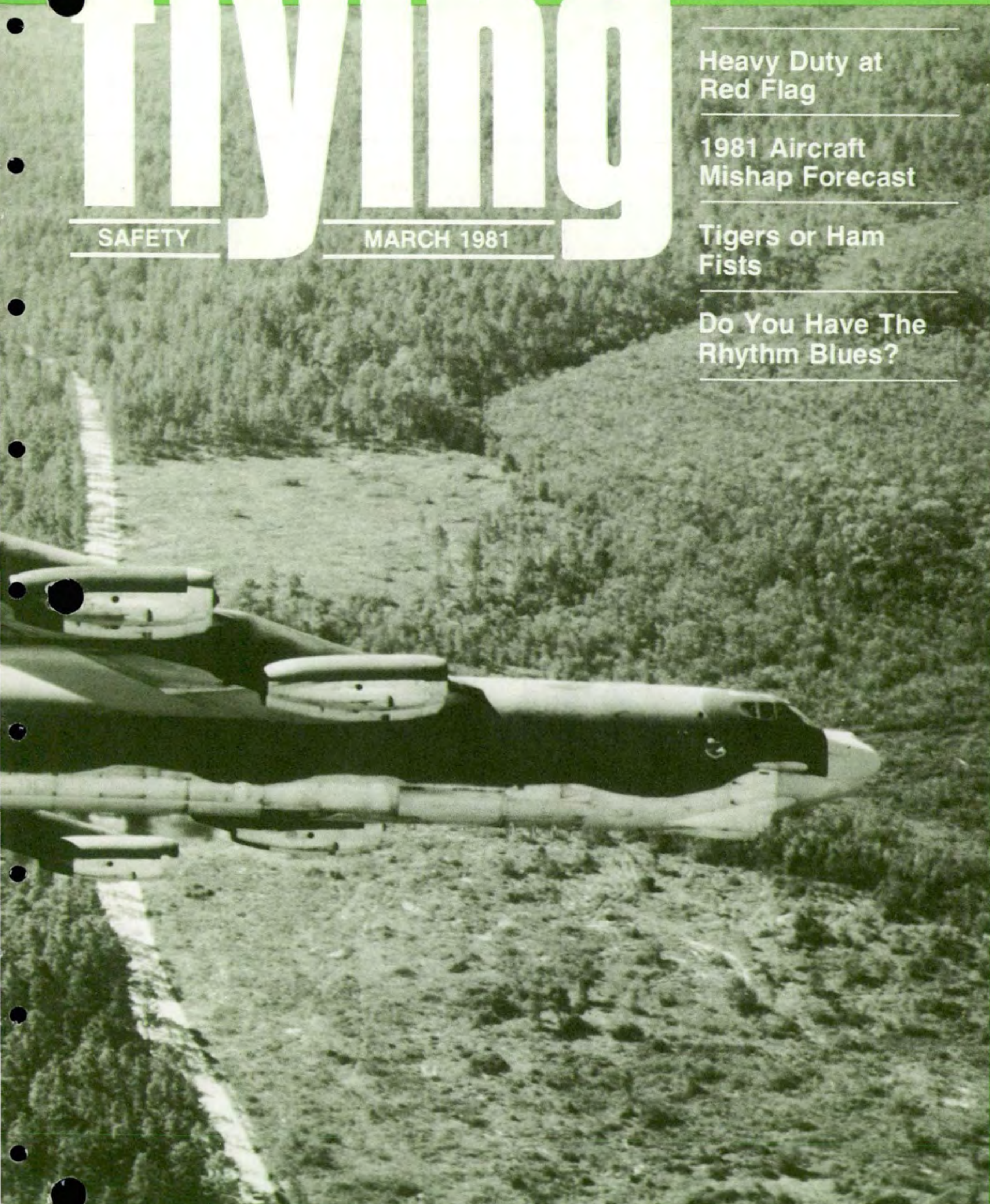
flying

SAFETY — MARCH 1981



Heavy Duty at Red Flag

1981 Aircraft Mishap Forecast

Tigers or Ham Fists

Do You Have The Rhythm Blues?

OPS topics

Twang!

■ A single-ship fighter flying an IR heard a loud noise and saw that the front of the 450 gal drop tank was missing and fuel vapor streaming. They immediately pulled to an up-vector to a higher altitude. They had hit two ½-inch static lines between power poles on the route. Fortunately, the aircraft didn't hit the 2-inch power transmission lines.

If you are new at flying these routes through valleys and canyons, be especially careful. This crew knew the lines were there but they didn't know how high they were above the ground. In a valley, those lines can be as much as several hundred feet to within 100 feet or so of the surface. Remember, they go *up* over the mountains and ridges as well as down into the valleys.

Water, Water Everywhere

An RF-4C with electrical problems made an emergency landing on a wet runway. The aircraft drifed slowly to the right and despite the pilot's efforts, left the runway 3,500 feet from the approach end. The pilot regained control, got back on the runway and hydroplaned again before he got the aircraft stopped.

All that was interesting enough, but the other details should get your attention. The aircraft hydroplaned because there were two inches of water on the runway. When the pilot got the bird stopped and went to shut down, he found both engines had flamed out. It was later determined that the flameouts were caused by water ingestion.

Wake of the Herk Witch

Had a real thrill lately? Here's one you could surely do without. The scene: night VMC, T-38 being vectored for a visual approach. At seven miles the runway is in sight and you're cleared for approach, with a C-130 ahead of you that you're not told about. The crew went to tower which told them they couldn't make a touch and go and to climb and . . . . No mention of the Herk. Next thing you know "There I was, gear down, flat on my back." The T-38 crew overcame that handicap, reentered the pattern and landed. Get too close to a biggie and watch out! The controller did not follow proper FAA handbook procedures.

Too Much Help

The pilot began taxi to parking after postflight end-of-runway checks and dearming were complete. He applied power and engaged nose wheel steering, but the aircraft made its own way toward places unknown to the pilot. Frantic attempts to use nose wheel steering or stop with the brakes had no affect. The aircraft departed the taxiway and shortly thereafter received a challenge of a stand of "Cellulosa rigida." As one might expect, the trees inflicted several thousand dollars worth of damage to the aircraft.

The mishap investigation revealed that the pilot decided to help out the crew chief by pulling a few circuit breakers that were normally pulled by the crew chief during postflight checks. He had done this before with no problems. On this particular day, the pilot pulled circuit breakers one row higher than the desired row. One of these circuit breakers disconnected the electrical signal from the cockpit to the nose wheel steering and brakes (normal and emergency).

This mishap undoubtedly resulted in some changes to one pilot's procedures. Maybe others in his unit or type aircraft got the message. What about you? Have you noticed anything in your procedures that are not prescribed in your checklist? Maybe someone else in your unit takes a short cut here and there just to help out a bit. The "help" you're providing is probably another person's duty for a good reason if it isn't in your checklist. If you think it should be changed, submit the change to the tech order managers. Try and persuade your buddy to do the same before "Murphy" helps either of you provide "too much help." —*Major James H. Ground, Directorate of Aerospace Safety.* ■

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SPECIAL FEATURES

REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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Heavy Duty At RED FLAG

■ 400,000 pounds of people, parts, and petroleum settled to the Nevada desert on a night last November. This was not an airborne assault force, a squadron of fighters, or even an apparition from Jules Verne's vivid imagination. The descending mass was a single B-52 on a routine training flight at the RED FLAG range.

Routine? Webster says routine means the habitual or mechanical performance of an established procedure. Is it routine to fly close to the ground, at high speed, in a machine weighing nearly one-half million pounds? Is it routine to do so in the dark, with electronic presentations as the main reference for avoiding obstacles? It's true that established procedures are necessary to ensure proper aircraft operation, but is this the place for habitual or mechanical performance? Perhaps a glance at the SAC operation in RED FLAG will uncover some thoughts about this slightly rhetorical question.

In recent years SAC has expanded the traditional role to include conventional operations around the world. Aircrews, maintenance personnel, and operations staffers must now be masters of many missions, and they must do them all well. Moreover, this must all be done with an aircraft designed in another era, for a different national policy. It's true that modifications are underway which will improve B-52 effectiveness, but the fact remains that more must be done with the same old airframe. This means that a total effort from an entire MAJCOM must focus on this monumental task of doing the new with the old. Never has this been more true than in the RED FLAG exercises, where one can practice for combat during peace.

If one is to practice for combat, it seems reasonable that missions must be prepared at each staff level with an acceptable balance between safety and a true learning experience. During mission development a variety of questions may surface as part of the staff preparation. Does the crew have adequate time to prepare for the mission? Are the pre-mission briefings complete and pertinent? Are commanders confident that each man is ready for the challenge? Have all the mission conflicts been resolved? Are FAA

MAJOR WILLIAM R. REVELS
HQ 15AF
March AFB, CA

facilities aware and prepared for a large scale exercise? Yes, yes, and yes comes the chorus from staff people around the CONUS, because B-52 operations have achieved an enviable safety record. If the answers are truly yes, then the pinnacle has been reached and the future glows brightly. If there is a doubter out there, it may be pertinent to ask if the planning cycle has become routine, methodical, or habitual. Is the safety record secure? Is the learning process complete?

Aircraft preparation is a continuous process conducted simultaneously with operations planning. When any aircraft stands on the flight line, ready for a mission, waiting for the aircrew, it represents the total efforts from a long line of logisticians and maintenance personnel. This is particularly true of the B-52 because of its size, age, and complexity. Generally, this total effort provides the best product available. A lingering question is whether the best product available is good enough; is it really the best available?

Ultimately the aircrew must bear the responsibility for making a mission work.

Since the newest aircraft are 19 years old, all of them are old enough to vote. Can it be said that aircraft systems and components receive the sort of geriatric care so necessary for the elderly? The aircrew plans for a machine which will do the job; one which does not add to variables they must deal with. Is each member of the support team confident this aging giant lives up to the need? Is the best available product on the line today? Is there any reason to think that aircraft preparation has become routine, leaving correctable gaps which the aircrew must fill?

Ultimately the aircrew must bear the responsibility for making a mission work. They must form the mission package and the aircraft into a whole which is greater and more complete than the sum of the parts. This is no small task because the crew must do more than ensure their own inputs are sound; they must correct or allow for any oversights which have come to them. In order to do this each man has to be a team member in addition to handling individual duties.

The RED FLAG mission is designed to simulate combat, and a combat mission is more than just a bomb run, an ECM run, fighter attacks, or evasive maneuvers. A combat mission is all of this simultaneously, with effectiveness and survival dependent on how well each man contributes to the whole effort. Safety and success then, can be linked to crew preparation and crew ability to deal with the unexpected.

A curious person might ask if each crew has reviewed such a mission together prior to flight. Does everyone know where to expect threats, and what they are likely to be? Where are the obstacles? Does the crew practice together, or as individuals? Is the mission planned with curiosity, insight, and imagination, or has it become a chore to be accomplished shortly after ordering the flight lunches? Does each crew prepare to make the mission work, creating the foundation for a productive learning experience?

The RED FLAG exercises are designed to provide aircrews with a simulated combat experience. It is a mission which is desirable to a force that must be constantly prepared for a variety of operations. In order to achieve the learning experience safely, there must be a coordinated effort from all participants. Perhaps the best time to review and evaluate this effort follows a period of good results, with a fine safety record. The present seems a good time to reflect on the past, look to the future, and remember the definition of routine. Has the mission become routine? Is routine performance the best performance for the heavy duty at RED FLAG? ■

1981 AIRCRAFT MISHAP FORECAST

LT COL JAMES I. MIHOLICK
Directorate of Aerospace Safety

The 1981 Aircraft Mishap Forecast, page 6, predicts a total of 85 Class A mishaps in 1981. Obviously, this is not a goal, nor is it inevitable that we must experience this number of mishaps. The forecast is highly dependent on the basic assumption that we will continue to support, maintain, and operate our aircraft in 1981 in essentially the same way as we have in the recent past. If, in fact, we do maintain the status quo, the forecast is very probably quite accurate in terms of what we can expect to happen. onversely, if we are successful in focusing our efforts on the areas of high mishap potential and in finding better and smarter ways of doing the job, we will beat the forecast and preclude some of the loss of our vital combat resources.

I have personally challenged myself and each of my people in the Safety Directorate to work the problems and effect the changes necessary to prove the analysts' predictions wrong. I extend this same challenge to all of you–operators, maintainers, engineers, logisticians, supervisors, and commanders at all levels. We can beat the 1981 forecast and make this the best year ever.

Brig Gen Leland K. Lukens
Director of Aerospace Safety

■ The aircraft mishap forecast predicts that the Air Force will have 85 Class A mishaps and that 78 of the aircraft involved will be destroyed. Of the 85 Class A mishaps, 48 will result from operational factors, 34 from logistics factors (part failures, maintenance, etc), and three from miscellaneous/undetermined factors. Fighter/attack aircraft will have 34 of the 48 operations mishaps and 24 of the 34 logistics mishaps. Eighteen F-4s will be destroyed, 11 of these in operations mishaps. These things, among others, will happen this year if the 1981 aircraft mishap forecast is correct (see the charts on page 6).

The 1981 aircraft mishap forecast is, like its predecessors, a reflection of the mishap potential that currently exists in the way we support, maintain, and operate our aircraft. The forecast is based on three basic assumptions: (1) that we have accurately defined the types of mishaps our aircraft are likely to have, (2) that we have accurately assessed current trends, and (3) that nothing changes in the way we support, maintain, and operate our aircraft in terms of procedures, policy, tactics, etc. It also presupposes that we will fly the 3,261,783 flying hours programmed for 1981 (PA 82-3, USAF Aerospace Vehicles and Flying Hours).

In spite of some past accusations, the forecast is not derived by a room full of fortune tellers with crystal balls, nor is it totally computer generated. It is, rather, the product of a logical, scientific process, the first step of which involves assessing mishap potential for each type mishap for each type of aircraft based on its historical signature or profile. Without going into a treatise on cumulative probabilities, suffice it to say that historical data are biased as a function of recency; i.e., the more recent data, the more "weight" it is given. This is the

MISHAP CLASS DEFINITIONS

A. CLASS A MISHAP. A mishap resulting in:
(1) Total cost of $200,000 or more for injury, occupational illness, and property damage, or
(2) A fatality, or
(3) Destruction of, or damage beyond economical repair to, an Air Force aircraft.

B. CLASS B MISHAP. A mishap resulting in total cost of $50,000 or more, but less than $200,000, for injury, occupational illness, and property damage.

C. CLASS C MISHAP. A mishap resulting in:
(1) Total damage costs of $300 or more, but less than $50,000. or
(2) An injury or occupational illness resulting in a loss workday case involving days away from work, or
(3) A mishap which does not meet the above criteria but for which reporting is required. . . .—*From AFR 127-4.*

only purely mathematical part of the process and involves some 8,775 separate calculations (39 aircraft x 25 mishap types x 3 mishap classes x 3 sample time periods). The weight given recent history is further biased by the aircraft's age, as newer aircraft (A-10, F-15, F-16) are still on the exponential part of their historical curve and do not exhibit the stability of older aircraft. Expressed as a rate, the potential is then compared to each aircraft's programmed flying hours for the year being forecast. For example, The F-4's weighted "control loss" potential for 1981 is 1.38 per 100,000 flying hours. 1.38 x 363,555 hours programmed for 1981 equals 5.017 mishaps; hence we forecast five F-4 control loss mishaps, all of which will be destroyed.

When this is done for all aircraft by type mishap, we then turn to our Class C mishap trending programs to see if any particular aircraft systems are exhibiting increasing or decreasing mishap potential. For example, the 1981 potential for a T-38 Class A flight control mishap is only .10 per 100,000 hours, or .36 mishaps for the 361,831 flying hours programmed. However, increasing Class C failure rates reflect increasing mishap potential, and we have forecast one T-38 Class A flight control system mishap for 1981.

Along with current trends, we further bias the mathematical projections as a function of our knowledge of current tactics,

continued on page 6

A Different Way To Count

■ Over the years we've counted accidents in many ways. We've counted destroyed aircraft, fatalities, majors, minors, incidents, and Class A, B, and C mishaps. We've even counted F-4 accidents, C-130 accidents, and T-38 accidents. Now all of these ways of counting are necessary for reporting and accounting purposes, but by themselves they do nothing toward prevention except indicate that perhaps we're doing better or worse than we did last year. They do little toward indicating where our prevention efforts should be concentrated.

About 5 years ago, a comprehensive study of 3,400 major accidents revealed that the factors involved in an accident were rarely unique to the specific airplane being flown. For example, when a pilot hit the trees on short final at night under a 200-foot overcast, he did it for the same reasons whether he had one throttle or eight. When the pilot departed during an attempt to defeat a gun kill, the reasons were the same whether for an A-7 or an F-4. An overtorqued hydraulic B-nut that failed didn't seem to care whether it was installed in a B-52 or an H-53. Granted, BLC accidents only happened to F-104s and F-4s, and TFR failures only occurred in F-111s, but the relationship of these types of accidents to the specific aircraft were the exception rather than the rule.

One of the major results of the study was that our accidents emerged in some 25 natural groupings or "types" which were relatively independent of the specific aircraft involved. These 25 major "types" (and some 200 "sub-types") were generally distributed between the three major categories of "operations," "Logistics," and "miscellaneous." The table below lists the mishap types under each major category.

The obvious questions now are "how are mishap types assigned to new mishaps," and "what specifically does each mishap type mean?" First, as information about a mishap under investigation is

continued on page 7

MISHAP TYPES

OPERATIONS	LOGISTICS	MISCELLANEOUS
Control Loss (PLT)	Engines	Birdstrikes
Collision/Ground	Engine FOD	Tests
Range	Flight Controls	Weather
Midair	Landing Gear	Facilities
Landing/Takeoff (PLT)	Fuel	Cargo Delivery
Flameout (PLT)	Hyd/Pneumatic	Undetermined
	Electrical	
	Structural	
	Bleed Air	
	Instruments	
	Comm/Nav	
	Prop/Rotor	

1981 AIRCRAFT MISHAP FORECAST

restrictions, mission, proposed/ongoing modifications, and special interest areas. For example, the A-10 has a 1981 flight control Class A mishap potential of .60, but due to recent emphasis on the ''white area'' and the current low altitude bank angle restrictions, we have forecast no A-10 flight control mishaps. Other factors that influence the 1981 forecast include a reduction in the programmed F-15 flying hours from that flown in 1980, constant progress in the F-111 stall inhibitor system modification, the reduction in the F-105 inventory, and no change in the F-15 DOC (no air-to-mud).

The final assumption upon which the forecast is based was first made by Newton. That is, if nothing changes, we will continue to experience mishaps at the current rate. The inevitability of the forecast is most dependent upon this assumption being correct. If something changes to increase the exposure, the numbers in that area will increase. On the other hand, if something changes to decrease exposure, the numbers will be reduced.

Remember, the forecast is *not* by any means a *goal*. The goal is to beat the forecast by additional prevention efforts in those areas identified as having high mishap potential. Success will result in a more effective operation along with preserving our combat capability. There is, after all, one thing better than having the world's best airplanes and pilots, and that's having a lot more of both around in 1982. ■

CHART 1

FORECAST 1981 MISHAPS
(Based on 3,261,783 Flying Hours)

	RATE	NUMBER
Class A	2.6	85
Destroyed	2.4	78
Class B	2.2	71
Total Class A and B	4.8	156

CHART 2

1981 CLASS A FORECAST

TYPE MISHAP	
Operations	48
Logistics	34
Misc/Undet	3
Total	85
Rate	2.6*

*3,261,783 Flying Hours

CHART 3

1981 CLASS A FORECAST BY TYPE AIRCRAFT

Type Mishap	Bmbr	Cargo	Ftr/Att	Tnr	Util/Obs	Heli	Total
OPERATIONS							
Control Loss (Plt)	1	2	14	2	1		20
Collision/Gnd	1	1	9		1		12
Range			5		1		6
Midair			3				3
Landing/To(Plt)			2	2		1	5
OPS Other		1	1				2
Total	2	4	34	4	3	1	48
LOGISTICS							
Engines	1	1	15	3		1	21
Flight Controls			2	1			3
Landing Gear			2				2
Fuel			3			1	4
Bleed Air							0
Hyd/Pneumatic			1				1
Electrical							0
Structural				1			1
Log Other			1			1	2
Total	1	1	24	5	0	3	34
Combined Total	3	5	58	9	3	4	82

CHART 4

1981 CLASS B FORECAST BY TYPE AIRCRAFT
(Based on 3,261,783 Flying Hours)

Type Mishap	Bmbr	Cargo	Ftr/Att	Tnr	Util/Obs	Heli	Total
OPERATIONS							
Landing	1		1	2			4
Takeoff							0
Total	1	0	1	2	0	0	4
LOGISTICS							
Engine	2	4	11	1			18
Engine FOD	2		21				23
Landing Gear		1	3				4
Hyd/Pneumatic		1					1
Total	4	6	35	1	0	0	46
MISC.							
Birdstrike		3	5				8
Other	1	1	10	1			13
Total	1	4	15	1			21
Combined Total	6	10	51	4	0	0	71

A Different Way To Count continued

gained at AFISC, rated analysts in the Reports and Analysis Division assign the mishap type. Of course, the circumstances have to fit the mishap type definition before the mishap is assigned. Second, the definitions of the mishap types follow:

CONTROL LOSS Control loss is the mishap type assigned when a pilot stalls, spins, departs, or otherwise exceeds his aircraft's flyable angle of attack. Mishaps where the pilot fails to cope with the aerodynamic characteristics of his aircraft (such as putting it in a position from which recovery is impossible) are included in this category, but flight control or autopilot malfunctions are not.

COLLISION WITH THE GROUND This mishap type is assigned when a pilot flies his aircraft into the ground without being forced to by a materiel failure. A materiel failure may exist, but if adequate control and power were available to avoid the terrain, this category is assigned. This category generally equates to civil aviation's Controlled Flight Into Terrain (CFIT) category.

RANGE This mishap type is assigned when a pilot fails to recover from an air-to-ground ordnance delivery pass, or if he loses control while engaged in the activity of delivering ordnance. Again, the activity is the governing factor rather than the location, and mishaps that occur during actual or simulated ordnance delivery are categorized as range mishaps whether or not the aircraft crashed on range property.

MIDAIR COLLISIONS Mishaps that involve aircraft hitting each other during "flight" (starting takeoff roll to end of landing roll) are categorized as midair collisions, regardless of whether the pilot or a flight control failure was the cause.

TAKEOFF/LANDING Mishaps that occur during takeoff or landing and that do not involve any materiel failure are categorized as takeoff/landing mishaps. These mishaps must occur on takeoff prior to configuring for climb, or during landing after the pilot begins his attempt to flare or align himself with the runway.

FLAMEOUT (PILOT) This mishap type involves pilot induced flameouts for any reason. Inadvertent or intentional shutdown, fuel mismanagement and/or flying out of the engine's tolerable envelope are examples of this type mishap.

TESTS This mishap type primarily applies to mishaps involving weapons testing; e.g., A-10 gun gas ingestion.

CARGO DELIVERY Mishaps directly involving cargo delivery problems (LAPES, etc) comprise this category.

OPS OTHER Mishaps that involve the aircrew but do not fit any of the major operations types are classified as "Ops Other." Examples are a pilot who perceives a problem that doesn't really exist and ejects from a perfectly good airplane, or a pilot who has a taxi mishap because he didn't notice brake hydraulic systems were turned off.

FLIGHT CONTROLS, LANDING GEAR, ENGINE, FUEL SYSTEM, ETC. Mishaps that involve failure of aircraft systems are categorized by the system that failed. The rationale for this is two-fold. First, our materiel failure prevention efforts are better served by isolating those mishaps where an aircraft system failure precipitated an aircrew error from those involving aircrew error only. Second, we believe that given enough system failures, the potential for an aircrew error increases, an error he would not have made had the system not failed to begin with. Mishaps involving aircrew error preceded by an unrelated system failure are categorized by the type of error made.

It's important to understand that "type mishap" does not necessarily imply "cause." Under the "all cause" system, a given mishap may (and generally does) have multiple causes ranging from aircrew error to materiel failure to facilities, but if for example an engine failure precipitated the chain of events, it is an "engine" type mishap and can be quickly counted among engine mishaps regardless of the presence or absence of any other factors. The other factors can be counted just as easily, but for the purposes of placing a mishap where it belongs relative to the other type mishaps, "engine" would be the type assigned.

The initial categorization of mishaps by type rather than by aircraft is only the first of many steps in the analysis of aircraft mishaps. It is, however, important in that it immediately reveals a general area in need of corrective action. It also reveals, primarily in the "operations" category, Air Force-wide problem areas that might not be apparent when only a specific aircraft or MAJCOM is being looked at. It represents our efforts to ensure the entire forest is not on fire before we attack a specific tree and, as such, is hopefully a step "in the right direction." ■

MAJOR GARY L. STUDDARD
Directorate of Aerospace Safety

■ "F-4 pilots just aren't as good as they were in my day." "Look at what that F-4 jock just did . . . really dumb!" "What do you expect, the guys nowadays just don't have the hands . . . ." As an F-4 project officer at the Safety Center, these are the type of remarks I sometimes hear. I don't believe any of them, usually make some obscene comeback, and keep walking down the hall. However, every once in awhile, my confidence is really shaken when an F-4 aviator makes an "uncharacteristic" error (I wanted to say "dumb," but my boss who's on my side, suggested the better word) by going out on a mission with his "hair on fire" and eventually ham-fists the aircraft into an out-of-control situation.

Sometimes I wonder if it's not an anatomy problem whereas when the tiger fangs appear, blood flow to the ol' noggin is reduced. All F-4 drivers know the aircraft possesses some undesirable flight characteristics. And, the dash one very adequately discusses such traits as adverse yaw, dihedral effect, stick force lightening, and post stall gyrations. But, I wonder if we don't all too often rely too much on the written word and fail to fill in the spaces between the handbook words with lots of headwork.

I'm not accusing everyone (just some) of not thinking while flying. I *am* saying, however, that our present-day environment does more of the thinking for the pilot and, therefore, may allow him to get a little out of the habit. This, combined with the limited number of sorties and the "more demanding" missions, may be impacting on total proficiency. Proficiency can only be maintained by constant practice as acquired knowledge, unfortunately, is not permanently retained. Forgetting is a very active process. In fighter pilot jargon, it's called "getting rusty." My point is if you have a week or so where you fly a lot of air-to-air missions, you become pretty confident, and, without a doubt, your advance handling skills improve. It's not an

Tigers Or Ham-Fists

earth shaking conclusion to say that after an extended layoff from these types of missions, you just aren't as good as you once were. This boils down to the pilot's recognizing his own abilities and limitations and the supervisor's ensuring aircrew training programs continue to incorporate the building block approach, placing more demands on abilities as greater proficiency levels are achieved and maintained.

In 1979, there were three F-4 Class A mishaps due to pilot induced loss of control. Two occurred during ACM, and one occurred in a low-altitude holding pattern. There were no Class B mishaps in 1979 associated with control loss.

For 1980, our loss-of-control mishaps increased dramatically with seven F-4 Class A's. Two were during ACM, one while in extended trail, one during landing; a formation rejoin accounted for one, one was an overcontrol while jinking off the target, and the last happened during a low-altitude crossover. In addition, there have been three Class B mishaps associated with major over-G. Each of these could have resulted in a more severe incident.

I think I've made my point, and I won't recap the numerous "whoa who" Class C reports I read each week involving an unexpected onset of G's or the pilots' just being along for the ride.

In all fairness, we still have some flight control maintenance-related/material failure mishaps. But, these are decreasing, and the aircraft is being made more reliable and safe to fly and is getting better all the time. Unfortunately, we aircrews cannot be programmed for improvement at the same rate as the equipment we fly. So, we become the weakest link in the mishap prevention chain.

A closer analysis of last year's mishaps shows that the maneuvers being attempted were basic maneuvers which should have been well within the capabilities of the crews, but through distraction, inattention or aggressiveness, the situation deteriorated to a point which momentarily exceeded the pilot's ability. Just as the aircraft has maneuvering limits, so has the pilot. However, there is no tangible way to measure these limitations. It comes down to the pilot's setting his own thresholds of how far he will allow himself to go in any maneuvering arena. Normally, these self-imposed limits serve him well, but there may be a time when he ignores or fails to recognize his own limitations. Maybe it's the competitive spirit which overcomes good judgment.

We preach aggressiveness and being a "tiger" until we may convince ourselves that we are a little bit better than we actually are. I don't want to criticize the tiger attitude too much because I'm all for it. It's important to be hard-charging and determined, but the tiger approach must be tempered or there is a chance another mishap will be added to the safety archives, and the mishap report will read, "another ham-fisted act."

There is no one specific area I can talk about to reduce loss-of-control mishaps, so here is an assortment of thoughts which may generate some local discussion.

- It's amazing how many jocks think optimum performance means maximum control deflection in minimum time. I'd like to have a buck for each time a pilot has rapped my head against the canopy on pitch-out for landing; or during an ACM engagement where my vision was blurred before my G-suit had time to inflate. These rapid control inputs mask your feel for the aircraft. Flying smoothly is best . . . staying clear of the unnecessary rapid stick inputs.
- Fighter aircrews have historically displayed the thinking that to win the fight you have to pull "the mostest G's the longest." This usually leads to the proverbial Lufberry or scissors, areas conducive to loss of control. This is not to suggest that a pilot should avoid getting thoroughly acquainted with his aircraft at all speed regimes. He should, however, be very familiar with all symptoms of control loss when maneuvering close to aircraft performance limits.
- It would be great if design of the aircraft would have allowed us a nice linear relationship between stick force and "G." However, as AOA increases, the center of pressure shifts inboard and forward, producing a nose-up pitching moment. This means the stabilator becomes more effective. As this occurs, it stands to reason that stick force-per-G decreases, and we have the infamous "stick force lightening." This change in feel is also affected by mach number, CG

continued

Tigers or Ham Fists continued

position, and external stores, all of which require judicious aircrew monitoring.

■ Most combat maneuvers and advanced handling profiles involve unsymmetrical flight (any roll rate). Therefore, the allowable G's are significantly lower than the symmetrical G limits. Admittedly there doesn't seem to be any "easy to remember rule of thumb" on G limits. For a two-tank configuration, the standard briefing usually is 4 G's at the beginning of the mission, 5 G's in the middle, and 6 G's right before coming home. These numbers are not that pure, and require better interpolation and interpretation. No one expects you to continually monitor the G meter during a hassle, but it can certainly come into play with good crew coordination.

■ AOA (and its associated tone) indicators are only trend instruments and portray what has already occurred. Relying totally on AOA can quickly result in overcontrol.

■ Trimming the aircraft should be done with care. There are definitely some different schools of thought here. Nose heavy trim, neutral, or nose down . . . all have their place. For example, the standard, and most effective, recovery technique from a pilot induced oscillation is to release the controls. If a significant out-of-trim condition exists, releasing the controls could be additive and amplify the oscillations. Conversely, at low altitude, a click of nose-up trim could prove very beneficial.

■ Avoiding adverse yaw is of paramount importance in high AOA maneuvering. Use of aileron for one or two more degrees of turn is the usual culprit and must be avoided.

■ At low altitude, rolling into a steep bank and simultaneously using afterburner will result in an out-of-trim condition when returning to wings level flight. This will necessitate a push over to keep the nose down and should be performed very smoothly. Coming out of afterburner at high speeds also produces pitch transients.

■ When flying at high speed at low altitude, be sure your "stab aug" is engaged and operating correctly. The dampers will decrease the stabilator response to rapid stick inputs, and the possibility of inducing oscillations is minimized. In conjunction, flying with the shoulder straps locked and the lap belt tight reduces the likelihood of body movements contributing to an inadvertent pitch input.

■ Loss of control is not always associated with air-to-air engagements. Jetwash, unexpected wind gusts, asymmetric loading, single engine operation, heavy-weight takeoffs, go-arounds, and recovery from a weapons delivery are all areas to be respected.

In conclusion, a periodic review of the flight characteristics contained in Section VI of the dash one can jog the old memory on the many variables affecting control characteristics of the F-4.

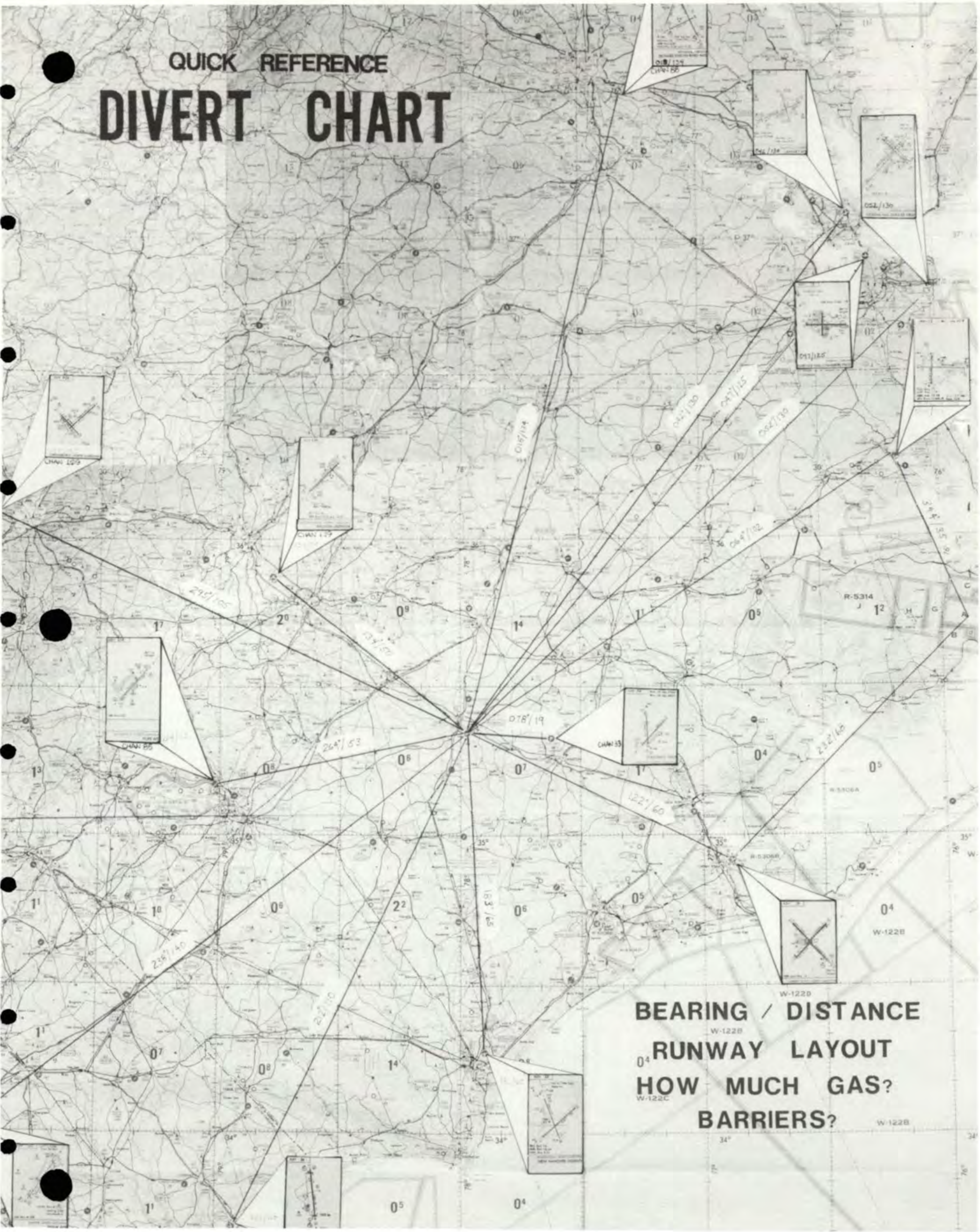
I hope I've provided some "food for thought." If the pilot doesn't have a thorough understanding and a healthy respect for the different maneuvering aspects of the aircraft or appreciate his personal responsibility for safe and effective operations, a loss of control will be more likely. Here's hoping you all remain tigers and never become known as a ham-fist. ■

SQUADRON DEVELOPS QUICK REFERNECE DIVERT CHART

■ The 336th TFS at Seymour Johnson AFB NC has developed a quick reference divert chart using a TPC 1:500,000 scale chart. The 3′ x 3′ chart is mounted near the duty desk for easy reference to aircrews receiving weather and notam information prior to briefing. Included on the chart is the bearing and distance to suitable divert bases within a 140 NM radius of Seymour Johnson. Also, associated with each base is an insert from the FLIP High Altitude Instrument Approach Procedures book giving field elevation, runway orientation, length, lighting, barrier information, etc., as well as the tacan channel.

The squadron had the chart reduced to 8″ x 10″ prints by the base photo lab and placed them in each briefing room. They provide handy references to aircrews, especially when home base weather is a factor in mission planning. The charts are also extremely helpful to incoming aircrews during their local checkout program.

With a little effort and materials on hand in practically any nav shop, this squadron has produced a useful tool to keep aircrews aware of their options during deteriorating weather at the home base. ■


QUICK REFERENCE
DIVERT CHART
R-5314
BEARING / DISTANCE
RUNWAY LAYOUT
HOW MUCH GAS?
BARRIERS?

'SEE (in time) TO AVOID'

CAPTAIN RICHARD A. BRUST
Directorate of Aerospace Safety

■ The UH-IN helicopter had just finished another practice hoist recovery, and the fuel gage indicated "time to go home." The trainee had performed well, and the entire crew was relaxing for the short return flight to base. Feeling good, the trainee suggested a PAR termination to really show this IP his stuff. The IP agreed. The sky was clear with excellent visibility and no wind—should be no problem.

Following ATC coordination, the trainee maneuvered the huey down final per the final controller's instructions. Approaching the 4-mile point, the IP in the left seat spotted a civil aircraft at what appeared to be the same altitude. Taking control, while simultaneously informing the trainee the IP executed a pitch-up with a left banking maneuver to avoid traffic. The trainee spotted the traffic as it passed near the right side of the helicopter. The estimated miss distance was about 150 feet.

Neither tower nor RAPCON had observed any traffic in the vicinity of the UH-IN at the time of the incident. However, after the near midair collision (NMAC), RAPCON observed a suspect target on the radar scope. The target track indicated and subsequent investigation confirmed that the light aircraft had properly departed from a local uncontrolled airport approximately six miles away.

It may be surprising to some that this incident (as do nearly all midair and near midair collisions) occurred in daylight hours in VFR weather. Probably not surprising is that most of these incidents happen within five miles of an airport in areas of the most concentrated traffic.

A review of the AF Inspection and Safety Center's Hazardous Air Traffic Report (HATR) program from 1 January 1976 through 31 December 1979, revealed 60 percent of all HATRs submitted were NMACs. A large proportion (79 percent) of these NMACs involved general aviation-type aircraft with a vast majority (81 percent) occurring below 7,500 feet.

During this time frame, 60 percent of the NMACs were further classified as "failure to see and avoid." This means that the incident occurred because pilots in both aircraft failed to look and detect (see) traffic in time to avoid the near collision. This was due to failure of the see-and-be-seen system. If at least one pilot had been using his eyes effectively, the incident might not have occurred. The human eye, through which we obtain approximately 80 percent of our total information, is a complex system and a basic understanding of its limitations can greatly reduce your chances of flying into another aircraft.

Visual Limitations

Many factors affect how well a pilot can see and detect objects. Factors range in origin from internal/external characteristics of the aircraft, atmospheric phenomena and most of all, to the inherent perceptual limitations of the eye. Everyone daydreams now and then, and we *see* and identify only what our mind allows us to see. Perhaps one of our pilots (civilian or military) in the incident described earlier could have prevented some unwanted excitement by not allowing himself to be concerned with tonight's activities or tomorrow's paperwork. Staring out into airspace without "seeing" breaks the first rule of avoiding a midair collision—see and be seen.

The ability of the eye to refocus on near and distant objects can take valuable time. For example, the eye takes 1 to 2 seconds or longer to refocus from something 2 feet away, such as an instrument panel, to an aircraft target 1 mile away. Now consider the additional time required to scan (search) for reported or unreported traffic and the resultant time of detection can be quite lengthy. This time period is critical in seeing and avoiding in-flight collisions.

The eyes' narrow field of vision severely limits the size of the area in which they can actually focus on an object. We can perceive movement in the periphery; however effective seeing is limited to this 10-15 degree arc. Therefore, with help from our brain, "tunnel vision" can create problems in our target detection.

The eye is also severely limited by environmental factors. In flight, atmospheric conditions, windshield distractions, background contrast, glare, lighting, "G" forces, and aircraft design can impede our ability to see outside objects. Glare can make object detection very difficult and scanning very uncomfortable. This condition is worse on days with the sun beaming over a cloud deck or when the aircraft is turning directly into the sun. Knowledge of these factors will help you compensate for their effects.

You can quickly note from our UH-IN incident that feeling secure with "radar contact . . ." is not the way to go. The radar system has its limitations and is not infallible in providing separation/traffic advisories. The use of positive control where possible is professional, but don't relax your ability and responsibility to see and avoid.

Research

Research is continuing in perceptual processes, rate of closure judgment and resistance to disorientation. These vital human processes are very complex and vary in degree of capability from individual to individual. Until a means is available to accurately measure and determine your strengths and weaknesses in these areas, a reminder to increase awareness is necessary.

Look Out

We have seen how visual perception is affected by many factors. Do not exclude the see-and-be-seen system. It is impossible to predict whether the inexperienced pilot or the pilot who "has seen it all" is most susceptible to midair collisions. The new guy may be task saturated inside the aircraft and fail to look outside. However, the experienced pilot, having sat through hours of flight, may grow complacent and fail to scan properly. No pilot is invulnerable. ■

Great Air Battles of WW II

■ Confederate Air Force Headquarters in Harlingen, Texas will host an air show featuring WW II aircraft of the CAF GHOST SQUADRON.

AIRSHO 81 will take place October 8-11. This four day show features the re-enactment of all major air battles from WW II. ■

SAFETY AWARDS

SECRETARY OF THE AIR FORCE

SAFETY AWARD
Major Command That Flies More Than 2% of The Total USAF Flying Time

UNITED STATES AIR FORCES IN EUROPE

Class A aircraft mishaps were the lowest in the past 4 years, with attendant reductions in the number of aircraft destroyed and aircraft-related fatalities. These achievements, while flying nearly 200,000 hours in high-performance aircraft in a complex international environment, attest to flight safety program effectiveness. Impressive records in other safety disciplines complement the flight safety achievements.

SECRETARY OF THE AIR FORCE

SAFETY AWARD
Major Command With Small Or No Flying Mission

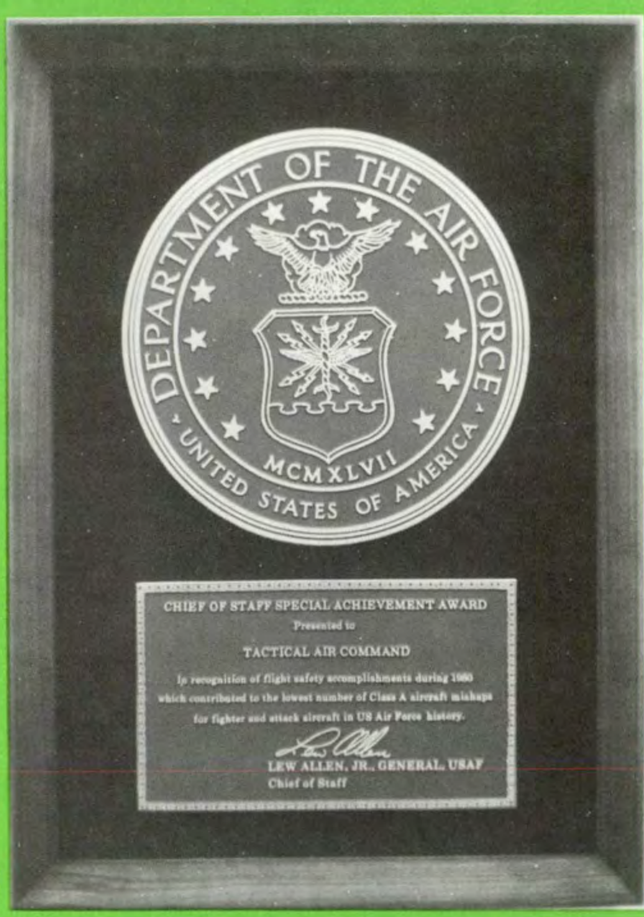
AIR FORCE COMMUNICATIONS COMMAND

An effectively managed ground safety program reduced fatalities more than 40 percent from the 1979 level to the second lowest number in the history of the command. There were no operational fatalities, and military and civilian injury rates were well below the Air Force average. These achievements were attained while performing a worldwide mission of providing communications, air traffic control, and automated data processing support for the Air Force and other Federal agencies. For the 16th consecutive year, the command did not experience a Class A aircraft mishap while performing a flight facility and communications evaluation mission.

THE MAJOR GENERAL
BENJAMIN D. FOULOIS
MEMORIAL AWARD

UNITED STATES AIR FORCES IN EUROPE

Presented by the Order of the Daedalians, the National Fraternity of Military Pilots, the Foulois Award recognizes the MAJCOM with the most effective flight safety program for the preceding year. USAFE achieved the lowest number of Class A mishaps in 4 years and 42 percent lower than in 1979, while flying nearly 200,000 hours in high performance aircraft with a demanding mission, in limited airspace and poor flying weather.



CHIEF OF STAFF SPECIAL ACHIEVEMENT AWARD

ALASKAN AIR COMMAND
AIR FORCE RESERVE
AIR NATIONAL GUARD
MILITARY AIRLIFT COMMAND
PACIFIC AIR FORCE
TACTICAL AIR COMMAND
US AIR FORCES IN EUROPE

In recognition of flight safety accomplishments during 1980 which contributed to the lowest number of Class A mishaps for fighter and attack aircraft in US Air Force history.*

*Identical plaques to all tactical forces. To MAC for having the lowest number of Class A mishaps in the history of the Command.

DO YOU HAVE THE RHYTHM BLUES???

CDR V. M. VOGE, MC
Naval Safety Center

When the ole clock on the wall says nine but your body screams it's twelve, then you're out of sync with circadian rhythm . . . you're into jet lag.

■ Ever hear of "circadian rhythm?" Probably not, although it is an extremely important consideration in deployments and night ops. Don't worry, it has absolutely nothing to do with things such as the monthlies, biorhythms, or birth control systems for grasshoppers. It simply refers to your own private 24-hour clock. Over 100 bodily functions have been directly related to this cycle, which varies from 20-28 hours in length (depending on the individual), is reset daily, and varies from individual to individual and even within the same individual. The basic trend of the rhythm does not vary, however.

"All right," you ask, "what is it?" Well, to start with, the word "circadian" comes from two Latin words: "circa"—about, and "dies"—day, which explains the variable 24-hour cycle we mentioned above. Since over 100 bodily functions have been directly related to this 24-hour clock, the curve will vary a little for each function. We will consider two functions that follow basically the same curve—body temperature and performance.

If you were to take your temperature at about 1400 and then again at about 0400, providing you sleep during the usual nighttime period and get up about 6 or 7 a.m., you will find that it basically follows the curve in Fig. 1. "But," you protest, "of course my temperature is higher during the day—I'm working!" Not so! If you were to, let's say, have an inopportune night hop, land at 0400, and then sleep between 1000 and 1400 the next day, the same basic curve would hold true. In other words, it is not upset by such things as temporary external time shifts.

Since we all are in the performance business, we will spend the remaining space discussing effects on your performance. There are basically two types of performance-related circadian rhythm problems: the so-called phase-point problems, and the phase-shift problems.

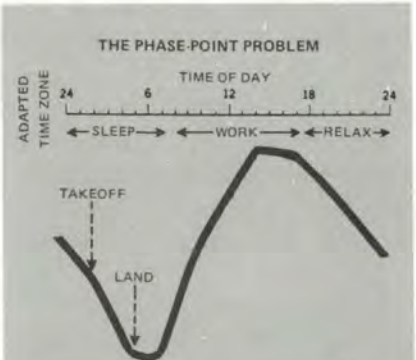
An example of a phase-point problem is when you are fortunate enough to get stuck with a 2400 brief and 0100 takeoff for a 3-4 hour flight. Sound familiar? You may try to get a few hours sleep from 1700 to 2100, but you really can't sleep well because the sun tells you it is not the time to sleep and your stomach soon calls you to reveille. No matter. You know you'll be in good shape for the flight, right? Wrong! Look at Fig. 1 again. Your takeoff is scheduled for 0100. Your performance, according to the curve, is on a definite down-swing. No

matter, a couple of cups of coffee will fix everything, right? Wrong! We'll discuss this a bit later. Look at Fig. 1 again. Your 3-4-hour flight will put you back in the landing configuration when you are at your absolute lowest ebb, performance-wise. You generally will have no real warning of this, except for feeling a bit tired, perhaps. What about the coffee? Coffee is a stimulant, but its effects last 3-5 hours in the normal individual. After this time, you are subjected to a lower than normal level of alertness. That is why you generally feel the need for another cup of coffee every 3-4 hours. Time your coffee intake right, and you'll be landing about 3 or less hours after the last cup. You may come out ahead, unless you're a heavy coffee drinker. Although your level of alertness is brought up by a new cup of coffee, it never reaches the previous level of alertness. Drink enough coffee and you'll find yourself behind the power curve!

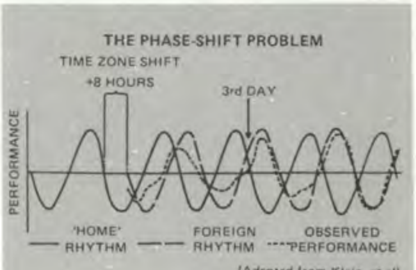
Other problems? Just one more we worry about. Caffeine has a dehydrating effect, i.e., you urinate more than normal. This may cause a further performance decline. Also, if you fly a "non-relief tube" aircraft, you may find yourself a bit uncomfortable!

"Okay, Doc, now that you've got me worried about flying at strange hours, what can I do to control my circadian rhythm problems?"

Nothing! (Sorry about that!) We can only give you some good, general advice. First the big one is *be aware of the problem!* If you realize your performance is going to be down when you land at 0500, you can compensate for it. Simply being aware of the problem will produce an extra spurt of adrenalin in your body that should help you over the crisis.



REPRESENTATIVE CIRCADIAN CYCLE FOR PERFORMANCE
(Adapted from Mohler, et al)
Fig. 1



(Adapted from Klein, et al)
Fig. 2

Second—*avoid fatigue*. This is *very* important! Get enough sleep when you are able. Usually, when you have a circadian rhythm performance debt, added fatigue does *not* have an *added* effect on performance decrement but has what we call a synergistic effect, i.e., a *multiplied* effect. So, be careful of this.

Third—*avoid smoking*. The more you smoke, the more hypoxic you become. The more hypoxic you become, the less oxygen goes to the ol' brain, and the less oxygen to the brain, the greater the performance decrement!! Don't increase your liabilities!

Fourth—*don't overdo the alcohol routine*. "But, isn't it 12 hours from bottle to brief?" Not really. This is an area that will be discussed at another time. Even if all the alcohol is out of your blood, you still have a "hangover effect" which, loosely translated is fatigue.

Fifth—*remember the short term effects of stimulants* (coffee); and sixth—*follow a normal routine and avoid excesses*.

"Okay, I get it. But how does this affect deployments?" Well, now we're to our second circadian rhythm problem area, i.e., phase-shift problems. Ever hear of "jet lag"? Of course you have! Some of you are affected more than others by

continued

Do You Have The Rhythm Blues? continued

this problem, and some are affected more going east to west, or vice versa. But the problem still exists. It usually only raises its ugly head when you cross four or more time zones, although it can appear at any time, especially when complicated by fatigue, altitude changes, changes in eating/drinking habits, etc. Let's face it. If you deploy to Spain for example . . . you've probably crossed at least six time zones. You've been trying to sleep at a time when you'd normally be having lunch. Your clock is upset, to say the least. Look at Fig. 2. This demonstrates the mess your internal clock is in when you rapidly cross four or more time zones. Usually, you won't start feeling right again for 3 or more days.

The cure for this problem? The same as for your phase-point problem — just general considerations. But, we can add a few new ones here.

First, if you know you're going to deploy via "rapid transit," and depending on the direction you're going, go to bed an hour or two earlier or later than usual a few nights before you leave in order to start to re-regulate your clock. You'll be ahead of the game!

Second, ideally, don't fly for the first 3 days after arriving. Have safety standdowns, briefings, a free day, or whatever. Try to give your clock a chance to readjust. I've already talked with several squadrons who did things this way without really knowing the mechanism. They just didn't want their guys flying with "jet lag"!

Be aware of the problem, and adjust your habits accordingly. By the way, these effects also apply to all your squadron personnel. A fatigued maintenance person working the graveyard shift should be watched carefully for the first few days. After all, he's working on an aircraft that you're going to bet your life on!

One more thing. At a recent conference, the following additional points/findings were brought out in regard to circadian rhythm. We thought you might find them interesting.

- Frequently crossing time zones causes one to age physically at a much faster rate than those flying north to south routes. Also, apparently, the life span is shorter.
- Social interaction is more important for helping one adjust to different time zones than are such things as day/night, lighting, clocks, meals, etc.
- One's best physical performance is when the circadian physiological curve is at its highest (otherwise, efficiency is lowered by up to 70 percent, and one is more susceptible to pathology, i.e., colds, flu, etc.).

- Factors that affect one's manifestation of circadian rhythm are: personality, motivation, sleep hours, amount of physical exertion, and desynchronosis.
- There are basically two types of people: introverts — get up early in the morning, programmed behavior, have difficulty adjusting to phase shift (time changes), peak early in the evening; and extroverts — able to stay up later, adapt to shift work easier, peak later in the evening.
- There is no significant sex difference, although women tend to adapt slightly slower. Older people tend to have more difficulty adapting to a new time zone or phase shift.
- The effect of many drugs and alcohol depends on where one is on his circadian rhythm curve (i.e., alcohol is metabolized much slower at 0200 than at 1600-1800).
- Deaths are much more common in the morning (0600-1000).
- There is a *higher accident* rate among night shift workers, and they tend to be sicker, e.g., Mexico City DC10 crash at 0330 California time and the Three Mile Island disaster at 0400 in the morning.
- Twenty-five percent of the population has little if any problem resetting their biologic clock; 30 percent of the population either cannot adjust or adjust with difficulty to phase work (night shift or time zone changes). — Courtesy January 1981 *Approach*. ■

Training + Experience = Survival

STAFF SERGEANT EDWARD E. SMITH
Education Division
Brooks AFB, TX

■ The sun was bearing down on me from high overhead. A small rock outcropping that I was using for shade offered very little relief from the discomforts of the hot desert. It had been several hours since I had drunk the last of my emergency drinking water from the survival kit and I wondered if rescue was ever going to arrive. If that wasn't enough, I'd noticed several enemy patrols moving up and down a distant road and a AAA site to the north that I had detected too late to avoid. There didn't seem to be enough vegetation anywhere in this desert tall enough to shade a jackrabbit and I was scared.

One of the first things I did after reaching the ground was to conceal my equipment and sit down for a couple of minutes to take a drink of water. Then I removed my survival radio and contacted John (my wingman), to let him know I was okay and tell him to get me out of here. Next, I took inventory of my survival equipment and hid those items that would be impractical to carry. I also inspected my survival vest to be sure that I knew where everything was located, especially my radio, signal mirror, and MK-13 flare. I placed the remaining loose items inside the rubberized container from my seat kit and zipped it up.

When trying to contact John on my survival radio, I realized that I needed to get to higher ground. Survival radios are line of sight; therefore, the higher I got, the more effective radio transmission would be. By moving to higher ground, out of a box canyon, I not only achieved better communications, but also, I would be able to better evaluate my predicament, and terrain. One thing I had to consider was that it is safer for a helicopter to make a landing pick up rather than hoist because the exposure time for the recovery aircraft is considerably less and high terrain is usually more conducive for finding landing areas. With these things in mind, I decided to head for higher ground to hide and await rescue.

Before moving toward higher ground, I took a couple of minutes to camouflage. First, I removed all light colored and shiny objects from my uniform (sanitized). Then I used the camouflage stick to subdue the prominent features of my face, neck and hands.

I drank the remainder of the open can of emergency drinking water and started moving. To reduce body heat and water loss, I moved slowly between what little cover there was available. I knew that I should travel only during the cooler part of the day to reduce water loss through perspiration, but I would have to risk the loss of water for a more advantageous pick up location. I tried to stay on the shaded side of rocky areas for concealment and stayed off high ground to avoid silhouetting. The desert ground was very soft in places so I stepped on rocks or under bushes wherever possible to cover my tracks.

The area that I chose to wait in for pick up was on a large plateau in an outcropping of rocks which provided both concealment and some shade. To the north was a range of hills, higher in elevation than where I was. This helped to conceal my position from the AAA site and would provide the rescue aircraft concealment during the pick up operations. I got as comfortable as possible and sat back to wait for rescue.

After resting several minutes, I opened my second and last can of drinking water and drank freely. I would just have to take it easy and rest during the day, rationing my sweat by staying in the shade. I achieved this by keeping any exposed skin covered to prevent water loss, sunburn, and minimizing my movement until the coolest part of the day.

Now I needed to establish my position. I was able to identify several landmarks from my location: a dry lake bed, a saddle in a mountain range, and a prominent peak. I remember I had to orient my map to true North and get azimuth

continued

readings from those landmarks. I discovered the prebriefed Selected Area for Evasion (SAFE) was about eight miles north, and a spring shown on the map was about four miles west of me. I knew if I wasn't picked up by dark, I would have to try walking to the spring in order to survive the heat of the desert.

Sitting under the shade of the rocks, I found myself getting anxious for someone to come get me. So I pulled out my MK-13 flare and tried to remember exactly how to operate it. I removed the orange cap from the day end of the flare, then the red cap with the three raised bumps from the night end, and then read the instructions on the flare body just to be safe. I replaced the red cap leaving the orange cap off so I would be ready to fire it when told to do so by the rescue on-scene commander.

I returned the flare to my vest pocket and removed my signal mirror. I remember reading that the signal mirror was one of the most effective signaling devices that I had. I found the reflection on my hand, being careful not to flash the surrounding area, which could compromise my position. The bright sun spot can be located through the sighting hole in the back of the mirror, and I found that I could easily manipulate the mirror to direct the flash in any direction. I put the signal mirror back in my vest pocket so it wouldn't inadvertently flash while dangling from my neck.

I was getting more impatient as the day dragged by. When are they going to come get me? I tried to keep myself from attempting radio contact with friendlies on the survival radio more often than every 30 minutes. I had to try and conserve as much battery life as possible by limiting voice transmissions. After making several attempts, my confidence of being rescued began to falter. Then suddenly, after I transmitted in the blind for help from anyone, I heard a friendly sounding voice, "Rebel 22, Rebel 22, this is King 27."

I quickly answered back with, "King 27, this is Rebel 22, I'm at grid coordinates CM4257, in good condition, and suitable landing site is available."

"Rebel 22, you are coming in extremely garbled and unreadable, please say again a little slower."

After making several attempts, confidence of being rescued began to falter. Then suddenly, after I transmitted in the blind for help from anyone, I heard a friendly sounding voice.

I had calmed down a little by now and remembered that I shouldn't talk so rapidly into the survival radio. I also realized that I gave my exact location over the radio before authenticating, which could have alerted the bad guys. I repeated my previous transmission in a calmer manner, but this time, gave my position as six miles west of a well-known mountain.

"Roger, Rebel 22, this is King 27, read you loud and clear now. What was the color of your first car?"

"King 26, the color of my first car was gold."

Now I knew King 27 was a good guy and not an enemy intruder. I knew that if he knew my first authentication question, he must be a member of the rescue forces.

"Okay, Rebel 22, give me a short count."

"Rebel 22, 1, 2, 3, 4, 5, 5, 4, 3, 2, 1, Rebel 22."

"Rebel 22, give me another short count."

"Rebel 22, 1, 2, 3, 4, 5, 5, 4, 3, 2, 1, Rebel 22."

The counts allowed King to get cuts on my position by using his ADF equipment.

"Okay, Rebel 22, I have your position. Prepare your flare but don't pop it until I tell you to. A rescue helicopter will be in to get you shortly. Do you have any bad guys in your area?"

"Roger, there is a AAA site approximately four kilometers north of my position as well as vehicle patrols along a road approximately two clicks east."

"Rebel 22, keep your head down and be ready for the chopper when he comes in to get you."

I still must have been pretty nervous and excited. It seemed like I was all thumbs trying to get the MK-13 out of my vest pocket. I no sooner got my flare ready and placed within easy reach, when I heard, "Rebel 22, Rebel 22, this is Jolly 41."

"This is Rebel 22, go ahead Jolly 41."

"Rebel 22, authenticate with the sum of the first and last digit of your authentication number."

"Jolly 41, the sum is eleven.

"Roger, Rebel 22, now give me a 5-second hold down."

"Rebel 22 holding down: . . . . Rebel 22 clear."

"Jolly 41, I have you visual at two and one-half miles south of my position, turn right. Roll out."

"Rebel 22, give me a mirror flash."

"Roger."

"I have your mirror flash Rebel 22. Pop your smoke."

I ignited my flare and before it

had quit smoking, the helicopter was coming into a hover overhead and began lowering the rescue device. In all of the excitement, I almost grabbed the penetrator before it touched the ground but I remembered that to prevent being shocked, I had to let the penetrator touch the ground to discharge static electricity buildup. It took just a few seconds from the time I first saw the chopper until I was on board and headed back to base. I found out later why the chopper didn't land to pick me up. Even though the surrounding terrain was high, free of obstacles, and provided for clear approach, the slope of the terrain was too great for a safe landing.

The scenario I've just described occurred during a Search and Rescue (SAR) training exercise conducted at Nellis AFB NV, in conjunction with Red Flag. These SAR exercise scenarios are developed by the ARRS units participating in the continuing Red Flag training exercises, and Survival Training Instructor personnel from Detachment 2, 3636th Combat Crew Training Wing, stationed at Nellis AFB NV.

Red Flag offers simulated air-to-air and ground-to-air fighter tactics training and experience for aircrew members against simulated enemy AAA and missile sites located on the Nellis bombing and gunnery ranges. Electronic equipment using video films allows the aircrew members to see how they fared against the simulated enemy sites. Aircrews can view their flights daily to determine if their tactics were successful or not. My tactics yesterday weren't too successful, so I was chosen to become a "survivor."

On the day of the exercise, I did everything I would have done before any flight with a few substitutions of equipment and simulation of activities to preclude injuring myself. I received a survival vest, survival kit, anti-G suit, helmet, and sanitized flight suit. An intelligence and safety briefing was given by the survival instructor acting as team leader for the day's exercise. The SAFE areas were briefed, as well as known threats in the target area. The use of the color-coded signal mirror sleeve was briefed. (This is a transparent, colored cover placed over the mirror to give a distinctly colored flash.) The color for the day was green. Whenever I flashed a friendly aircraft, I would have the green cover on the mirror. It allowed rescue aircraft to easily authenticate a friendly survivor's mirror flash from any of those of the enemy.

"I have your mirror flash Rebel 22. Pop your smoke." I ignited my flare and before it had quit smoking the helicopter was coming into a hover overhead.

I was then transported several miles north of Nellis AFB to one of the ranges. This simulated my parachute landing position after being shot down by a AAA site. I was given the location of simulated enemy threats, as well as my physical condition. I'm sure I would have had a much more difficult time of getting rescued had I been injured with a broken arm or leg. A survival instructor stayed a short distance away from me to monitor the safe conduct of the SAR and to observe my actions.

After the SAR was over, I sat down with my instructor for a debrief. It was during this debrief that I became aware of some of the mistakes I made or could have made. This exercise was the first time I had a chance to use items from my survival kit as well as from the survival vest in such a realistic survival environment. It made me think about how to move, prepare and ignite the flare, and operate the radio or signal mirror, and a dozen other things a survivor must do if he expects to live and be rescued. It also made me more familiar with some of the problems that rescue forces have in initiating a rescue of a downed survivor. Because of this unique opportunity to be an almost real-life survivor, I feel much more capable of coping with the real thing. ■

DISTRACTION

MAJOR ROGER L. JACKS
Directorate of Aerospace Safety

■ Roughly 50 percent of our mishaps are aircrew related. Low aircrew experience and more demanding mission profiles will continue to challenge our aircrew ability to safely fly the mission. For years, we have tackled the materiel-related mishaps, and statistics tell us our efforts have paid off. We have driven the mishap rate down to the point where all avenues will have to be explored to experience future success. We must place additional emphasis on the intangible, sometimes elusive, often ill-defined human factor mishap. However you describe human factors, the fact remains that finding ways to reduce human errors is the key to drastically reducing our aircraft mishap rate. Since the human factor arena is so large, I will limit this article to just one facet of the problem, that of distraction.

Distraction results from stress, frustration or anxiety which, in turn, combine to cause a mishap.

Distraction is a common event that occurs all too routinely in our daily activities. It sometimes goes unnoticed as we accommodate the unplanned event without giving it a second thought. At other times, distraction results from stress, frustration, or anxiety which, in turn, combine to cause a mishap. In flying, distraction often carries a heavy penalty. It can act as a catalyst for leading the human brain astray, causing checklist omissions, misplaced priorities, lack of concentration, daydreaming, and confusion. A classical example is the L1011 that slowly descended into the everglades. The crew, distracted by a gear indicator light, unknowingly departed their assigned altitude of 2,000 feet and slowly descended into the darkened swamp. In a 1978 study on distraction by Captain W. P. Monan, it was verified that distraction is one of the primary causes in airline human factor mishaps. The following are some anonymous accounts where distraction nearly caused a major aircraft mishap.

"We were climbing out of ____________ Airport. The First Officer was flying. I acknowledged a 7,000-foot restriction, then went back to my paperwork. I didn't see the First Officer set 17,000 in the altitude select window. As we passed 12,000, Center called, wanted to know where we were going."

"We were cleared to descend to 5,000. I was doing the approach checklist. Suddenly I saw the altimeter going through 4,200. Before I could do anything, a light airplane came over the top of us. We missed him by maybe 200 feet."

"During the descent to our assigned altitude (7,000 feet), door warning light illuminated. Pilot and copilot attention was diverted to depressurizing the aircraft. My next instrument scan showed approximately 2,000 fpm descent passing through 6,000 feet. I immediately added full power and pitched up 25 degrees and climbed at 4,000 fpm back up to 7,000 feet. As we climbed, another aircraft called and asked Center for our altitude. In writing this report, I am not minimizing the error in crew coordination: I personally will review my cockpit procedures."

The Deadly Sin

We in the Air Force have documented the same type of distractions. You, the reader, can probably cite your own examples. In fact, if you do have some good examples, submit them under the anonymous "There I Was" program so that others can see *real-life* examples of the seriousness of distraction in aircraft operations.

When a distraction occurs, an individual can react in several different fashions: He or she can tune it out and proceed with the task at hand; turn his or her attention to the distraction, devoting whatever resources are necessary to handle it; or assess the distraction and give it a priority of accomplishment. Two out of the three decisions can be bad and lead to a fatal event depending on how your luck is running that day. We can teach ourselves to deal with distraction better than we do. We can make dealing with distractions successfully an individual goal and an organizational goal.

Most Air Force flying training programs already teach the aircrew member to establish flying priorities and, above all else, to fly the aircraft. We can expand on that foundation and build training programs that educate the flyer on the various types of distractions he or she can expect to encounter, and then expose the flyer to as many realistic distractions as possible in the simulator program. The subject can also be addressed in flying safety meetings, crew meetings, and hangar flying sessions. Whether you're a single-seat driver or a multi-seat driver, believe me, distractions are a timely subject and it is worth your time to increase your awareness of these deadly effects.

As a memory jogger on the types of distractions a flyer can expect while flying his aerospace machine, I have provided the following list. Hopefully you can add some items to the list yourself. Each of the following items is capable of causing a person's career to come to an untimely end if he or she lets the event divert his or her attention away from aircraft control or directing the aircraft along the desired flight path.

- Overfixation on mission accomplishment.
- Untimely checklist accomplishment.
- Overinvolvement in an aircraft malfunction.
- Untimely crew intercom conversations.
- Unplanned or unforeseen event.
- Overattention to bad weather, i.e., thunderstorm penetration, poor visibility during an approach, etc.
- Monitoring or instructing a new crewmember.
- Additional people in the cockpit.
- Radio calls with ATC or other outside agencies.
- Fatigue (increases vulnerability to other distractions).
- Emotional stress (increases vulnerability to other distractions).
- Flight lunches (believe it or not, we have had near mishaps because crewmembers were wrapped up in eating a flight lunch and forgot to monitor the aircraft or didn't notice an aircraft malfunction).
- Complacency.
- Overattention in locating the airport or runway.
- Attention diversion on a ground item of interest to the exclusion of monitoring the flight path.
- Daydreaming.
- Target fascination/fixation.
- Overattention to approach/chart reading.
- Overattention to accomplishing mission paperwork rather than monitoring the aircraft.

continued

- Boredom.
- Untimely conversations with command control elements.
- Coffee spills and stewards/ stewardess (for the heavy drivers).

If we commit ourselves to learning more about human factor caused mishaps, and if we're willing to pay more attention to human factor lessons learned and apply these lessons to our training programs, the number of mishaps will continue to decrease. I hear a lot of office talk and bar talk as to how low can we realistically expect the mishap rate to go? How close to a zero mishap rate is attainable? No one knows for sure; but one thing that is for certain, we've only scratched the surface on figuring out just what causes a person to commit a glaring error—one, which from observer's point of view, appeared to be easily preventable.

When we figure that one out, we can really bring down the mishap rate. A partial answer to seemingly gross human errors is distraction. That brings us to the bottom line of this article. Hopefully, your interest has been at least tickled enough to give the human factor of distraction some additional thought . . . how can you prevent its negative effect from being a part of your flying? ■

ACES II Seat Care

MR. DON PERSON
APG Specialist
McDonnell Acft Co.

■ That age-old habit of stowing the survival kit straps and seat lap belts over the seat side structure, and not properly securing the CRU-60/P oxygen/headset connector when not in use is now causing serious problems, and here's why.

The clearance between the "ACES II" ejection seat side structure and the right console of the F-15 is approximately 1 inch. During up and down travel of the seat, the survival kit straps, the lap belt buckles, and the CRU-60/P connector can become wedged between the seat side structure in the area of the seat restraint release handle and the console. Fortunately, up to this time F-15 seat damage has been limited to bent and buckled upper seat flanges and broken support clips for the seat restraint handle. Other aircraft equipped with the "ACES II" seat have not been so lucky. Their damage has consisted of pieces broken out of the seat upper flange. Perhaps this damage may seem minimal to you but, and this is a big BUT, *damage of this kind cannot be repaired at the local level. Depot level assistance is mandatory.*

With a little care and concern this unnecessary damage can be prevented. Next time you leave the cockpit of your Eagle make sure you stow the CRU-60/P connector in its storage plug on the right console, connect the lap belt buckles, and leave the survival kit straps on top of the survival kit cushion. This action takes only a few moments of your time and it can save an expensive piece of your life support equipment.—Courtesy of *Product Support Digest*. ■

F-15 Dual Engine Restart Procedures

GLEN LARSON
Engineering Test Pilot
McDonnell Aircraft Company

Eagle engines ordinarily give off the reassuring glow pictured above. However, for that rare occasion when the light from both sides suddenly diminishes, here are some newly developed dual engine restart procedures.

■ Double engine failures or malfunctions of any kind are no fun; and fortunately, the problem rarely occurs in the F-15. Since it is an isolated occurrence and no one has a great deal of experience in handling dual engine problems, we felt that some research and simulation effort was needed. Numerous dual engine-out simulations were conducted in the Goodyear simulator at Luke AFB, where we found that pilot technique often departed from flight manual philosophy.

We examined the problem and suggested a procedure that is a reasonable resolution consistent with engineering design and pilot behavior. The procedure was presented and accepted at this year's F-15 Flight Manual Review Conference. In short, our goal was to maximize the probability of regaining engine operation regardless of the failure cause. Of course, all situations cannot be covered by a single procedure; and to quote the flight manual, "you must determine the most correct course of action using sound judgment, common sense, and a full understanding of the applicable system(s)."

The simulation effort revealed some interesting pilot techniques. Many pilots will tend to lower the nose excessively. If the problem was introduced at very low airspeed and extreme nose-up attitude, the pilot tended to enter a 70-80° dive, remain in the dive, and occasionally go supersonic while attempting to clear a dual stagnation. This technique drastically reduces the time available to clear the stagnation and often results in some pilot disorientation. A dive angle of approximately 10° will generally sustain 350 KCAS and sufficient windmill rpm on the engines to retain hydraulic power. For example, for a clean aircraft gliding at 350 KCAS at 10,000′ MSL, with one engine stagnated and the other windmilling, the actual glide angle will be 12.8°. Remember, this is to sustain rpm on a previously windmilling engine. If you have let rpm go to zero, airspeeds of 450 KCAS may be required to get the engine windmilling again; but 350 KCAS will sustain rpm at 18-20% with *normal* flight control demands. Windmill rpm will decrease as altitude decreases, but as long as 350 KCAS is maintained, windmill rpm will not normally drop below 12% at any altitude.

A major pilot concern was that some source of hydraulic power,

continued

F-15 Dual Engine Restart Procedures continued

usually from a stagnated engine, be retained at all costs. As you can see, an engine windmilling at 18-20% is adequate unless you constantly cycle the flight controls, thus imposing a *continuous* demand on the system. It is important to note that normal gliding flight does not tax the hydraulic power available from a windmilling engine. (By the way, when was the last time you practiced flying on the standby instruments? Remember, with rpm on both engines below approximately 45%, the main generators will drop off the line and the primary flight instruments will freeze at their last readings.)

Since we are addressing a specific procedure, it's best to examine each step with its supporting philosophy. Dual engine problems are usually associated with stagnations; therefore, the procedure is oriented to a high altitude, low airspeed problem. Assume you are at 35,000', 150 KCAS, and both engines start giving you problems:

Step 1—Both throttles—CHOP TO IDLE (Military if in A/B).

This assumes that the first indication of a problem was a stall (it usually is) and is an effort to clear the stall. Unfortunately, it wasn't your day, and the engines entered a classic stagnation.

Step 2—Throttle (right engine)— OFF WHILE ESTABLISHING 350 KNOTS.

Lower the nose to establish a 350 KCAS glide while shutting an engine down. We recommend the right engine due to lower hydraulic demands on that engine, which results in a lower spooldown rate and a higher rpm for a given airspeed and altitude. If maximum FTIT is a consideration, then the left engine may be a better choice. If the problem is due to a flameout, the right engine is always the best choice.

Step 3—Perform restart procedures.

It is important to emphasize the spooldown start procedure. It is not necessary to wait for a stabilized rpm before attempting a restart. A spooldown start is performed by moving the throttle out of cut-off at or above 25% rpm. Since time is critical, we recommend initiating the start attempt at 25% rpm even if airspeed is low or FTIT is high. This procedure gives the best chance for a restart. Placing the throttle in the mid-range position instead of idle will deliver thrust 8-10 seconds sooner. This "tiger start" technique may go against your instincts, but it is the best way to get power back—fast! This technique allows the engine to accelerate quickly and minimizes the chances of a stall.

Placing the throttle to mid-range allows the engine controls to bypass the idle operating condition and move directly to the condition called for by the pilot. Since the engine doesn't have to establish a stabilized idle, time to regain thrust is reduced; and as an added benefit, stall margin is increased. If the throttle were placed at Military, exactly the same sequence occurs, except that the EEC comes into play. If the original problem was related to an undetected EEC problem, then the original stall or stagnation may reoccur; therefore, placing the throttle to mid-range is the optimum choice. If you move the throttle out of cut-off as the engine spools down through 25%, the rpm will continue to decrease to some value below 25%, stabilize, then begin to increase as the engine relights, and FTIT will increase shortly after rpm.

We elected a spooldown restart instead of using the JFS on the first engine because the engine start envelope is larger than the JFS operating envelope, and the 350 KCAS glide during the start will descend the aircraft into the JFS envelope. Some other relevant considerations during the first start are—

- The upper limit of an airstart for the subsonic case is 35,000 ft.
- Avoid steep dives since time available for restarts is drastically reduced, and ejection at high speed in a steep dive may be out of the envelope.
- 350 KCAS is more than sufficient speed for a "zoom and boom" maneuver, if necessary.
- Since the other engine is still in stagnation, a 350 KCAS glide will allow you to move on to clearing the stagnation on that engine as soon as practical, thus reducing the thermal stress on that engine.

As a point of interest, spooldown airstarts are routinely performed on all production acceptance flights with virtually a 100% success rate. The starts are performed on the start limit line shown in the chart, usually at 10,000 ft/.46 Mach and 30,000 ft/ .8 Mach. The following points from the chart are representative of the lower airspeed limits at which starts can be obtained:
30,000' and .85 Mach (330 KCAS);
20,000' and .65 Mach (320 KCAS);
10,000' and .46 Mach (260 KCAS)
for all engines, Lots III and IV. Lot IV engines can be started slightly slower. In any case, a 350 KCAS glide will be adequate below 35,000 ft.

Step 4—At rpm increase on engine being started or if restart is unsuccessful, shut down the other engine.

This step requires a bit of thought. At what point during the attempt on the first engine do we abandon it and move on to the other engine? The issue is somewhat academic since the first engine will do one of three things:

- Start and run fine.
- Not light off, in which case it probably wouldn't start anyway.
- Go back into stagnation, so there's no point in wasting time on it.

In any of the above cases, it's best to move on to the other engine when rpm increase is noted or if there is no start in a reasonable time. A "reasonable time" is best defined as a function of altitude available. Obviously, at 5,000 ft AGL, a few seconds is long enough, while at 30,000 ft MSL, you may have the luxury of waiting a full minute or more. As a guideline, it takes 10-12 seconds from the time you move the throttle out of cut-off for the fuel manifold to fill and establish the proper fuel-air mixture in the combustors. Indication of a relight should be apparent within 12-14 seconds after moving the throttle out of cut-off. If time permits, using the High/Low position of the engine start switches may be of some help; but remember, the object is to get either one running as quickly as possible.

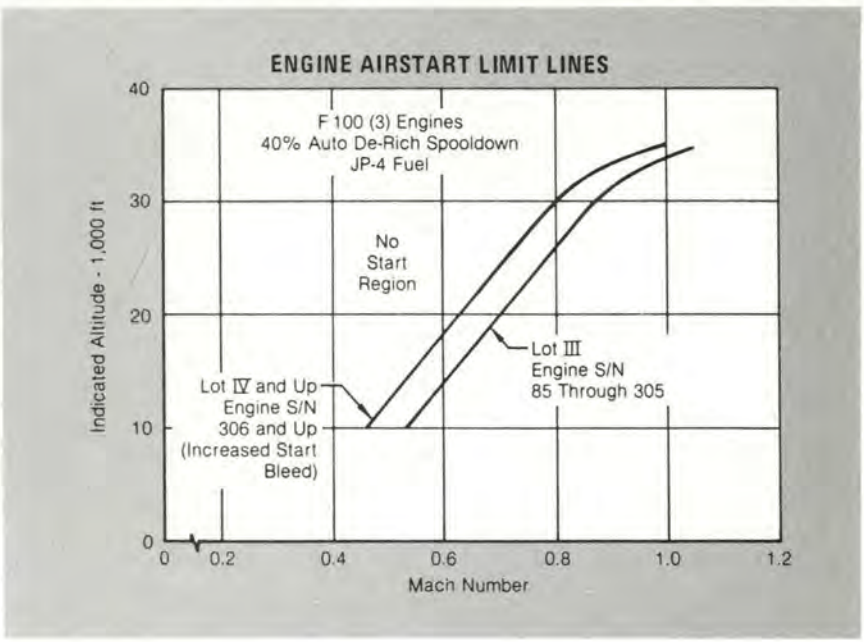
Step 5—Perform restart procedures.

At this point, we have given up on or succeeded with our efforts on the first engine and this step depends on whether or not you have airborne JFS capability. If you do, fire it up and commence a JFS-assisted restart per the flight manual. It's not necessary to use the JFS, since a spooldown start will work as described before, but a JFS-assisted restart is another effort to maximize the probabilities of regaining an operating engine ASAP.

A word of caution: If you plan to use the JFS, be careful when shutting down a stagnated engine. Don't hold the fingerlift full up while moving the throttle full aft since that will activate the microswitch, which causes the JFS logic to attempt to engage the JFS as soon as it is started. If engine rpm is 30-50% when the JFS attempts to engage, a "crash engagement" occurs which results in a sheared starter shaft. An engineering change has been proposed to solve the crash engagement problems; but until it is approved and incorporated, caution must be exercised.

In summary, using spooldown "tiger" starts gives you the best chance of restart. Use a spooldown "tiger" start on the first engine and don't waste time attempting multiple efforts. Move on to the other engine and use the JFS, if available, or a spooldown "tiger" start and maintain a 350 KCAS glide to maximize time available.

During the entire procedure, hydraulic power is *always* available. During first engine restart, hydraulics come from the other engine. During second engine restart, hydraulics come from a running/restagnated/windmilling first engine. In the event of a no-start on either engine, hydraulics come from the second engine while engaged to the JFS, if available, or windmilling engines.



Now that you've gained a better understanding of the systems involved and optimum procedures, you can analyze the situation and take the best course of action to resolve your problem. If you have the opportunity, I highly recommend a few minutes in the simulator exploring dual engine malfunctions, corrective actions, and standby instrument flying. — Courtesy *Product Support Digest,* Vol 27, No. 5 1980. ■

THERE I WAS . . .

■ . . . deep in the Phantom's pit on a pitch black night in the weather, without a radio, without a TACAN, without an INS, without a radar, and without a clue! Lead was 20 seconds ahead of us and out of sight on a radar departure. Not only didn't we know where we were, we didn't know where we were going. God must take pity on young aviators because we were a Class A waiting to happen. While the red lights glared off the instrument panel and the radio whined in our ears, we learned what it's like to be lost and all alone.

The mission started in typical Jink and Thundergib (old friends from pre-Wart Hog Bentwaters) fashion. Avid aviators from the desert, we were crested capping it in Europe and playing the hurry-up-and-wait game to go fly. Finally we were on the schedule, nr 2 for a two-ship night round robin. The flight lead was an old SEA grad, but as green to Europe as we were. He had completed the required checkouts, and this was his first chance to lead a flight into the tangled airspace of the Luftwaffe and Rhine radar! We briefed, preflighted, and proceeded on our way for the simplest of missions—take off, fly a 5-leg round robin, shoot some approaches, and land—right!

We had our books, charts, checklists, flight plans and briefings. Somewhere, though, we left our smarts behind.

I learned what synergistic meant that night. All those little things you take for granted or ignore, all those little what if's that will never happen get together and hit you harder and with less warning than an SA-6.

We took a questionable aircraft with known radar and navigation deficiencies, but we were nr 2—right!

The radio didn't work all that well, but we were nr 2—right!

We had our local area procedure books. An ominous security blanket, but we were nr 2—right!

We almost knew where we were going, but we were nr 2—right!

Immediately after takeoff the radio started channelizing and wouldn't stop, the TACAN wouldn't lock on, the INS dumped, and both aircraft were swallowed by the thick German fog. That's when I dropped my *!!@$ map. Amazing how fast things turn brown.

Thoughts of rocks, towers, conflicting traffic and, of course, the bewildering buffer zone monster permeated our thoughts. The only good direction to go was up. I listened to the weather, even wrote it down, but never thought to ask about the tops. What's worse, the cold sweat of terror started to bead on our foreheads as the consequences of being lost sunk in.

We broke out somewhere near double ugly's real service ceiling of 30,000′ and saw a light on the horizon. With thoughts of terrifying an air liner, starting an international incident, or even worse, we closed on it. The force must certainly have been with us because it was our quite relieved leader.

The point is simple. Don't get in an air machine unless you know where you're going, what you're going to do, how to get there, and how to get back. That means knowing what's in the book, not that it is somewhere between the covers. It means Blue 2's job isn't just to say "toop," because when you're alone you suddenly become nr 1. But mostly, it means you've got to have a plan. Survival starts with a plan.

What would you do in this situation if that light was only a star?

How many times do these lessons have to be relearned? Thanks for telling us about your experience; maybe it will save someone from having to learn the hard way, or save someone–period.

While delivering conventional bombs from the B-52 at low altitude on a recent RED FLAG mission, I had a semi-bad case of target fixation. After over 3,000 hours in the BUF (Big Ugly Fellow—in polite company), I didn't think that it could happen to me, and believed it only occurred to the little fellows. But there I was at 40 seconds to go.

The target was acquired in the TA/EVS (terrain avoidance/electro-optical viewing system) and I began watching intently while waiting for the radar navigator to pickle the bombs out. The target filled the whole TV screen before I cross-checked the radar altimeter. The pull-up was abrupt, and dangerously close to being too late.

Target fixation scared the heck out of me—once is enough.

I never would have believed it of the big fellows, either. Your experience provides a good lesson: Fly the airplane! ■

Brig Gen Leland K. Lukens
Director of Aerospace Safety

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MAJOR

John H. Smith

178th Tactical Fighter Group
Ohio Air National Guard
Springfield Municipal Airport, Springfield, Ohio

■ On 27 May 1980 Major Smith was flying as nr 2 in an A-7D on a ground attack mission. During the return flight while cruising at 500 feet and 300 knots, the aircraft collided with a large white sea bird. The impact shattered the left quarter panel, which, along with bird remains and other debris, struck Major Smith in the face shattering his visor, visor shell, eye glasses, and breaking his nose. Although blinded, temporarily without communications, and separated from his leader, Major Smith maintained enough composure to control his aircraft. After regaining partial sight in his right eye, but hesitant to attempt clearing his left eye because of glass fragments, Major Smith, with help from center and a chase aircraft, flew 65 miles over water to Naval Air Station, Barbers Point, and successfully landed his aircraft. Major Smith's superior airmanship and prompt reaction to this inflight emergency prevented possible loss of life, and a valuable aircraft was recovered. WELL DONE! ■

The ever adaptable B-52
swings into its low level role

Photo by MSGT ROBERT LEACH