manufacturers' engines. Check your engine manufacturer's service bulletins or ask your A and P mechanic.

It looks like the new fuels are here to stay. By using good judgment and following the manufacturer's recommendations, you will enjoy many hours of flying more economically and with fewer problems. ★

FUEL GRADE COMPARISON CHART

Previous Commercial Fuel Grades (ASTM-D910)			Current Commercial Fuel Grades (ASTM-D910-75)			Current Military Fuel Grades (MIL-G-5572E) Amendment No. 3		
Grade	Color	Max. TEL ml/U. S. gal.	Grade	Color	Max. TEL ml/U. S. gal.	Grade	Color	Max. TEL ml/U. S. gal.
80/87	red	0.5	80	red	0.5	80/87	red	0.5
91/98	blue	2.0	*100LL	blue	2.0	none	none	none
100/130	green	3.0	100	green	**3.0	100/130	green	**3.0
115/145	purple	4.6	none	none	none	115/145	purple	4.6

* - Grade 100LL fuel in some over seas countries is currently colored green and designated as "100L".

** - Commercial fuel grade 100 and grade 100/130 (both of which are colored green) having TEL content of up to 4 ml/U.S. gallon are approved for use in all engines certificated for use with grade 100/130 fuel.

Applied research has improved both aircraft braking systems and pavement surfacing systems, but unfortunately, at times, these two systems can work against each other to put the aircrew in a hazardous position. For instance, an aircraft landing on a wet runway having a concrete touchdown zone and a primary braking area which has an improved traction surface presents such a case.

After landing, the pilot uses maximum aerodynamic braking, but prior to reaching the traction surfacing, he begins to apply the brakes. Because of rubber deposits and the relatively smooth concrete texture, aircraft wheel spinup may not have started; hence, the antiskid system (if available) would not sense ground speed. When the aircraft transitions into the improved traction area, the wheels are virtually locked up and the potential for blowing the locked wheel tires is great. Because of this abrupt change from a low to a high traction surface and the masking of the antiskid sensing subsystem, the pilot could face an emergency rather than a normal landing.

This problem of transitions can just as easily occur when the touchdown area is covered with rubber or the surface is worn and the aircraft passes to a better surface before the aircraft has sufficient time for wheel spinup. Either of these conditions may result in blown tires or a skidding incident which, in the main, are uncontrolled situations for the aircrews. Both of these situations occurred in recent USAF and civil aviation incidents. Luckily no loss of life was involved, but equipment and manpower resources were required to restore the aircraft to flyable condition.

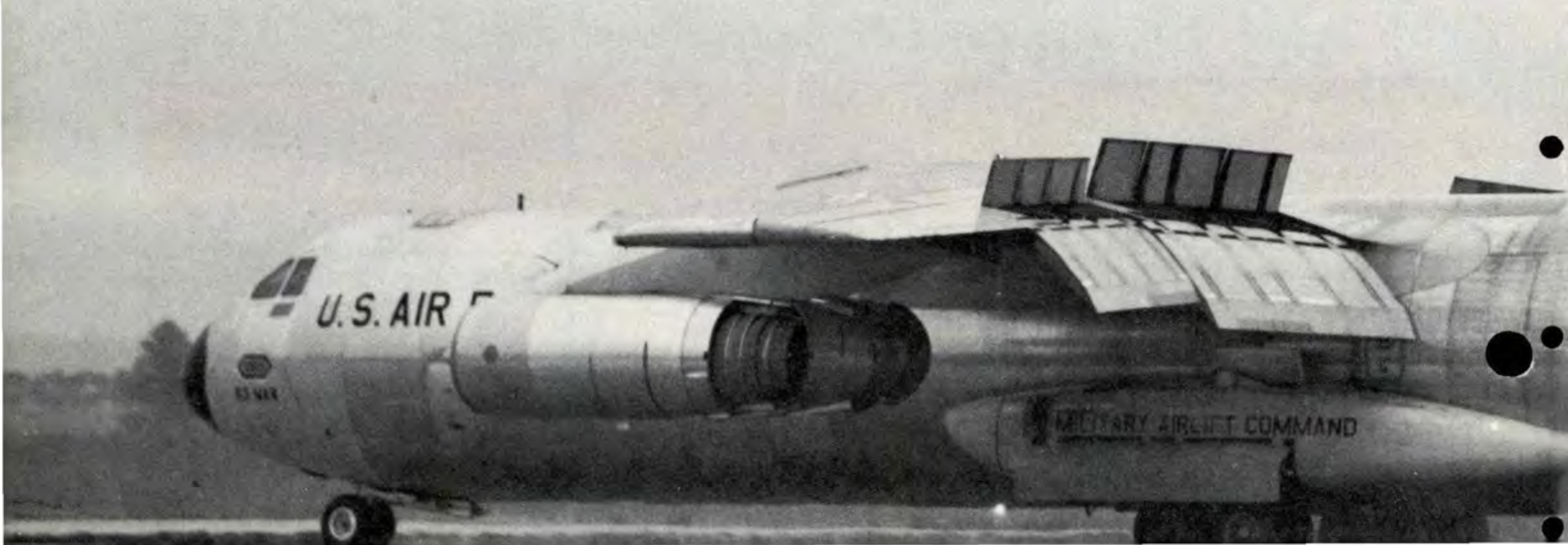
These accidents occurred partly as a result of a lack of communications between engineers and operations personnel, and partly as a result of reliance on systems that are operating on the edge of their limits.

PAVEMENTS

Pavement engineers have over recent years developed, at the request of aircrews, surface treatments that provide a rapid recovery of runway skid resistance characteristics after a rainfall of any intensity. Two basic surface treatments prevail.

The first treatment is for concrete pavements. This generally puts some dimensional grooves into the surface either at the time of construction (plastic grooving or wire combing) or by cutting into the surface after a period of operation that has shown the surface is susceptible to hydroplaning or skidding. The second method of treatment are those applied to asphaltic type pavements. While grooving has been used successfully for asphalt at commercial airports, it is not generally used on USAF asphalt runways. The primary method of treatment on asphalt has been one of several types of skid/hydroplaning resistance surface courses. These may vary all the way from overlays which improve surface drainage (with no special surface preparation) to application of Porous Friction Surfaces which provide for water drainage paths through the pavement. See Figure 1 for comparison of recovery rates on different surfaces.

runway surface hazards



These treatments have been developed and, are being used. However, to reap their full benefits, the pavement engineers must inform aircrews where these treatments have been applied and define their advantages and limitations. Additionally, where new surfaces have been placed that may have different traction properties the aircrews must be knowledgeable of the potential hazards.

Economics play a vital role in the decisions about where, when, and how new surfaces are to be placed. As a result of aircraft tire damage and other economic considerations, antiskid/hydroplaning surface treatments are generally not applied to the first 1000-1500 feet of each runway end. In wet runway situations this sets up potential problems when transitioning between the touchdown zone and improved surface.

The second situation can develop as a result of inadequate attention to surface texture and/or drainage of pavements as well as lack of rub-

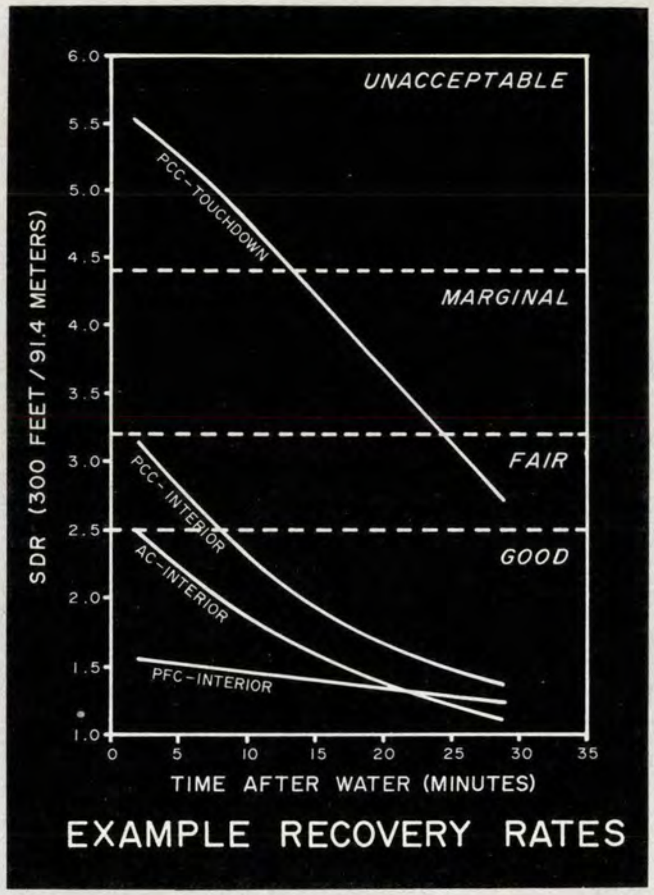
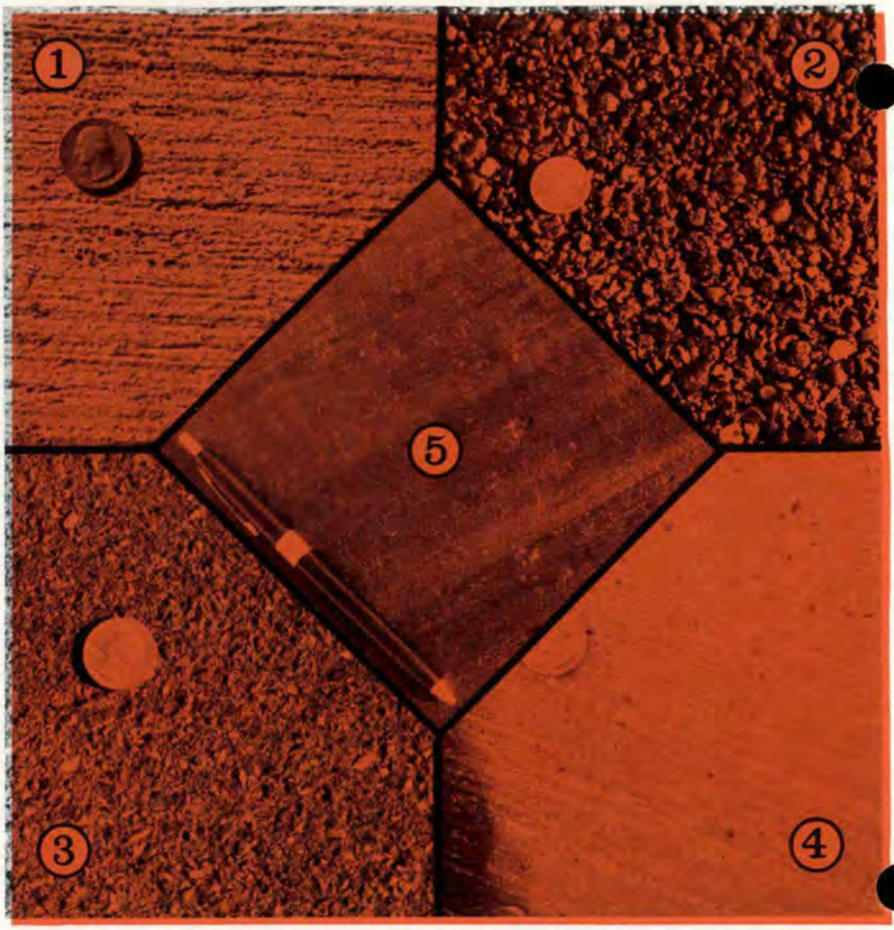


Figure 1

CAPTAIN DANNIE O. BURK
Air Force Civil Engineering Center
Tyndall AFB FL

runway surface hazards

continued



Different Runway Surfaces
1. Concrete (PCC) 2. Porous Friction Course (PFC) 3. Asphalt (AC) 4. Concrete (PCC) 5. Rubber Deposits Over Concrete

ber removal and/or too frequent rubber removal. Rubber deposits are defined as buildups that obliterate any pavement surface texture.

Both situations, one created by new technologies and one created by maintenance inadequacies, can lead to the same results and the aircrews should be aware of the potential problems, either through tower advisories, NOTAMS or IFR supplement descriptions.

PREDICTING AIRCRAFT RESPONSE

At this time the Air Force does not have a satisfactory method of predicting aircraft stopping distances (except in the case of ice and packed snow, where RCR is acceptable) and is not likely to develop a reliable, easily used system in the near future. But we have verbal descriptions (see table 1) for the skidding or hydroplaning potential for runways. These need to be provided to the aircrews. Although they provide limited information, these descriptions are available from Skid Resistance Reports, which have been prepared for most USAF bases.

SKID/HYDROPLANING EVALUATIONS

The standard skid test used by the Air Force Civil Engineering Center (AFCEC) was developed by the Air Force Weapons Lab (AFWL), culminating research conducted in the late 60's and early 70's. This research found that no ground vehicle could consistently predict the stopping distances of aircraft. As a result of this research, the inspection decelerometer method of arriving at RCR's was voided except in ice and snow conditions. The only method of evaluating the potential stopping distance of aircraft at this point is the wet runway RCR as recommended by the "Dash One" of each aircraft. This is a questionable value since each runway has a different set of surface friction characteristics. The present skid testing program attempts to identify runway sections with potential for skidding/hydroplaning. The report resulting from a skid test recommends improvements in the worst cases or advisories to aircrews when conditions do not warrant corrective action, but do present a potential problem.

The runways are evaluated with two basic types of measuring devices. In this article it will be sufficient to state that each piece of equipment evaluates the pavement's frictional characteristics in a slightly different manner and the results are jointly used to evaluate each runway. Table 1 provides a description of the results from both pieces of equipment. Skid testing divides the runway into four distinctive segments: primary touchdown, primary braking, edge, and secondary touchdown. Each segment of the runway is evaluated and results presented to reflect expected skidding/hydroplaning potential. The edge section is evaluated to obtain data on the wear characteristics of the runway. Table 2 gives some typical ranges of hydroplaning potential obtained for the different sections and the changes that can occur between different sections of the runway. Figure 1 points out the varying recovery characteristics that are anticipated for several sections and types of pavement surfaces. These recovery graphs are indicators of the time period that could be expended

NUMERICAL RESULTS AND THEIR MEANING

TABLE 1

Mu-Readings	SDR	Expected Response
0 - .25	4.4 and greater	Very high hydroplaning potential
.26 - .41	3.20 - 4.39	Potential for hydroplaning
.42 - .50	2.50 - 3.19	Transitional
.51 - 1.00	1.00 - 2.49	No hydroplaning anticipated

1. For a complete description of test procedures see any skid resistance report available at most bases.

2. Coefficient of friction (Mu) measured by an ML-Aviation Mu-meter.

3. Stopping distance ratio (SDR) as computed using a standard dry stopping distance (300 ft/91.4 meters) divided into wet stopping distance as measured by NASA developed diagonally braked vehicle (DBV). Limits based on ASTM E-524 tires incorporated into testing procedures in August 1975.

Ranges in the Skid potential of Runway Sections immediately after wetting.

TABLE 2

	MU		DBV	
	MIN	MAX	MIN	MAX
Touchdown Zones	.23	.82	1.8	5.5
Primary Braking Interior Sections	.37	.80	1.64	4.4
Edge Section (section with same materials as center line of runway but out of major traffic lanes)	.40	.84	1.18	4.3

in return to an essentially dry condition.

These differences between sections and surface type point out the problems that can develop. This emphasizes that some standard procedure should be used when landing on a wet runway.

METHODS OF AVOIDING THE PROBLEM

The best method of avoiding this potential problem is to not land on wet surfaces, but this is obviously impractical. Since the USAF must operate on wet runways, several simple precautions should be used to help avoid these possible situations.

1. Make maximum use of aerodynamic braking while the aircraft is in the touchdown zone and during wheel spinup.

2. Avoid brake applications while the aircraft is in the touchdown zone, rubber coated area, or in transition to primary braking area pavement.

3. Be aware when landing on up wind side of runway (runway assumed to have a crown) that water will tend to be standing deeper as a result of wind action against the natural drainage of the runway.

Other precautions to help avoid a skidding/hydroplaning situation.

1. If wet runway operation is anticipated, ensure some tread remains on tires.

2. As rainfall intensity increases, the potential for hydroplaning increases and the period of recovery is increased. Poor drainage increases hydroplaning potential on any runway.

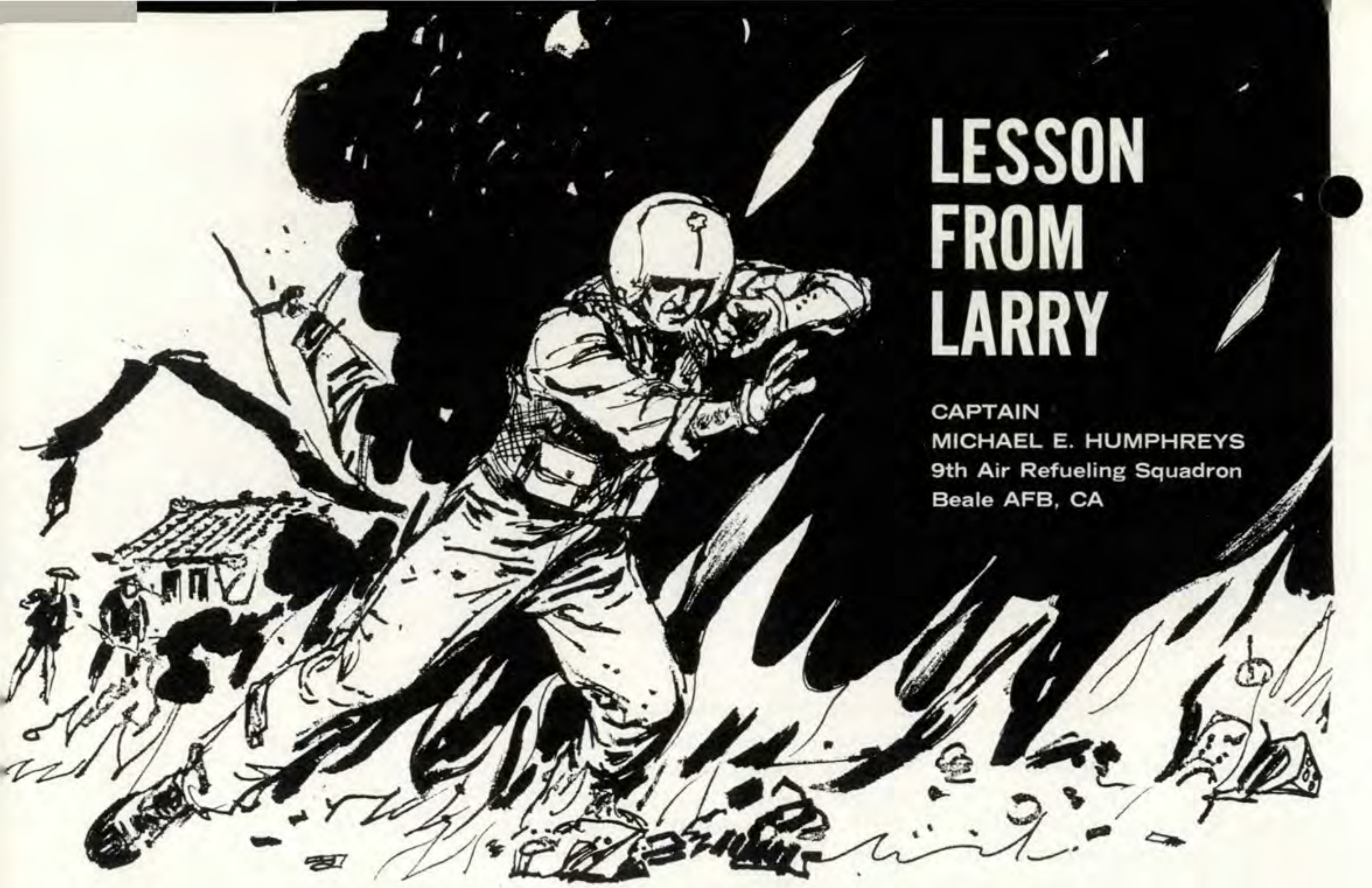
3. When turning off the runway in a touchdown area, be aware of the reduced friction due to wear and/or rubber deposits. Reduce speeds accordingly.

I have attempted to point out a problem that has developed and some of the things that can be done to avoid accidents which could be caused by the problem. The AFCEC is operating a continuous evaluation program to test runways for skidding/hydroplaning potential*. When problem areas are pinpointed, the AFCEC recommends procedures to alleviate or avoid the potential hazards pointed out by the test evaluations. ★

*One note to be injected at this point is that the testing is conducted as requested and justified by the base and not on a recurring basis. Changes in surface characteristics can occur as a result of wear or maintenance and this should be considered when reviewing older skid reports.

20 YEARS SAFE

Mississippi Air Guardsmen were flying B-26 aircraft like this one in 1956 when the unit sustained its only major aircraft accident. The accident, which happened 20 years ago, was attributed to material failure after the washer on the nose wheel malfunctioned. Since that time the Guardsmen from Jackson's 172nd Tactical Airlift Group have flown almost 85,000 hours in 5 different types of airplanes without a major accident. In the entire 23 years of the unit's history, no one has ever been killed or seriously injured as a result of an aircraft mishap.



LESSON FROM LARRY

CAPTAIN
MICHAEL E. HUMPHREYS
9th Air Refueling Squadron
Beale AFB, CA

The author's experience prompted a formal suggestion which, because of its relevancy to aircrews, is reproduced here. This does not constitute complete agreement with all facets of the suggestion, since some points are debatable. —Ed.

During 1972, while stationed at NKP, Thailand, flying CH-53's, I became acquainted with another pilot whom I'll call Larry (not his real name). Larry flew a hot little number called a QU-22. In case you have never heard of a QU-22, it was an off-the-shelf purchase of a lightplane with a turbocharged engine and *loaded* with relay avionics. It was well known for engine failure at inauspicious moments; also for coming apart around pilots inside thunderstorms. There was a good deal of competition among us helicopter guys whenever we saw a QU-22 on takeoff; we were always concerned over who was going to get the "pick-up."

It was a typical, hot, muggy, Thai afternoon the day that Larry taxied out for what turned out to be his last flight. QU-22 drivers were in the habit of leaving the door open until just the last minute before takeoff, in an attempt to get a breeze through the cockpit. This day Larry did too, closing it as he was cleared onto the active.

Sometime during the takeoff phase, the engine failed and Larry's QU-22 settled-in straight ahead and landed a couple of hundred yards off the end of the runway in the middle of a small Thai village. By the time the crash crew got to the site, Larry was already out of the burning airplane and standing a little distance away. He probably could have walked away from that wreckage without a problem except for one thing: because of the high humidity and temperature, Larry had taken off with his Nomex flight suit sleeves rolled up and his gloves turned down. Consequently, his arms, hands and back were badly burned. As the Flight Surgeon explained it to me later, it wasn't flame that burned him; it was heat so intense that it actually went up his open sleeve and burned his back. Had he been wearing his Nomex clothing properly, he would most likely be flying today. Larry was medevaced to Clark AB, where he died about 10 days later. Cause: he contracted pneumonia and his body just wasn't able to cope with both that and the severe burns. To say that his death was tragic, needless, and a complete waste would be a pitiful understatement. His death was caused by the fact that he chose to opt for a few minutes of comfort against the chance of being burned if an accident occurred. He gambled and lost. Immediately after Larry's death, the Wing there ordered a pen and ink change to all checklists. They were amended to read "Flight suit sleeves down and cuffed. Gloves on", before engine start. It was, in a phrase, a "day late and a dollar short."

The reason that I have put all this down on an AF Form 1000, is that I have seen the same trend among some other pilots I have flown with. Having kept my eyes open while on the flight line, I have seen a lot of guys walking around with their sleeves rolled up during hot weather. I have also flown with enough different IP's in both T-37's and T-38's, in the helicopter-fixed wing conversion program, who flew the mission with their sleeves rolled up to guess that it is accepted practice to fly with bare arms. I think it is also safe to assume that at least *some* of the pilots walking around the flight line with rolled up sleeves have flown that way.

Another pilot once remarked to me, "What they should do is throw away all the manuals and regs and just say, 'Use good judgment'." The problem with that is the Air Force has learned the hard way that there are not enough people around who use "good judgment" consistently without some form of written guidance to help out. It is time for someone to set down written guidance about the hazard of flying with flight suit sleeves rolled up.

Captain Humphreys then suggested that directives be published, providing written guidance on the wearing of Nomex flight clothing.

I also strongly urge that the T-37 and T-38 checklists be changed to include a step in the checklist before engine start where the crew will ensure their sleeves are down *and cuffed* and gloves on . . . many habit patterns learned in initial training by UPT students will be carried over into later flying assignments. It is quite possible that someone's life could be saved at a later time in a different type aircraft because he developed, as a student, the habit of properly wearing his Nomex flight suit.

Editor's note: We would like to add another consideration to the proper wearing of the Nomex coverall, and that is mandatory wear of a cotton T-shirt under the flight suit. A layered effect increases the burn protection provided by Nomex. ★

The Professional Killer

CAPTAIN TOM FOLSE
25 TFS

Wait a minute! Don't throw this article aside until you read further. I know what you're saying: "Here comes another story about a stud fighter pilot who thinks he's the greatest thing since sliced bread." Well, you couldn't be further from the truth.

The person I'm speaking of is not an experienced combat aircrew member, not a "hundred-mission jet jock", but *you,* a highly-trained Air Force flight crewmember, and the killer in this case is what I call "professional nonchalance."

At some point in every crewman's career he reaches a plateau. He has been through that slow and tedious process of initial training in his chosen aircraft. He has taken the backseat, figuratively speaking, and has heard a thousand times, "You can't do it, because you haven't done it." Gradually, his responsibilities are increased in direct proportion to his flying time. At last he's a flight lead, aircraft commander, senior nav, or loadmaster. In general, he is good, and if you ask him, GREAT, if not the greatest, airman around. Understandably so, for he has worked diligently, learned rapidly, and waited patiently. For the moment, he can do things HIS way.

This trained flier no longer worries about starting the engines, aligning the INS, or preflighting his equipment. All of this comes naturally. After all, he has done it hundreds of times, and he could recognize any problem with his eyes closed. His abilities and capabilities are well known in his squadron. Further, he is recognized by his fellow airmen as a competent and knowledgeable flyer.

Then the inevitable happens! A call comes in from the command post for the operations officer: "Sir, one of your aircraft has just landed gear up." A bit drastic you say, but let's take a closer look.

How many times have you heard an "old head" say, "Just let me get one engine started, and I'll get this 'beauty' off the ground." Admittedly exaggerated, but you get the idea.

Have you ever told your backseater or copilot to disregard a portion of the checklist because you had already taken care of it? Even more basic than this, when was the last time you really checked those gauges and hacked the clock to see exactly when you got rotation, hydraulics, or oil pressure?

Better yet, have you ever said, "That's okay, chief, we won't need the primary heading system and attitude indicator—it's VFR today."

Without going further, the "big picture" becomes clearer. As we gain more and more experience, we tend to get away from all the sound basic training we have had and begin to ad lib or take chances we might not otherwise have taken. Sometimes whether we like to admit it or not, we even get a little careless and forgetful. That's just the time "the killer" will reach out and take a big swat at you. Think about it. . . . Is it worth risking all the blood, sweat and tears you have put into it, not to mention the extensive cost of your aircraft, just to save a few minutes? The answer is obviously, "No!" FLY SAFE! ★

THE IFC APPROACH

Ever have an instructor, teacher or professor tell you to ask any question, regardless of how basic it may seem, because someone else probably has the same question but is afraid to ask? We will use this philosophy and relay to you some actual questions that have been asked recently.

POTPOURRI

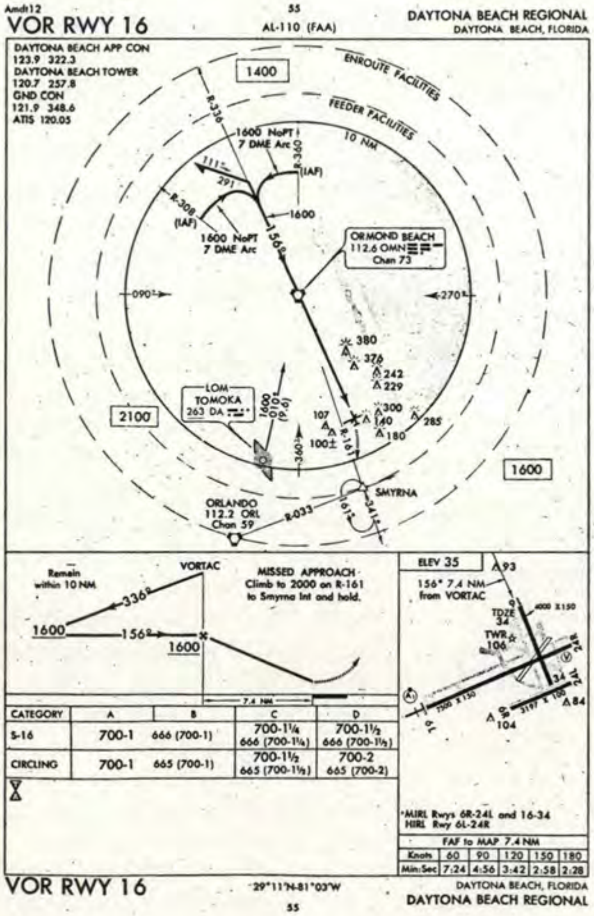
Q. FLIP General Planning states that I must file my IFR flight plan to an initial approach fix (IAF). My aircraft is VOR only so I can't file to either of the labeled IAF's in Figure 1. Since a procedure turn is depicted off of the Ormond Beach VOR, can I file to the omni?

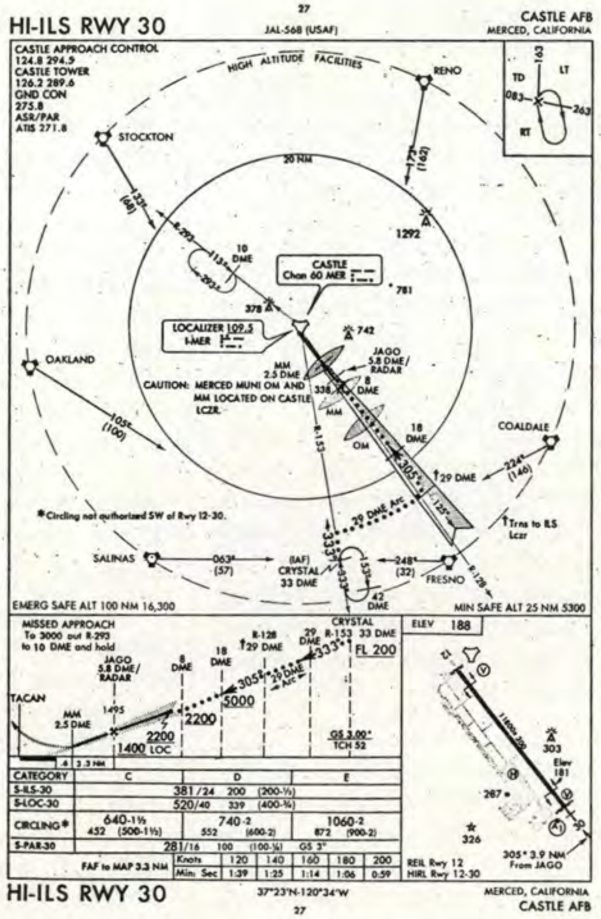
A. Yes. Even though the VOR is not labeled as an IAF, procedure turn fixes are IAF's (Ref FAAH 8260.19, para 1008.D).

Q. Reference the penetration tracks that are shown as dots on high altitude instrument approach procedures. Does each dot equal one nautical mile?

A. No. The only thing standard about those dots is their size and spacing. However, on the plan view of some approach plates, each dot does approximate a mile. In Figure 2, for example, the distance between the 153 degree radial and the 128 degree radial, on the 29 DME arc, is about 12 miles. How many dots are there? Amazing! Notice though, that counting dots in the profile view doesn't work. The dots between the 18 DME and 8 DME stepdown fixes are not representative of the distance.

Q. There are two high altitude ILS approaches to the same runway at a certain Air Force airpatch. The PAR decision heights on the two plates differ by 100 feet. Which is correct?





By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

A. Only the phantom knows. Not really, the approach designer knows. At USAF bases, approach design is the responsibility of the Air Force Communications Service Squadron. Get in touch with them on the phone and let them know that something is wrong. An error such as this would necessitate that a NOTAM be sent listing the correct decision height. The folks who design the approaches and those who do the graphics do an excellent job, but as humanoids, they can err. Another fellow called one day and told us that the localizer frequency was not published on a back course localizer approach. That would make it kind of hard to fly wouldn't it? Thought about studying the approach during preflight planning lately?

Q. I have seen dead reckoning segments on approach plates, SIDs, and STARs. Should I apply a drift correction to attempt to fly the depicted course, or just fly the heading?

A. Apply any known drift correction so as to fly the depicted course over the ground. The guy who designed the approach, SID or STAR has figured obstacle and terrain clearances using the ground course. Although the amount of protected airspace is enlarged for dead reckoning segments, we can fly more safely by attempting to fly the course.

Q. OK, I'm going to apply any known wind correction on those DR segments. Where should I get the wind information so I can figure a drift correction?

A. A Doppler or inertial drift obtained from on-board equipment would be the best. Since some of us don't have that equipment in our flying machines, consider the following:

- Estimated wind from a previous leg.
- Wind obtained from pilot to forecaster.
- Forecast wind from preflight weather briefing.
- If operating near the surface, the wind given by ATIS, approach control or tower.

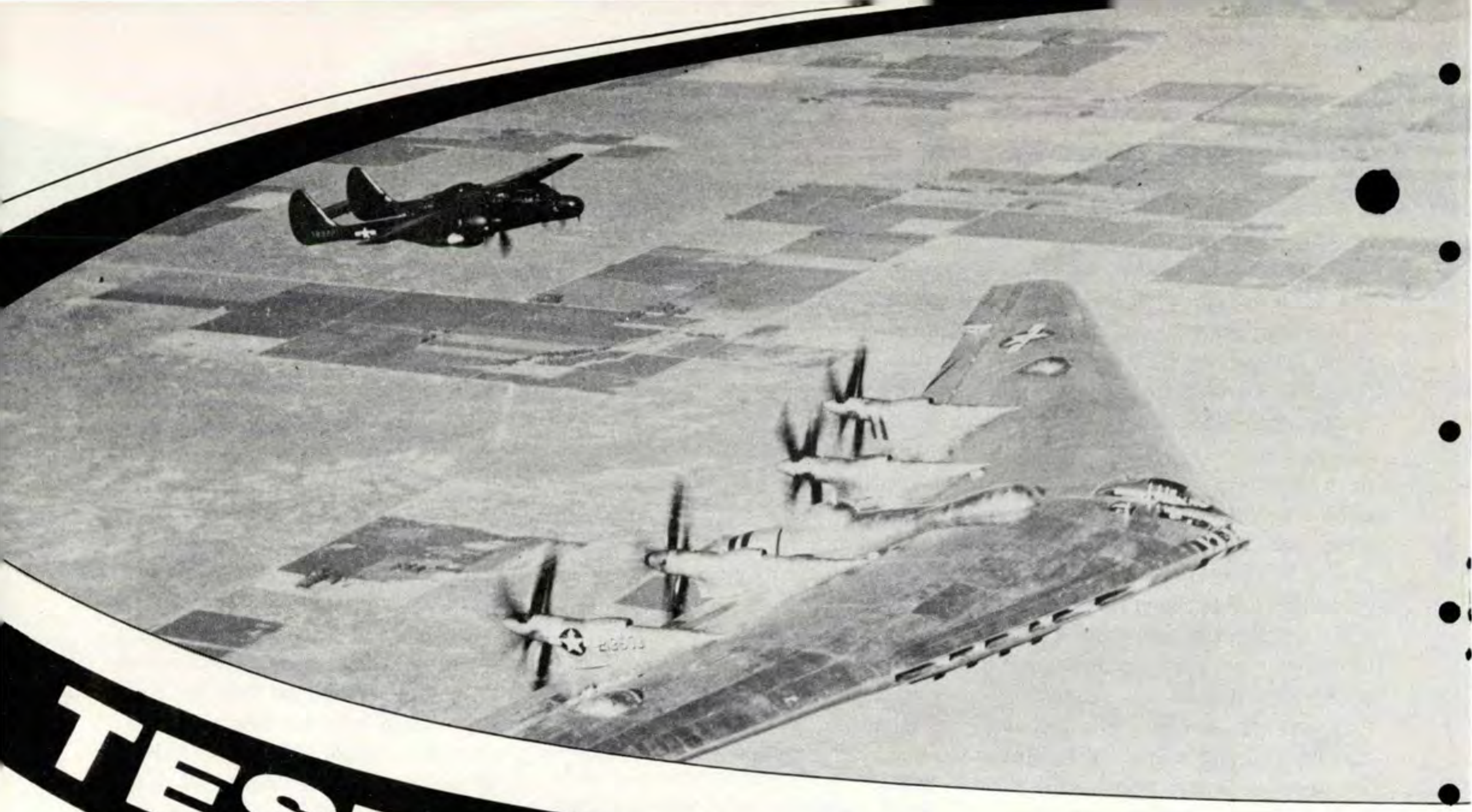
Q. The ILS chapter in AFM 51-37 includes, "If the glide slope warning flag appears, or glide scope indicator deflection in excess of one dot (half scale) fly-up occurs after intercepting the glide slope, the approach should be flown no lower than the published localizer minimum descent altitude." My questions are (1) what does fly-up mean, and (2) if I get more than one dot below the glide slope and subsequently recapture and get back on the glide slope, can I continue descent to decision height rather than to localizer minimums?

A. First, a fly-up indication tells you that you are below the glide path and that you must fly-up to get back on it. The answer to the second part of your question is yes. However, if you get more than one dot below the glide slope, when you are below localizer minimums, your wheels may be dragging in the trees.

Q. Prior to change 3 to AFM 51-37, I could continue an ILS to decision height with anything less than full scale glide slope deflection. Why did that change?

A. Once upon a time some Air Force pilots were flying multiple ILS approaches. Since the weather was good, the pilot that wasn't on the gauges was spending most of the time looking outside so as not to collide with any other heavier (or lighter) than air vehicles that might be traversing the area. Said he, "Hark, we seem to be quite close to the trees." They were. The flight inspection people from Air Force Communications Service were called in to investigate. After flying several ILS approaches on different days, they discovered that the glide slope beam was bending down toward the ground. "Hark," said they, "if we let pilots fly near full scale below the glide slope during the times when atmospheric conditions are causing the beam to deflect downward, they may drag their wheels in the trees." Seriously, that is what actually happened. Aircraft with large distances between the aircraft's ILS antenna and the bottom of the wheels are the most susceptible to this danger. However, since AFM 51-37 is written for all aircraft, it was changed to make it a little safer for all of us.

In summary, if you discover something questionable or wrong on an instrument approach procedure plate, call the Communications Squadron at that base and ask for clarification. USAFIFC will answer any questions that you have about pilot procedures/directives or about the approach design book, AFM 55-9. Please keep your questions coming. If we don't know what you don't know, we don't know what to put in these articles. For TERPS, call AUTOVON 487-4274. For pilot procedures/directives, call AUTOVON 487-4276/4484. ★



TEST FLIGHT ... TH

GROVER "TED" TATE
BDM Corporation
Edwards AFB CA

> *"After all of the analyses, tunnel tests, simulations, ground tests, training, planning and discussions have been completed, the moment of truth arrives and the test pilot must face the execution of flight tests that he recognizes as difficult and dangerous in spite of all of the preparations. Continuing on, notwithstanding these risks, he exercises the final requisite which is born of governed apprehension—COURAGE."*
>
> *Richard M. Wenzell,*
> *Pilots Handbook for*
> *Critical and Exploratory*
> *Flight Testing.*

"There was a rather noisy bang, a cloud of black smoke, we yawed somewhat to the right, there was light flame about the nr 4 engine and the smell of fuel inside the aircraft. I retarded power on all engines, executed the recommended emergency procedures and returned to the airfield without further incident." This was how B. A. Erickson, test pilot supreme, described an engine failure during a B-58 test flight.

I stared at him in astonishment, for I had been in the seat behind him during the incident and that wasn't the way that it happened at all. We were doing test runs at Mach 2 at 45,000 feet when nr 4 engine turbine wheel broke loose and crashed through the cowling. The wheel came inboard toward us, raking the protective steel cover of the flight control package. Great

E ARENA OF TRUTH

chunks of heavy cowling structural parts peppered the aircraft like attacking enemy flak. One heavy gauge piece about 2 feet long penetrated the lower surface of the wing fuel tank and JP-4 flowed over the aircraft like a waterfall. The sky around us turned black as the fuel spilled over the tail pipes of the hot engines and we boiled in the heavy smoke. The aircraft swung violently to the right as if some giant hand had suddenly grabbed the wingtip. Even with close fitted oxygen masks the smell of raw fuel and exhaust fumes within the aircraft was stifling. A great mushroom of bright orange flame surrounded the stricken nr 4 engine and threatened the entire fuel soaked aircraft. It seemed to be the end of that aircraft so I got ready to eject—ready in all respects, mechanical, physical, and spiritual.

Ejection was not to be that day, for just as he said, Mr. Erickson brought the aircraft under control and we landed safely at home base. During the debriefing after the flight I declined comment, because after hearing Mr. Erickson's description of the flight, I decided that we really were not in the same aircraft.

Flights like this are those that make flight test programs fascinating, and test pilots a special breed of low key hero. Granted, this wasn't the every day typical test flight, but it was typical of the stimulating events that periodically punctuate the routine. It was typical of the expertise exercised by competent, trained and well disciplined test pilots during test programs. Not all incidents turn out as well as this B-58 story, and test crews are often taxed to pay the supreme dues for probing the unknown. With modern technology, computers, and realistic simulators the incidence of catastrophic inflight failure has diminished—but it has not always been that way.

My admiration for test pilots started back in the 30's with Gable and Arlen and Bogart. It grew with all of the drama of the screen and bumped nose-to-nose with reality about 36 years ago in 1940. After a stint as a "rag boy" with Glenn L. Martin Co, I was elevated to airborne grease monkey and got to fly my first test flight with Captain Thomas L. Taylor in the short wing Martin Marauder. From that beginning with this magnificent pilot I was always privileged to fly with excellent test pilots. There weren't too many test pilots around in the 1941 era; but I always seemed to luck out and get to fly with the really good ones.

There were pilots like Roland Sansbury, Ken Ebel, Carl and Mel Hartley, Henry Myers, Ellis D. Shannon, Denny Morelock and Pat

TEST FLIGHT .... THE ARENA OF TRUTH

continued

Tibbs. Carl Hartley and Hank Myers were killed during the B-26 program but all of the others lived on to become chief pilots, board members, airline captains, etc. Mr. Shannon in later years became the first man to fly a delta winged aircraft—the Convair XF-92.

While flying in the old B-26 "Widow Maker" or "Prostitute" (no visible means of support), I experienced almost every known inflight emergency and always escaped relatively unscathed. There were jammed flight controls, ruptured accumulators, inflight fires, engine failures, runaway props, failed electrical systems, gun interrupters that didn't work, flaps that jammed, gear-up landings, no-brake landings, hatches that blew off, and all sorts of minor aggravations, but somehow the pilots always delivered us home in one piece.

Among the flying mechanics, or "aerial engineers", there was an obvious hero worship for the test pilots that was often more pronounced for one pilot than another. Carl Hartley was the epitome of the glamour test pilots. With the pink pants of the old Air Corps, the leather A-2 jacket, the neat scarf and the yellow pigskin gloves, he always looked as if he was ready to do the love scene with Carole Lombard or Irene Dunne. We all loved this guy, his appearance, his dramatic flying, and particularly the way he always treated us as equals. It was several days before any of the mechs would touch a B-26 after Carl Hartley was killed in one. For awhile the airplane was regarded as an assassin—one who had taken something precious from each of us.

After a stint in the Big War, I flew a part of the B-36 and XC-99 programs. Here again the excitement of flight test flourished, although the total B-36 program was a rather docile one. There were moments when the routine was infrequently shattered by explosive decompression, fuel leaks, all engines quitting simultaneously, engine fires, stuck landing gears, lightning strikes, bird strikes, loss of all electrical power, and miscellaneous other problems.

One XC-99 flight created enough excitement and used up enough adrenalin to make up for the relative calm of the B-36. Through a series of personal, personnel, and equipment problems we wound up with a burned out aux power unit, a gaping hole in the rudder, gigantic wheel well doors blown off, rup-

From the late Gen Al Boyd, first commander of AFFTC, and the early B-58 test program to Col Joe Cotton, Lt Col Fitz Fulton and the XB-70 to today, the men who make the test flights write aviation history.

tured hydraulic lines dangling in the breeze bleeding red oil like blood from a wounded giant, broken windows, no pressurization, limited flight instruments, and a bright red unsafe landing gear warning light. After making a visual check to assure that the gear was locked, we landed to discover that we had no brakes or prop reversal. We finally came to a stop off the runway—appropriately very close to an adjoining cemetery. Once again, through the skill of the test pilot, "we had defied death and won."

All of those flight test programs were only the ghosts of programs past, and a subtle prelude to that of the B-58. Here was a program that was a pilot's challenge—after all of the practice, the gates opened and the real bull invaded the arena.

During the 50 years following the Wright Brothers' flight we had progressed from their craft to a bomber capable of high subsonic speed and then suddenly, with the B-58, we more than doubled that speed. Fifty-three years of progress compressed into a short flight test program. Compress and double we did—but not without paying a very high price.

The test pilots on the B-58 program were great. No helmet and goggles but with hard hat and pressure suit they demonstrated their skill and courage in developing the Mach 2 B-58 from an idea to an operational aircraft. There were B. A. Erickson, Doc Witchell, George Davis, Ray Tenhoff, Jack Baldridge, Ray Fitzgerald, Val Prahl, Gen Al Boyd, Gen Guy Townsend and Lt Col Fitz Fulton. I would have paid to get to fly with those guys. The radical advance from subsonic to double sonic was demanding and it extracted its toll—Ray Fitzgerald, Ray Tenhoff and Jack Baldridge were killed during test flights of the B-58 and the other pilots survived an unbelievable matrix of incidents and accidents.

It seemed that everything that could happen to an airplane happened during this program. With eye witness participation on the coattails of the pilots who flew it, my admiration for them grew to greater proportions. Incidents like the one quoted in the beginning of this story were almost daily events and the pilots coped with them to make the aircraft a success.

During flights with Doc Witchell, we landed at Kirtland AFB with a heavy airplane and no brakes, got into violent pitch oscillations at Mach 1.6, blew all 16 main tires and had a magnificent fire during a landing, had a Chinese New Year on-board electrical short during a night takeoff, had a bomb pod hit the aircraft after release, and a host of lesser events. With Jack Baldridge we had an on-board fire that knocked out all nav and communications equipment and then had to penetrate a squall line to get back home (at night).

Another time we had an auto ILS signal virtually roll the aircraft at 1500 feet. With Ray Fitzgerald and a guest general aboard, at Mach 2 we got a random roll signal that created an unidentified supersonic maneuver that exceeded the published aircraft structural limits. With Gen Boyd there was a drag chute and fuel dump probe dropout and engine failure on the way to Mach 2. With George Davis there was a failed windshield and gear drop at Mach 2. There were hung weapon pods, exploding batteries, hardover flight control inputs, non-predicted supersonic gyrations, unlocked hatches and all of the lesser events regarded as routine. Each time, the pilot did a great job of bringing the aircraft home.

In the F-111 program I had limited exposure, but one flight with Fred Voorhies, a real cool "cajun pilot", was typical of the professionalism of the test pilot. We had, by plan, dropped a 600-gallon pylon fuel tank from the aircraft only to have it return to angrily attack us. It hit the underside of the aft fuselage, knocked out the right engine, ruptured the fuel tank, started a fire and inflicted structural damage. I was ready to depart via the escape system but Mr. Voorhies calmly and quietly landed the aircraft on the dry lake bed at Edwards AFB. A multi-million dollars saved.

We are inundated with a flow of tributes to all who have contributed to our 200th anniversary as a nation, and I think we should throw a few bouquets to the guys who carried aviation from infancy to the dominant world influence that it enjoys today. Coincidentally, this year is the 20th Annual Banquet and Symposium of the Society of Experimental Test Pilots and I say "HAPPY ANNIVERSARY." Surely, Ray Tenhoff, Dick Johnson, John Fitzpatrick, Scott Crossfield, Tom Kilagraff and Joe Ozien, who started the whole thing should be honored.

TEST PILOTS ARE MY FAVORITE PEOPLE—AND I ALWAYS CALL THEM "SIR." ★

ABOUT THE AUTHOR

Grover "Ted" Tate spent many years as a flight test engineer and retired from the Air Force Reserve in which he served as a navigator. Ted has been a frequent contributor over the years to **Aerospace Safety** and other USAF safety magazines. His consuming interest in survival led him to write frequently on the subject. Generally the article was based on some Tate experiment such as bailing out of an airplane in Death Valley in the summer and surviving—even with a broken ankle.

His interest in Death Valley and desert survival took him to the ghost town of Ballarat. The result was **The Ballads of Ballarat,** a seldom seen, slim volume of verse, one of the few copies of which, no doubt, resides in the editor's desk drawer.—Ed.

Killer Of The Unprepared

SGT ALLAN L. BOBST
Programs and Current Operations
3636th Combat Crew Training Wing
Fairchild AFB WA

More and more we hear about people dying of a condition called hypothermia. Exactly what is hypothermia and why is it called "Killer of the Unprepared?" What can I do to combat it? The techniques outlined below will apply in any case and can save your life.

Two most basic factors in the prevention of cold injury are the heat producing capacity of the body and the effectiveness of the measures to conserve this heat. Hypothermia results when the body's core temperature is lowered because the body is unable to produce enough heat to keep up with the losses.

In acute accidental hypothermia, the loss of heat from the body's vital core can result in uncontrollable shivering, followed by increasing clumsiness, loss of judgment, and a fairly rapid descent into unconsciousness and death.

What then are the conditions that cause accidental hypothermia? In cases affecting mountaineers and outdoorsmen, a combination of four factors is likely to be present:

- Cold (not necessarily extreme).
- Wetness (caused by rain, melting snow, immersion or even condensed perspiration).
- Wind (which vastly increases the chilling effect of the coldness and wetness).
- A likely victim (meaning a person who is possibly exhausted and is certainly unprepared to protect himself).

Adequate clothing, adequate knowledge, emergency shelter and emergency rations would prevent most fatalities from accidental hypothermia. This is the reason why it is called "Killer of the Unprepared."

HEAT PRODUCTION Food and muscular activity are the chief sources of body heat. When resting and awake, the body produces heat at a specific rate known as the basal metabolic rate. The metabolic rate can be elevated by such natural hormones as thyroxin and adrenalin, by diseases which produce a fever, and physical activity.

Intense shivering can produce heat approximately equivalent to running at a slow pace. Moderate exercise, such as hiking up a trail with a heavy pack, can increase heat production up to ten times the basal metabolic rate. During sleep, heat production drops to 80 percent of the basal rate. External sources of heat include sun and fire and the immediate warming effects of hot liquids. Intake of hot liquids is important in the prevention and treatment of hypothermia.

HEAT LOSS Radiation is a leading cause of heat loss in almost any situation, and the head is the most efficient portion of the body's radiation system. An unprotected head may lose up to one-half the body's total heat production at 40 degrees Fahrenheit; up to three-quarters of the total body heat production at 5 degrees.

The body continually warms a thin layer of air next to the skin to a temperature nearly equal to that of the skin. If this warm air layer is retained close to the body by clothing, we remain warm. However, if this warm layer of air is constantly being removed by a brisk wind (convection) we feel cool and put on more clothing. The wind chill chart is reproduced to remind you of the devastating effects wind can have on your body.

Everyone notes with awe that at

−50° and 33 knots wind speed the equivalent chill factor is −130°. But note the chill factor for a comfortable plus 20° and a 16 knot wind (not too uncommon conditions anywhere in the US). Suddenly you're faced with a chill factor of −10°.

In short, the primary function of clothing is to retain that layer of warmed air close to the body and, if worn properly, to prevent hypothermia.

The evaporation of perspiration or other water from the skin and lungs accounts for a substantial loss of body heat.

Inhaling cool air and exhaling warm air accounts for a significant loss. But there is very little that we can do to prevent it.

The thermal conductivity of water is 240 times as great as that of still air. This means that wet clothing can extract heat from your body up to 240 times as fast as dry clothing. It is worth noting that the wicking action of wet wool is considerably less than that of other fabrics. Wool can provide some warmth even when wet.

Inevitably, if heat loss continues, the temperature of the body's inner core will begin to fall below 99 degrees. As core (internal) temperature drops, symptoms are as follows:

99 to 96°: Shivering becomes intense and uncontrollable.

95 to 91°: Violent shivering persists. Difficulty in speaking, sluggish thinking and amnesia start to appear.

90 to 86°: Shivering decreases and is replaced by strong muscular rigidity.

85 to 81°: Victim becomes irrational, loses contact with environment and drifts into stupor. Pulse and respiration are slowed.

80 to 78°: Unconsciousness.

Below 78°: Usually failure of cardiac and respiratory control centers in the brain, followed by death.

The primary purpose of this article is to warn you to be prepared for the cold-wet-windy situations which can kill you. Preparation and prevention consist of six essential factors:

- Know your enemy.
- Dress for warmth, wind and wet.
- Eat! Keep nibbling.
- Carry emergency bivouac gear.
- Bivouac early.
- Keep active.

Treatment for hypothermia is as follows:

- Prevent any further heat loss.
- Add heat to rewarm the victim's body.
- Place the victim out of the wind and in the best available shelter.
- Replace his wet clothing with dry clothing.
- Place as much insulation as you can between the victim and the ground.

Placing a hypothermia victim in a cold sleeping bag, no matter how much down it contains, is not sufficient. The bag should be prewarmed by another member of the party who has stripped down to his underclothing in order to transfer a maximum amount of heat from his body to the bag. Ideally if the bag is large enough, place the victim in the bag with the other person.

If the patient is conscious, he should be given warmed fluids. If he is able to eat, he should be fed candy or sweetened foods; carbohydrates are the fuel most quickly transformed into heat and energy.

In summary, the treatment of acute hypothermia in the field is to get the patient out of the wind, replace his wet clothing with dry, insulate him from the ground, and warm him by the most expedient means available. ★

WINDSPEED

COOLING POWER OF WIND EXPRESSED AS "EQUIVALENT CHILL TEMPERATURE"

NOTS	MPH	TEMPERATURE (°F)																				
Calm	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50	-55	-60
		EQUIVALENT CHILL TEMPERATURE																				
3 - 6	5	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50	-55	-65	-70
7 - 10	10	30	20	15	10	5	0	-10	-15	-20	-25	-35	-40	-45	-50	-60	-65	-70	-75	-80	-90	-95
11 - 15	15	25	15	10	0	-5	-10	-20	-25	-30	-40	-45	-50	-60	-65	-70	-80	-85	-90	-100	-105	-110
16 - 19	20	20	10	5	0	-10	-15	-25	-30	-35	-45	-50	-60	-65	-75	-80	-85	-95	-100	-110	-115	-120
20 - 23	25	15	10	0	-5	-15	-20	-30	-35	-45	-50	-60	-65	-75	-80	-90	-95	-105	-110	-120	-125	-135
24 - 28	30	10	5	0	-10	-20	-25	-30	-40	-50	-55	-65	-70	-80	-85	-95	-100	-110	-115	-125	-130	-140
29 - 32	35	10	5	-5	-10	-20	-30	-35	-40	-50	-60	-65	-75	-80	-90	-100	-105	-115	-120	-130	-135	-145
33 - 36	40	10	0	-5	-15	-20	-30	-35	-45	-55	-60	-70	-75	-85	-95	-100	-110	-115	-125	-130	-140	-150
IN AB HA TTLE ADDITIONAL EFFECT.		LITTLE DANGER					INCREASING DANGER (Flesh may freeze within 1 minute)						GREAT DANGER (Flesh may freeze within 30 seconds)									
		DANGER OF FREEZING EXPOSED FLESH FOR PROPERLY CLOTHED PERSONS																				

INSTRUCTIONS

Measure local temperature and wind speed, if possible; if not, **estimate**, enter table at closest 5°F interval along the top and with appropriate wind speed along left side. Intersection gives approximate equivalent chill temperature. That is, the temperature that would cause the same rate of cooling under calm conditions.

NOTES

WIND 1. This table was constructed using miles per hour (mph); however, a scale giving the equivalent range in knots has been included on the chart to facilitate its use with either unit.

2. Wind may be calm but freezing danger great if person is exposed in a moving vehicle, under helicopter rotors, in propeller blast, etc. It is the rate of relative air movement that counts and the cooling effect is the same whether you are moving through the air or it is blowing past you.

3. Effect of wind will be less if a person has even slight protection for exposed parts. Light gloves on hands, parka hood shielding face, etc.

ACTIVITY Danger is less if subject is active. A man produces about 100 WATTS (341 BTUs) of heat standing still but up to 1000 WATTS (3413 BTUs) in vigorous activity like cross-country skiing.

PROPER USE OF CLOTHING and ADEQUATE DIET are both important.

COMMON SENSE There is no substitute for it. The table serves only as a guide to the cooling effect of the wind on bare flesh when the person is first exposed. General body cooling and many other factors affect the risk of freezing injury.

OPS TOPICS

BIENNIAL FLIGHT CHECK

If you have an FAA pilot's certificate you must have a flight review every 24 months. For military pilots this normally isn't a problem since the annual 60-1 checks fulfill the requirement. However, as more and more pilots find themselves "flying a desk" the FAA check becomes important. Remember, if you have not had either a 60-1 check or an FAA flight review within the last two years, you cannot legally fly as a pilot (see Part 61 of the FAR's).

A MESSAGE FOR THE HIGH ROLLER

When a warning device is actuated, the odds clearly favor impending danger with respect to the warning, *not* . . . the probability of a faulty warning device. To wit—

> At 1000 feet AGL, the firewarning light illuminated. The throttle was retarded and the light extinguished. A visual check of the engine revealed no evidence of smoke or flames. The throttle was then advanced to a high rpm. The fire light did not illuminate, however, sparks were observed coming from the cowling. The engine was then shut down.

Readvancing the throttle on an engine after a malfunction warning, particularly fire—is risking half a million dollars, needlessly. Burned out circuits will not mend themselves! Disprove the danger *before* you disprove the warning.

TURBINE WHEEL FAILURE

A T-33 was forced to make a flameout landing as a result of a turbine wheel failure. The crew did a good job on the recovery; and on this flight no limits or regulations were violated. However, the turbine failure was typical of the type caused by over-temperature and overstress. This is one more example of the absolute necessity for observing engine operating limits. It gets very quiet at 35,000 when the engine quits.

LOW EPR

The B-52 pilot was completing the after takeoff checklist. As the flaps were coming up the nr 5 fire warning light came on. After flight maintenance found that the spider duct assembly had ruptured. During takeoff, the pilot had noticed that the nr 5 engine EPR was slightly lower than normal. But since he thought this was the result of only partial water on this engine, continued the takeoff knowing they had dry capability. It is not uncommon in the case of bleed air leak for the EPR to be low. If the crew had known this and then had checked on the low EPR, maybe a lot of firewall repair could have been prevented.

SLUSH + COLD = ICE

A B-57 could not get the nose gear down because slush thrown into the wheel well during taxi froze at altitude. Not to be outdone, a T-37 attempted the same trick and was just as successful. The major difference between the T-37 and the B-57 was that the T-37 was able to use the speed brake as a support for the fuselage.

INSTRUMENT HOOD FIRE

A T-33 instrument hood had a 3-inch hole burned in it. This is another instance of sunlight magnified by the canopy burning the hood. The unit has forwarded information on the problem to the ALC. But until a fix is approved, be careful about leaving instrument hoods in the T-Bird.

OPS TOPICS

COULD NOT DUPLICATE

A B-52 could not be fixed because maintenance could not determine the cause of the malfunction. Why couldn't they determine the cause? The aircrew's write-up was too vague and incomplete. Maintenance performed all the checks they could without success, but were unable to question the aircrew due to schedule conflicts. None of us like to be disturbed on our time off, but it's no better to find the airplane down because maintenance could not decipher the pilot's write up. We are all in a hurry after a mission; but take the time to *adequately and completely* write up any discrepancies. If you have doubts about the information needed, ask to have a specialist meet you at the aircraft. If we, the aircrew, want quality maintenance, we must do our part by really telling it like it is.

F-4 ANTISKID

The following is a quote from an F-4 FCF pilot's hazard report. "I completed an FCF high speed taxi check to test the new antiskid system installed. The new system worked beautifully but had such a different feel that I believe that an aircrew that is used to the old system may misinterpret the lack of any antiskid cycling to be an indication of an antiskid failure and cause him to 'paddle it off' just when he needs it most. This lack of any antiskid feel by cycling would be especially confusing during the transition when some aircraft are modified and some are not."

WHAT IF HE WAS IMC?

On a radar vector to a precision approach to a naval air station in VMC, a P-3 pilot was given a descent from 4500 feet to 2000 feet. Approaching 3300 feet, the pilot decided that 2000 feet provided insufficient clearance for the mountain ridge directly ahead. Therefore, he leveled at 3300 feet and cleared the ridge by 500 feet.

The approach controller had mistakenly given a premature descent. Fortunately, the VMC weather prevented a disaster. Nonetheless, the important message here is that the pilot must always be aware of minimum terrain clearances and sector altitudes when operating at low altitudes. (Controllers don't often make mistakes but when they do it could ruin your whole day if you aren't prepared). This case adapted from NAVSAFECEN Weekly Summary nr 35-76.

"TOO MUCH TROUBLE?"

see correction
page 18, Jan
77 ASM

After completing a practice firing run, the HH-53 crew collected the expended brass and unexpended ammo and sealed it in ammo boxes. The boxes were then thrown out of the aircraft from the rear ramp. When the fourth box was thrown overboard the lid flew off and struck the tail rotor. Fortunately, the damage was minor and the crew was able to make a precautionary landing on a deserted road. The reason given by the crew for dumping the boxes was that turning in the ammunition and brass was "too much trouble."

BUGS BUNNY WON'T HOP AGAIN

On the fourth approach after three touch and go's the T-33 crew could not get the right main gear down. All attempts to get a safe indication were unsuccessful; and after landing, the right main collapsed. During the investigation the outer gear door was found jammed between the inner door and the wing. There were remains of a rabbit on the outer door. Evidently during a touch and go the aircraft struck a rabbit. The impact weakened or broke the forward outer door attach bracket. This allowed the airloads after takeoff to pull the door loose and jam the gear.

OPS TOPICS

VMC?/VERTIGO! The helicopter pilot was attempting to fly at tactical altitude (tree top level). However, it was a very dark night with marginal weather (rain, low vis and ceiling). Guess what? The pilot got vertigo and hit the ground.

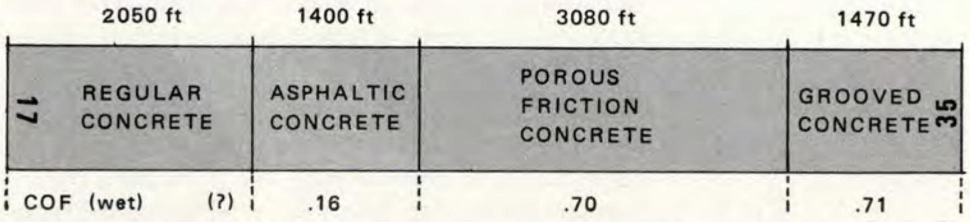
BENT FLAP When the RF-4 pilot lowered the flaps during the initial ground check, the leading edge flap indicator showed a barber pole condition as the flaps stopped at the one-half position. The crew chief checked for abnormalities but could find none. The pilot then cycled the flaps again. This time as the flaps retracted, the left outboard leading edge segment did not retract, and the left center segment struck it causing some minor damage. The flap bellcrank was broken at the connection to the actuator rod. Cycling the flaps two or three times with a malfunction is not recommended when on the ground—it may cause further damage.

LIGHTS HELP The F-111 departed the IP for a low level bomb run. The weather was IMC with the aircraft in and out of clouds. The pilot's attention was caught by a bright light similar to a landing light at 3 o'clock, co-altitude. He then saw wing tip lights and a rotating beacon, and started immediate evasive action. Although he lost sight of the traffic during the maneuver, he estimated a proximity of less than 1 mile! Suppose the other aircraft had not been using a bright light?

CHECK YOUR PUBS During preflight, the pilot discovered that a FLIP Letdown book was missing *31 pages*. The book had been assembled with the pages missing. Fortunately there was no problem; but it could have been hairy if discovered airborne in the weather. It pays to check before you go.

PFC NAS Dallas runway 17/35 has an experimental porous friction surface (a special porous asphalt aggregate overlay which allows water to drain through it). This surface drastically increases the coefficient of friction and thus braking action. The problem is that this rapid change can cause blown tires. A T-39 landed at Navy Dallas with a coefficient of friction (COF) of .16 (poor). The aircraft immediately began to hydroplane. When the aircraft crossed onto the porous friction surface, the COF changed from .16 to .70. The main gear tires immediately blew out.

The following graph of coefficients of friction for NAS Dallas was published by the NAVSAFECEN in the *Weekly Summary of Major Aircraft Accidents* (for more information on runway surfaces see Captain Burke's article "Runway Surface Hazards" in this issue). ★



COF (dry) The average for the last three sections of Runway 17 is from .74 to .76.
No COF was available for the regular concrete since that was not part of the experiment.

CUTTING THE ACCIDENT BILL

MAJOR THOMAS R. ALLOCCA
Directorate of Aerospace Safety

People cause accidents and these accidents involve a substantial loss of USAF resources. In fact, in the 10-year period from 1966 through 1975, there was a $1 billion loss incurred in those aircraft accidents where human error was cited as causal. One billion dollars!

People differ greatly. At the ball park or the beach on any hot summer day, even the most casual observer cannot help but be impressed with the amazing array of physical differences among people. But people differ in a myriad of other less easily determined characteristics—qualities such as intelligence, trainability, interests and motivation.

These two facts—that people cause accidents and that people are different—concern those of us in the accident prevention business (and that's all of us), particularly when we seek to identify measures which will lead to a reduction in human factor-caused accidents.

The aircraft dollar loss figures mentioned earlier involve systems which include the F-4, C-141 and the B-52. These are man-machine systems in the classic sense; that is, they are equipment systems in which one of the components is a human who interacts with the machine component during operation of the system. If we are to prevent accidents with these systems, then we must consider their major subsystems—man and machine—and the interface of the two.

The machine (or hardware) subsystem must receive a significant portion of the safety effort—and it does. Air Force accident files are filled with actions we've taken to minimize the hardware-failure input to the accident sequence.

. . . there's really no way to predict the infinite variety of responses man will

takers of the full consequences of their actions.

We've done everything from complete systems redesign to major fleet modifications.

But how about the man? The accident statistic mentioned earlier supports the contention that the human subsystem is also worthy of our efforts. Human factors deals with the human subsystem and attempts to minimize man's contribution to the accident sequence. Three primary areas on which human factors concentrate are: design of equipment, selection of people, and training of people.

Human factors-types are the first to grant that people make mistakes. In fact, the "to err is human" thing has been used so often it has become a part of our vernacular. But, when human factors engineers look at the human error "goofs", they raise some crucial questions, such as: "Can part of the blame be found in the design of the equipment that people use?" "Do certain kinds of equipment become involved in more mishaps than others?" "Can we redesign a piece of equipment in such a manner that the possibility of human error is minimized?" The answer to these and similar questions is a resounding "yes!" And, in all fairness to the human factors engineering community, remarkable strides have been made redesigning machines for man-machine compatibility.

During the design phase, the human factors engineer considers such things as machine displays, controls and working environment so that they are "in tune" with man's natural abilities. This is not easily done; man is the most complex of beings and a program attempting to design equipment that is compatible with man's natural characteristics is ambitious at best, impossible at worst. But the pervasiveness of the field—human factors types are employed in every branch of the armed services, in government, in the aviation, electronic and automotive industries—strongly suggests that we are making substantial strides in this area. How about the selection process?

To answer this question, let's consider the task of selecting, from a number of applicants, one person to do a particular job. To make the proper selection, psychologists insist that a number of questions must first be answered—questions such as: "What aspects of this job must be taken into account for defining those human characteristics needed to do the job?" "How should we analyze this job?" "What kinds of behavior constitute successful job performance?" The answers to these and similar questions will undoubtedly prove helpful in job placement and selection, but I suggest that, for accident prevention purposes, we need continuously to ask—in spite of past failures—questions such as: "What methods should be used to 'size up' or measure the tendency for USAF pilots to become involved in accidents?" "What evidence shows adequately the relationships between certain measured human characteristics and involvement in USAF accidents?" "What identifiable human qualities can be introduced into a battery of tests which will help establish some measure of accident proneness?"

I submit that we've addressed the first group of questions fairly adequately; USAF's classification and assignment system has (and I know you're going to mention the Ph.D. mathematician who was assigned to the gym) done remarkably well in properly placing the thousands who join our ranks each year. But what about the second group of questions? This is the group most germane to this discussion.

In making the selection or assignment decision, two kinds of error are possible—an individual is assigned to a job on which he fails, or an individual is not placed on a job in which he would have been successful. For our purposes, only the first error is of concern. If, for example, a pilot is given an F-15 assignment and becomes involved in a pilot-caused F-15 mishap, or if an airman is assigned as a C-5 engine specialist and becomes involved in a human error-caused C-5 engine-related mishap and if, through proper selection procedures, both of the human *make in a given situation . . . we must somehow apprise the potential risk-*

factor aspects of these accidents may have been predicted with a reasonable degree of accuracy, we seriously missed the boat. The relative cost of both of these "wrong" decisions far outweighs any expenditures we could have made in improving our selection procedures. Maybe such a selection program is not possible; maybe humans are so complex that "there's no way" to accurately predict their behavior (especially accident-proneness); but is it worth a try? You bet! Now let's briefly discuss training.

Training programs in the Air Force are widespread. In fact, a large part of our day-to-day existence involves training. We train people to modify their knowledge, skills and attitudes in order that they may perform their jobs better. Now personnel selection and job placement are inextricably intertwined with job training. If we select and place people perfectly, our training problems are substantially decreased. But we don't select and place people perfectly, so it becomes necessary to base selection and placement partly on the basis of what training can achieve and to select people who are most "trainable." But here also, as in the selection process, we must include in our training programs a proper appreciation for accident prevention. Do we? I think not.

Even a cursory review of USAF mishaps indicates that in 1976 humans make the same general kinds of mistakes they made in 1966; failure to follow prescribed procedures; insufficient attention to a potentially hazardous situation; incorrect diagnosis of a situation. Can we design a training program that will ensure that a pilot will not land in weather known to be below minimums, or that a flight line mechanic, by not following tech order procedures, will install an engine filter backwards? Probably not—there's really no way to predict the infinite variety of responses man will make in a given situation.

Both examples cited above have a common cause: "risk-taking." The flight line mechanic was probably trained satisfactorily; he probably knew how to do the job. Furthermore, he undoubtedly knew he was supposed to follow tech order procedures—but he didn't! The pilot's mistake also involved risk-taking; he, too, was properly trained; he knew he should not attempt the landing, but he did it anyway. He made the decision, by himself, to take a chance. The human factors question is: "Why do we engage in risk-taking?" For, if we agree that risk-taking differs from confidence, then we can state that it's not a desired characteristic in people working in and around airplanes. Somehow we've got to get this across to the risk-takers. Can training do this? Perhaps.

The Air Force conducts excellent training programs for aircrew, maintenance and support specialists; the training problem, therefore, is not one of quality—it's one of emphasis. We must somehow apprise the potential risk-takers of the full consequences of their actions. This should be done in such a way that the potential risk-takers believe what they're being taught. Why? Because the most effective control of their actions must be self-generated; that is, they'll most effectively exercise self-discipline when they are convinced it's in their best interests to do so. Is this self-generated control an easy thing to teach? Hardly. But, as with the selection question, it's certainly worthy of our best efforts.

In summary, then, if we are to appreciably change USAF's human factor-caused accident losses, we must make a concerted effort to identify those new or novel courses of action which will lead to such a reduction. This discussion has suggested that these approaches should address the selection and training processes, but to significantly reduce that $1 billion figure will require many new ideas in many new areas. I've repeated the words new and novel with purpose—the conventional approaches have been tried and have achieved some success—but the time is ripe for some different ideas. Help! ★

Don't Put The Blame On Mame

MAJOR RONALD L. DeCOSMO
Directorate of Aerospace Safety

Someday, you could be asked to provide testimony before a board, or officer, investigating an Air Force mishap in accordance with Air Force Regulation 127-4. Perhaps you or a friend are directly involved in the mishap. In either case, you might feel you are between the proverbial "rock and a hard place. . . ." You know it's vital for the Air Force to determine causes to prevent future occurrences; yet, you don't want to point the finger at yourself or a friend. If you ever find yourself in this position, the following thoughts may help put this dilemma in perspective.

The crux of the Air Force accident investigating/reporting process *is not* to place blame for mishaps. Rather, the thrust is to determine *what* can be done to prevent future mishaps and *who* can do it. Certainly, we need to determine who was involved in a mishap and how, but this information is only important as a means of finding ways to prevent future occurrences.

The Air Force commitment to this philosophy is evidence by the existence of "privileged information" and the privileged nature of nuclear, aircraft and missile mishaps. Air Force Regulation 127-4 provides the specifics; however, the key points are that mishap investigations are for the sole purpose of preventing accidents—nothing else. Second, the regulation recognizes that frank and open communication with people involved in mishaps is vital. Therefore, confidentiality and immunity are granted to anyone who provides information to flight and missile mishap investigations. In short, it can't be held against you.

Unfortunately, at the Air Force Inspection and Safety Center, we often see individuals and/or organizations preoccupied with trying to point, or avoid, the finger of blame for mishaps. They are missing the point. Who was involved and how they were involved are only a means to an end. The end is what can be done to prevent future mishaps and who can accomplish it! ★

MAIL CALL

Thank you very much for the beautiful job your staff did in publishing my article "From Fighter to Airlift" in your August '76 issue. The art work done by Mr. Baer, is beautiful and really adds that crowning touch to an article which I hope all aviation people will enjoy. We have done a sequel, after ten months flying the C-130 and I will, hopefully, be able to send you a copy in the very near future. Thanks again for your great article.

P. K. Wood, M.D.
Flight Surgeon
Ohio Air National Guards
Mansfield Lahm Airport
Mansfield, Ohio

I have read with interest Major Harrison's article "Life Support Discipline." Discipline with life support equipment and procedures is as important as that required for all aspects of flight. The probability of making an ejection, bailout, or emergency ground egress should be considered just as other emergency procedures such as a fire light and hydraulic failure are. "Life Support Discipline" is an integral part of "Flight Discipline." It should be exercised from the pre-mission briefing through engine shutdown.

I do disagree with one point. The majority of aircrews who are conscientious of life support training and equipment are not necessarily comprised of those who have "been there." A sizeable portion, if not the majority, of aircrews I have worked with are adequately concerned with the safety and well being of their bodies in flight. Sometimes, however, what concerns them does not seem to be high on the list of our considerations in life support thinking. Some are concerned that when we increase the weight and bulk of the helmet by adding a dual visor they will not be able to adequately "check six." They know/feel that this added restriction may cause them to put that life support discipline to work sooner than necessary. They don't know when an F-4 Jock/Gator has demonstrated a need for that dual visor! They do not know who has put this requirement on them. They do feel that whoever it was has not spent a great deal of time in the combat environment of their cockpits.

"Look realistically at what is provided?" Yes—at *all* levels.

TSgt Rudolph J. Buday
91TFS Life Support

Your letter was referred to the author who replied as follows:

"All items of life support equipment are initially generated by one source—the user . . . (generally because of) lessons learned through accident investigations and combat mishap reports. . . .

"In the specific concern over the dual visor requirement, please keep in mind that dual visors are listed as an aircrew option and only made mandatory in certain MAJCOMs, wings, or squadrons by the direction of that organization's 'Director of Operations.' In our experience, most DOs fly right along with the other jocks, so to say these decisions are made by inexperienced individuals, is an invalid accusation." ★

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Program.

STAFF SERGEANT

Michael A. Moseley

920th Weather Reconnaissance Group
Keesler Air Force Base, Mississippi

On 14 January 1976, Sergeant Moseley, an Air Force Reserve Crew chief on a WC-130H aircraft, was standing by his aircraft awaiting the arrival of a fuel truck. As the truck approached, he spotted smoke and then flames emerging from beneath the pump portion of the 4500 gallon tanker truck. The driver of the truck, unaware of the spreading flames, continued into position midway between two aircrart, just 10 feet from the wing tips. Sergeant Moseley, disregarding the possibility of explosion, rushed to the fuel truck, warned the driver of the fire, and grabbed the truck's portable fire extinguisher. In minutes he had the flames under control, but the danger had not completely passed. Sparks from what looked like the truck's braking system were still visible from the underbelly of the truck. He continued to contain the sparks until the fire department arrived a few minutes later. Sergeant Moseley's immediate response to this dangerous situation prevented the loss of a fuel truck, and possibly two C-130H aircraft and the lives of the individuals in the area. WELL DONE! ★

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