flying

SAFETY

AUGUST 1983

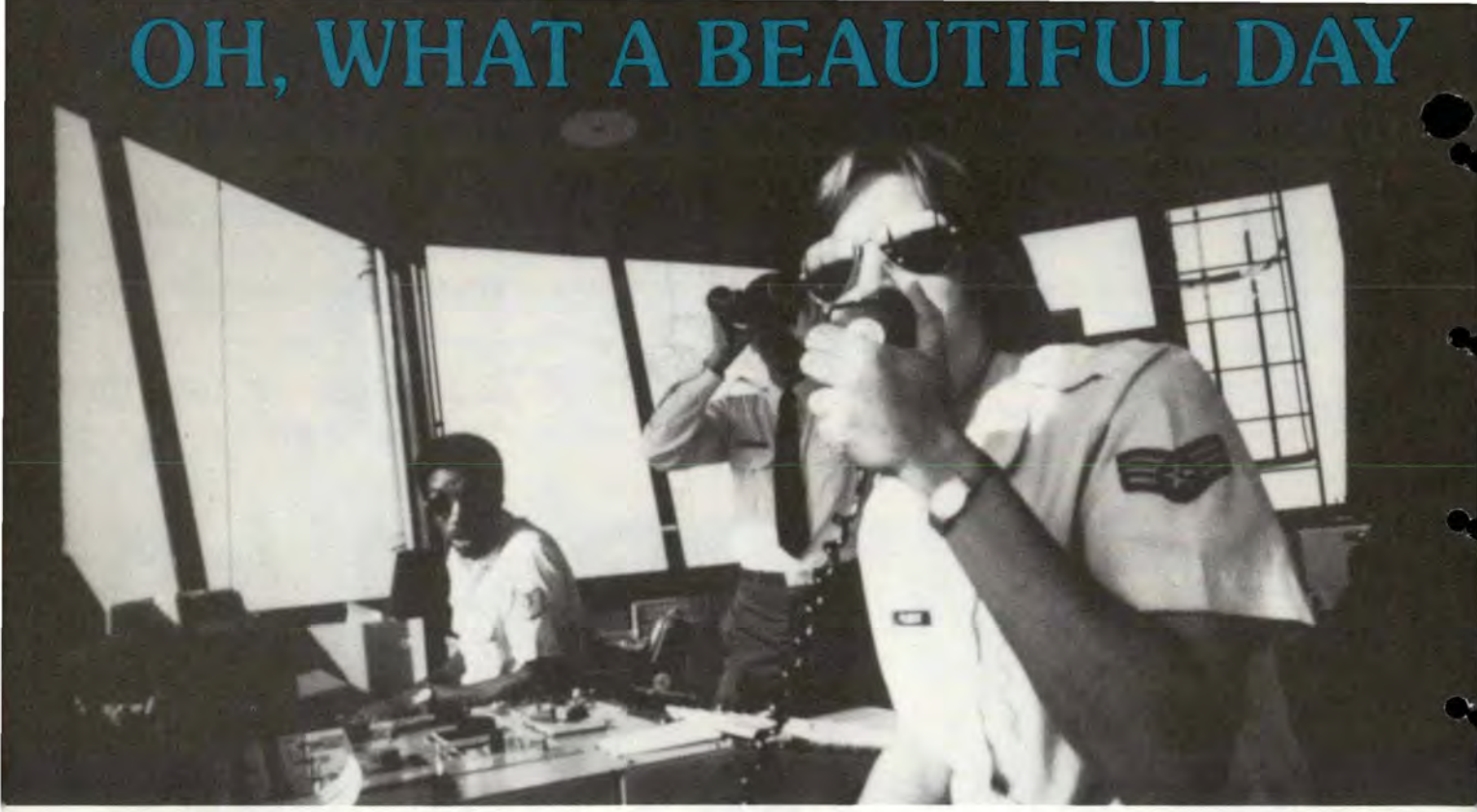
"Please Tell Us What Happened, Sir!"

Subtle Pilot Incapacitation

How It Went

Put Your Finger On Your Nose!

OH, WHAT A BEAUTIFUL DAY



TGST BENNIE J. WELLS
Tower Watch Supervisor/Unit PAR
Richards-Gebaur AFB, MO

■ It was a beautiful spring day. As I listened to the man I was relieving as local controller brief me on the traffic, I gazed out across the quiet ramp of Richards-Gebaur Air Force Base.

"The only traffic you have is a T-38 on multiple approaches VFR. He has requested 1700 instead of standard pattern 2700'. The local A-10s have shut down."

"OK, I've got it. See you later."

With a nod, my predecessor picked up his hat and left the Tower cab. I settled down to a rather peaceful, if not boring, tour. The T-38 flashed white in the afternoon sun as it turned for another pattern.

As I cleared the pilot for his next approach, I wished briefly I could trade places with him. Then my thoughts were interrupted by a call over the Tower VHF frequency.

"Richards-Gebaur Tower, Cessna N8081S, 5 west at 2,700 feet. Request permission to cross your airspace."

Keying the mike, I checked the position of the T-38 and acknowledged.

"Cessna N8081S, Richards-Gebaur Tower, cleared to cross the airport traffic area maintain 2,700. Traffic a T-38 at 1,700 on downwind west of the field."

The light plane rogered his clearance, and I scanned the west quadrant to see if I could pick him up. I soon saw the light plane and then turned back to check the T-38 on downwind. I immediately sensed something was wrong.

For a moment I wasn't sure what it was, but then I realized that the T-38 was at a different altitude than before. I quickly called the pilot for an altitude check and had my worst fears confirmed. The T-38 was at 2,700' heading right for the Cessna.

"Randy 35, descend immediately! Traffic 12 o'clock, less than a mile!"

I watched, scarcely daring to breathe, as the two aircraft seemed to crawl toward each other. Then, just as I was sure that a midair was unavoidable, the T-38 seemed to duck rapidly under the light plane.

Later, I talked with the still rather shaken T-38 IP. He had climbed back up to standard traffic pattern altitude for some more patterns. He had not called the Tower to advise us because he thought that he owned all the airspace up to the traffic pattern altitude. He had not heard the conversation with the Cessna because it was on VHF.

At first the IP tried to argue that I could have given him a traffic advisory. Well, if there had been more time I might have. But he didn't have much more to say after I pointed out that there would have been 1,000 feet of separation between the T-38 and the Cessna if he had not violated his clearance by departing an assigned altitude without a new clearance. ■

UNITED STATES AIR FORCE

flying

SAFETY MAGAZINE

AIR FORCE RECURRING PUBLICATION 127-2 | AUGUST 1983 | VOLUME 39, NUMBER 8

AFRP 127-2
Entered as a publication at the Second-Class rate (USPS No. 586-410) at San Bernardino Postal Service, 1331 South E Street, San Bernardino, CA 92403

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SPECIAL FEATURES

REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

"PLEASE TELL US WHAT HAPPENED, SIR!"

A PILOT'S PART IN MAINTENANCE

When you land with a maintenance problem, you start a sequence of events. This sequence begins with your local maintenance specialist and may go all the way to the depot.

CECILIA PREBLE
Assistant Editor

■ You're coming in at about 1,500 feet AGL, 210 knots, when you notice your B system hydraulics gauge reading low and dropping fast. Having to coordinate with the supervisor of flying and considering the after landing procedure adds to your problems. Luckily, you're on final approach so all you really have to do is reduce your airspeed and point the nose to the right spot.

Dispatch learns of your malfunction and after your safe and expert landing, you're greeted by the hydraulics specialist. He asks you a series of questions about how it happened, when it happened, and whether you experienced this or that. Most of the questions seem logical; most you can answer.

As you step into the debriefing room, you meet a small maintenance crew. They try to pinpoint the cause of the problem by asking more questions. Meanwhile, you're trying to make sure all the necessary forms are being completed. There's never a shortage of paperwork.

You're late for a training class and don't have time to discuss it much more. You remember experiencing a similar problem just after UPT. One of the hydraulic lines had been damaged. The symptoms today were identical to those you observed on that occasion, so that's probably the cause of the trouble. You tell the crew chief as much and having imparted this little pearl,

After you've completed your writeup and debrief and departed for a "cool one," the real work starts for maintenance. First, the schedulers work your aircraft into the schedule for repair.

exit one pilot.

As far as you're concerned, you've done your part. But it's only the beginning of a long series of events leading to the solution of the problem you've uncovered.

Last year there were 41 Class A logistics mishaps Air Force-wide. Aircrew members can help get this number down. A pilot who understands the intricacies of the maintenance process (not so much from the technical aspect, as from the standpoint of what's involved in attaining a permanent fix) can contribute a great deal. The hypothetical circumstances of this article are intended to illustrate the ripples which one writeup can create. This is not necessarily the way it always happens.

The reporting process is time-consuming and often seems pointless. It's easy to feel frustrated when you've repeatedly written up the same malfunction and never seen it fixed. But the more you know about maintenance, the less you'll feel that your time is being wasted and the more you'll be willing to provide comprehensive and detailed writeups.

Back to our hydraulics problem. At this point, debrief sends the discrepancy up to job control or to the aircraft maintenance unit scheduler. They assign a maintenance priority to your aircraft which reflects how soon your discrepancy may receive attention.

The controllers and schedulers work with production supervisors and expeditors to schedule troubleshooting. Once troubleshooting begins, hydraulics personnel begin working with the information you've provided as well as the system's history and tech order guidance. Although there are standardized fault analysis procedures for many systems, the more complete your information is, the more quickly extraneous factors can be eliminated.

Once troubleshooting begins, the specialists can often use standardized fault analysis procedures. Extraneous factors can be eliminated more quickly if the information on your write-up is complete.

The information in your writeup has led the hydraulics personnel to suspect a landing gear valve failure. Fortunately, it failed after the gear was down and locked. They remove the landing gear valve and order a new one. If the part is available locally, it's usually no problem. If a part is not available, it has to be back ordered to the depot. Then a decision is made, based on how soon your aircraft must fly, whether to cannibalize the part or wait until supply can provide it. In this case, the part is delivered from supply and is replaced. Because this component is part of the landing gear system, a gear retraction check is performed.

If everything checks out, the writeup is cleared, the other inflight discrepancies and those discovered on basic post flight are worked and cleared, and your aircraft is prepared for the next scheduled flight.

Meanwhile, the defective valve is routed to the pneudraulic shop, where the technicians inspect it for obvious external damage and may or may not perform operational checks. In this case they are not authorized to disassemble the valve (virtually all aircraft components have assigned codes specifying repair at the organizational, field, or depot level).

After their inspection, the technicians process a material deficiency report (MDR), for the defective landing gear valve to supply. This report will include information from your writeup and from the specialists'

continued

continued

troubleshooting. The exhibit (valve and MDR) will be sent to the item manager at the prime ALC for the part. A teardown analysis will be performed on the valve and the failure mode determined.

Because many other landing gear valves have been failing in the past few months, a failure trend for the component exists. Based on this trend, the item manager, in concert with the weapon system manager, determines that an engineering study should be performed. Many different factors are evaluated during the study. Because of the failure trends of this particular landing gear valve, a modification proposal is submitted by the engineering study group.

Upon approval, the item and system manager decide the priority of the modification of the valve within all the other actions proposed for the aircraft. The rest is a matter of money and procuring the parts needed for the modification (TCTO) kit.

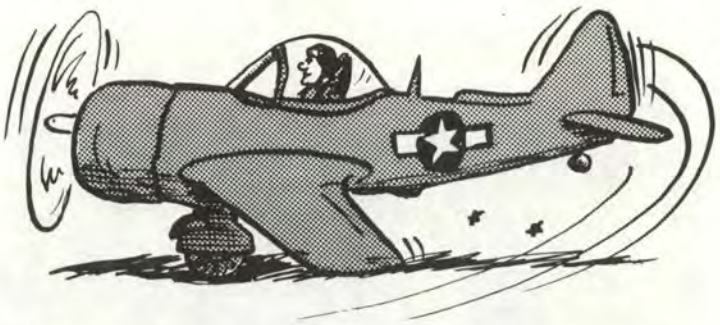
The TCTO is scheduled once the kits are available. The modification will be made either in the field or at a depot, depending on the complexity. In your case, it will be a depot modification to the valves. The depot will first modify all spare valves and provide them to the field for changeout. The unmodified valves (removed from the aircraft in the field) will be returned to the depot until the fleetwide change-out is complete.

Obviously, there's more to maintenance than replacement of faulty parts. As part of an aircrew, you can contribute considerably toward troubleshooting by being observant when the malfunction occurs and relaying as many details as possible to the maintenance crew. Try to foresee the questions they will be asking you and jot down the details, if you can do so without jeopardizing your safety. Make a mental note of the questions maintenance personnel ask about the circumstances of your malfunction. If it occurs again, you'll be better prepared to answer them. Also, be tactful in telling your maintenance crew what is *really* wrong with the aircraft. They're interested in your opinion, but wouldn't it grate on you a bit if they started suggesting ways to improve your landings?

Writing up malfunctions, especially the minor ones, is a frustrating ordeal and it's just one of a growing number of demands being made of your limited time. Even the most seemingly insignificant malfunction is important. After all, don't you want a clear conscience when your buddy takes off in the aircraft you flew yesterday? ■

The debriefing is the pilot's best chance to communicate information to maintenance. The face-to-face discussions can provide valuable insight into the nature of the problem. Maintenance needs your information to quickly and accurately clear the malfunction — especially during an exercise.

THE LITTLE THINGS



You know you're not the only one who occasionally has been tempted to overlook an ostensibly minor malfunction. It's a mental battle but the consequences of this sort of negligence can be serious. In the long run, somebody usually has to pay; it may even be you. This problem has been around for a long time, as the following 1949 *Flying Safety* article testifies.

■ So the little things don't count? They're too trivial to be bothered with, are they? Well, I was a hot rod once, and the little things weren't important to me either. So I thought! All I did was bring the F-47 in, taxi to the ramp, swing around on one wheel into the parking space, cut the fan, and hop out and head for home.

Sure there were a few little things I'd noticed in the flight that day, and there were a couple of kinks in the controls when I headed on final. Like that right rudder pedal. The adjustment-locking pin must have been worn because you could slam that pedal the whole way to the wall and you couldn't get much control. I sure had to burn some rubber on that right tire to keep straight on the runway.

You're supposed to enter such things on the Form 1A (forerunner to the 781A) but it was just a little detail and the crew chief would probably catch it in the morning anyway. Besides, I was in a hurry. I wanted to hurry home to the little woman and the kids. So I scribbled OK on the 1A and headed for my car.

Must have been about an hour after lunch the next day when one of the boys walked in and asked me if I'd heard about Joe. Of course I hadn't heard about Joe! I'd been buried behind a stack of paperwork all morning and I was just getting started on an afternoon session with the stuff.

I was told that Joe's plane groundlooped and nosed over on him. His arm and nose were broken and he had some cuts and scratches. He was lucky. I was glad it wasn't more serious.

"What caused the accident, do they know?", I asked.

The right rudder pedal gave him trouble, I was told. The adjustment-locking pin must have been worn. He tried to apply right brake to keep the plane straight and the right tire flew off. He started to groundloop and the right wingtip dragged, caught, and cartwheeled him over. An examination showed that the tire tube had been damaged by heat from too much brake some time before.

"Wait a minute," I said. "What kind of plane did you say it was?"

"An F-47."

I guess I did look a little sick. I couldn't tell him that was the same plane I was flying yesterday.

A faulty locking pin. I knew and didn't do anything about it. Just because I was in a hurry and the little things didn't seem to matter, Joe almost got it. Maybe the guy before me knew too, but maybe the little things didn't bother him either. That could have been me the day before instead of Joe that day.

You may not think those little things count until one of those big things that grow out of little things hits close to home. As for me, ever since that time, even if it's just a scratch on the wrong place in the windshield, it goes on that 1A. Yes, sir, that little form gets religious attention before my John Henry goes on the bottom.

— Adapted from *Flying Safety*, June 1949. ■

THE OPS AND MAINTENANCE TEAM

"Fixing" is just as important to the mission as "flying and fighting."

CAPTAIN DUANE W. DEAL
HQ USAF/LEY
Washington, D.C.

■ "How about an additional duty as a maintenance officer?"

"You gotta be kidding. With Stan-Eval on my back, the mission planning, and alert, I barely have enough time for my Ops duties."

"Me? I'm a fighter pilot! I just want to fly and fight!"

Let me rephrase the question. "How would you like to help yourself accomplish your Ops duties while making it easier to 'fly and fight'?"

"Sounds good to me."

"Roger."

Back to the original question. The way to accomplish this feat *is indeed* for each aircrew to become a more active part of the Ops side of the maintenance program. Further, perhaps one of the most important things aircrews can do to insure their own success and that of their unit is to serve daily as "ex officio" members of the maintenance Quality Assurance (QA) office.

In a parallel to the Stan-Eval office, maintenance has its QA office. As a direct representative of the DCM, it has the dual charter to conduct evaluations of personnel and inspections of equipment to determine the health of the maintenance complex. Another important aspect of the office is its responsibility to serve as the maintenance watchdog to assure that sound safety practices exist throughout maintenance. Quality Assurance has an interface with every other area in maintenance, performing evaluations, soliciting feedback and insuring that adequate training is provided. Finally, QA offices are tasked with other essential duties, to include monitoring the functional check flight (FCF) program, the aircraft weight and balance program, Tech Order and Material Improvement programs, and serving as the focal point for all Tech Orders in the unit (from the Dash One on your aircraft

to checklists on nearly everything done in maintenance). But how does the aircrew fit into the QA picture?

As with the new recruit or technician, part of an aircrew's in-processing to a new unit should ideally be an introduction to the maintenance complex. This overview, led by the Ops Training office with QA and/or Maintenance Control guidance, should inform the aircrews not only about the location of the various work centers, but also about the functions of those areas. Just visiting the working areas of specialists during a unit tour provides a new dimension for many aircrews, as they witness the behind-the-scenes activity which provides them with full mission capable (FMC) aircraft. Also, an appreciation might be gained for why specialists support sometimes takes longer than desired due to workload, priorities, and/or sheer distance. Most importantly, the aircrews should become aware of their much needed contributions in providing a sound maintenance product. These contributions/responsibilities include:

Complete 781 discrepancy writeups. An effective description will provide enough detail to speed up troubleshooting and subsequent repair. Although the following actual writeups may have seemed sufficient at the time, each created extra work on the part of maintenance due to its inexact nature: "cabin pressure shaky," "IFF inop," "afterburner slow" (afterburner *slow?!*), and "radio operation intermittent." Discrepancy narratives *must* include such information as instrument readings, time into the flight, aircraft configuration, altitude, attitude, and weather conditions (as appropriate for the discrepancy). Other clues not readily available to maintenance should also be included, such as the aircrew resetting circuit breakers or applying "Gs" to remedy a problem. Finally aircrews aren't doctors, and maintenance troops aren't pharmacists — take the time to write and sign legibly!

Proper application of Dash One procedures. To prevent problems induced by a lack of knowledge, you should work to maintain a complete understanding of your equipment

As the aircrew, you can have a major effect on the quality of the aircraft you fly. By doing everything you can to support maintenance, you make your own job that much easier.

An accurate and detailed 781 writeup is maintenance's most valuable tool in correcting a malfunction. Troubleshooting is enough of a problem without guessing games about what the aircrew really meant.

usage procedures, beyond what is available in the inflight checklists. Such knowledge obviously promotes everyday individual effectiveness and success, particularly during tests and checks by the Stan-Eval section. Just as important, however, this knowledge serves to avoid preventable malfunctions, and thus frees maintenance for other repair priorities.

Along the same lines, an up-to-date knowledge of current modifications on your system will go far to prevent "embarrassment" on your part and wasted work on maintenance's part. If you've missed the Training shop or the QA officer's discussion of aircraft changes, make certain you know the Dash One supplement guidelines which accompany the modification. Also, with newer systems having different blocks of aircraft, don't be shy to ask technicians about malfunctions before writing them up.

A healthy interchange with maintenance. The aircrew is looked upon in many ways. They may serve as an example to younger

continued

THE OPS AND MAINTENANCE TEAM

continued

troops who might possibly prefer the perceived "glory aloft" to the tough work of maintaining the aircraft below. Hopefully, the aircrew is at least seen as a partner in providing a healthy product to meet the unit and USAF mission. Regardless of how it is perceived, it is this aspect of partnership which is the aircrew's most important role. To enhance his side of the team, the aircrew should:

- Within security constraints, let the ground crew know what is planned for your mission; likewise, after the flight, let them know the mission success (unless you bring a boom home or otherwise have a doggy flight!). You might be surprised to know the pride and rivalries that develop between the technicians over the success of their birds. Also, if Training will promote allowing maintenance troops into Ops mission briefings, it will increase their understanding both of the unit mission and what "stresses" their airframes are programmed for.

- Maintenance knows that you have to debrief the mission, call the controller, fill out reports, and plan for future missions. But, by all means, *please* take the time to answer questions that maintenance debriefers may have over your discrepancy entries. You should prepare yourself for these questions while in flight by noting as much information as you can; such things as altitude, airspeed gauge readings, etc. The specialist and debriefer may be trying to isolate the cause so that the aircraft may be turned for another flight, for alert, or another purpose. They also may not be able to read your writing, or may not understand the writeup at all, and once you've left the maintenance debriefing area for the Ops sanctuary, you're pretty hard to find.

- The technicians have a tough job. They sometimes feel unsure of their contribution to the overall unit mission, they work *long* hours, may feel they have little voice, work with old equipment, are given additional base details that aircrews would probably refuse, and finally, in a sense they put their career on the line every time you walk out to their aircraft. Yet it is the individual technician who has the greatest impact on the quality of the product that the unit produces, which includes your success in the air. To protect that valuable resource, you must treat them as the team members that they are, although *you* may get the "quarterback's recognition," you need those "linemen" out in front of you!

- If you see things that you think are wrong in maintenance, you may use formal chain of command channels or several informal channels to voice your concerns. If the problem is safety related, call attention to it immediately through whatever supervisors are present. If, in your judgment, the problem should remain somewhat low key, approach a flightline supervisor, QA, or go through your Training officer to utilize informal lines of communication. At any rate, *don't* let any perceived problem go unspoken!

- You probably get pretty good service overall from your maintenance troops. However, when that certain individual comes along and gives that extra 10 percent, please make sure he (or she) is recognized (preferably in writing). If no type of ground crew evaluation form exists, suggest that Debriefing get one. Until then, letting the supervisor *and* the individual know about a good job will insure that the same treatment is provided again.

The technicians have the greatest impact on the quality of the product your unit produces, and that includes your success in the air.

This article has presented a brief prescription for us Ops folks to follow toward fulfilling our end of the Ops-Maintenance partnership. In an informal but major way, every aircrew is a member of the maintenance Quality Assurance team: through the use of the equipment provided by maintenance and the subsequent AFTO Form 781 entries, the *aircrew* is the final evaluator of the effectiveness of maintenance. Thus, one of the most important things an aircrew can do to insure their own success is to be an active partner of this essential team. ■

SUBTLE PILOT MENTAL INCAPACITATION

JEROME LEDERER
Flight Safety Foundation President-Emeritus

Subtle pilot mental incapacitation has become the subject of increasing concern and focus within the aviation community over the past few years. Reported incidents of such incapacitation have increased with the growing awareness of the problem and its potentially dangerous consequences.

Jerome Lederer, a pioneer in the field of aviation safety, addressed the issue of how to control mental incapacitation within the cockpit in a paper presented at the 29th annual SAFE Association Symposium in Las Vegas, Nevada, in December. Because of its importance and the legitimate concern surrounding the issue, Mr. Lederer's paper has been adapted for publication.

Abstract

■ Several fatal aircraft accidents and near accidents indicate that subtle mental incapacity, as distinct from subtle physical incapacity, is an unresolved problem that demands attention. Typically, the captain or aircraft commander acknowledges warning signals of imminent danger made to him by the concerned copilot but takes no corrective action. The copilot is inhibited from action by cockpit discipline.

Subtle flight crew incapacitation was brought to industry attention and defined about 15 years ago by Captain Harry Orlady, of United Airlines. He construed it to be a "physiological or psychiatric state or situation that adversely affects performance." Then he, Dr. Charles Harper and Dr. George Kidera, also of United Airlines, proceeded with the development of a memorable program focused on the recognition of subtle physical incapacitation and ways to cope with it.

A cardiac arrest would typify this; the pilot may not be obviously incapacitated. Pilot incapacitation occurs more frequently than many emergencies that are trained for routinely (Figure 1). The procedures they devised to perceive and to isolate the incapacitated pilot have been widely acclaimed and adopted by the air transport industry. Simulator training is recommended.

This article suggests an extension of this problem from subtle physical incapacity to subtle mental or cognitive incapacitation. In the context of this deliberation, subtle cognitive incapacity is tentatively defined as the indifference of a pilot to correct a perceived error and/or laxity in the conduct of a flight after it has been called to his attention and acknowledged, or the failure of a cockpit crew member to alert the pilot flying to an obvious hazard.

This discussion will dwell primarily on how to control the effects of pilot cognitive incapacity,

continued

continued

rather than why it occurs. However, a variety of reasons may account for irregular behavior or mental inertness: fatigue, self-doubt, alcoholism, complacency, unknown physiological problems — such as a brain tumor — stupidity, conceit, lack of training and/or discipline, psychiatric pressures, obstinancy, personality traits such as a dominance syndrome exemplified by the "macho" captain: "No one can tell me what to do!"

Incidentally, while this trait, common to pilots, may create problems in cockpit cooperation, it also is a trait likely to provide leadership in emergencies.

Life events such as the death of a spouse, a divorce, financial problems and even nice events such as euphoria caused by a promotion may induce performance aberration (Figure 2).

Figure 1

PILOT-INCAPACITATION ACCIDENTS: PHYSIOLOGICAL

DATE	AIRCRAFT	REGN	OPERATOR	LOCATION
17.6.48	DC-6	NC37506	United	Mt. Carmel
17.12.50	Dakota	VT-CMD	Airways India	Tangail
12.9.60	Dakota	VT-DFM	IAC	Agartais NF*
3.1.61	DC-3	OH-LCC	Aero O/Y	Finland
28.3.61	IL-18	OK-OAD	CSA	Germany
24.5.61	DC-4	NH-TAA	TAA	Queensland
14.12.62	L-1049H	N6913C	FTL	Burbank
12.8.63	Viscount	F-BGNV	Air Inter	Near Lyons
28.1.66	CV440	D-ACAT	Lufthansa	Bremen
22.4.66	L-188C	N183H	AFAC	Admore
5.8.66	DC-8	PH-DCD	KLM	Tokyo NF (Captain Died)
13.3.67	Viscount	ZS-CVA	SAA	E. London
3.6.67	DC-4	G-APYK	Air Ferry	Near Perpignan
22.6.67	Viscount	EI-AOF	Aer Lingus	Near Ashboume
28.6.70	CV580	N5826	AAA	Morgentown NF
1..9.71	DC-8	N80TU	Universal	San Juan NF
18.6.72	Trident	G-ARPI	BEA	Staines
3.11.73	Boeing 707	N458PA	PAWA	Boston
13.5.76	DC-10	N-1801U	UAL	Near Billings NF (Flight Engineer Died)
6.8.76	North American TB-25N	N9446Z	Air Chicago Freight A/L	Chicago
5.10.76	Boeing 737	N4523W	Western A/L	Salt Lake City NF
6.10.76	DC-8	CU-T1201	Cubana	Off Barbados
13.1.77	DC-8	JA8054	Japan A/L	Anchorage
6.8.78	Boeing 707	N746YW	TWA	Chicago (NF Ground)
17.6.79	DHC-6	N383EX	Air New England	Hyannis, Mass.

*Non-Fatal

Peripheral Aspects

A singular cause of mental apathy, or, as one psychiatrist suggests, mental constipation, is habituation to repetitive routine. This can affect even the most responsible person. A pilot who thoroughly learns and operates by the rules and procedures may be induced to perform by rote. It is exemplified by the litany of cockpit callouts. A case in point involves a highly experienced airline captain undergoing a crew check in a simulator. He was asked if he had any concern about the callout performance of the second officer. He had no criticism. But, when the cockpit voice recorder was played back, it showed that the second officer had never uttered a word! This illustrates cognitive incapacity resulting from mental preprograming created by following a routine with infrequent exercise of judgment.

Mental programing may be induced also by an inordinate desire to accomplish a specific task. An example is landing at a busy airport in marginal weather. The captain may precondition himself to continue landing when it might be more appropriate to order a go-around. The air traffic controller may also be mentally programmed to cooperate to get the airplane down because of other traffic. Assertiveness by other crew members could alleviate the hazards of this type of situation, but lack of assertiveness is a very important feature of this review.

When discussing the problem of copilot assertiveness or, more significantly, copilot takeover, its kinship to mutiny is often mentioned. Tradition and discipline

Figure 2

CANDIDATES FOR ACCIDENTS

By JEROME LEDERER
(Reprinted from FLIGHT Magazine)

An Air Force general once told me how strongly he wished for a device that would quickly indicate the emotional stability of a pilot just before takeoff. He kept careful tabs on the family life of his pilots, for example. Those who were soon to expect an addition to the family, for instance, were not permitted to fly very far from the base. He felt that a pilot was likely to take unusual risks to get back to his family if the baby arrived while he was some distance away.

Efforts have been made to develop a "Human Performance Measuring Device." One is described by that title in NASA Tech Brief 70-10619. Called "The Complex Coordinator," it tests perceptual and motor skills by posing a series of problems through means of a pattern of lights. The problems are solved by correct manipulation of hands and feet. When the subject is in a good "psychomotor state," a base line is established for his response to problems. When he is distracted or under the influence of drugs or alcohol, his performance will vary from the base line.

This can be applied to the early detection of psychophysiological body changes due to toxicity or stress. Other methods are under investigation, such as voice patterms electronically recorded, or brain wave monitoring. The pressure with which a pen is squeezed and the pressure exerted on the paper while writing have also been validated as clues to varied emotional stress (gripping the wheel!).

Perhaps of more immediate usefulness, however, is a weighted list of life events that increase the probability of human error because of emotional instability. This concept was appraised in the September/October (1973) issue of "Lifeline," the excellent safety publication of the Naval Safety Center at Norfolk, Virginia.

In the article, Dr. Robert A. Alkov of the Center briefly described studies underlying the relationship between personal stress, disease or accident-precipitating behavior. Some people, he suggests, are more susceptible to emotional factors than others. He also suggests that "it is incumbent upon those in supervisory positions to monitor and observe how turmoil in the personal lives of these personnel effect their performance.

Dr. Alkov then presents a list of events with their scale of importance. It was developed by questioning hundreds of people. Death of a spouse was arbitrarily weighted at 100 points. The list is itemized at Table One.

— End

TABLE ONE

Rank	Life Event	Mean Value	Rank	Life Event	Mean Value
1	Death of spouse	100	22	Change in work responsibilities	29
2	Divorce	73	23	Son or daughter leaving home	29
3	Marital separation	65	24	Trouble with in-laws	29
4	Jail term	63	25	Outstanding personal achievement	28
5	Death of close family member	63	26	Wife begins or stops work	26
6	Personal injury or illness	53	27	Begin or end school	26
7	Marriage	50	28	Change in living conditions	25
8	Fired at work	47	29	Revision of personal habits	24
9	Marital reconciliation	45	30	Trouble with boss	23
10	Retirement	45	31	Change in work hours conditions	20
11	Changes in family member's health	44	32	Change in residence	20
12	Pregnancy	40	33	Change in schools	20
13	Sex difficulties	39	34	Change in recreation	19
14	Gain of new family member	39	35	Change in church activities	19
15	Business readjustment	39	36	Change in social activities	18
16	Change in financial state	38	37	Mortgage or loan under $10,000	17
17	Death of close friend	37	38	Change in sleeping habits	16
18	Change to different line of work	36	39	Change in number of family get-togethers	15
19	Change in number of arguments with spouse	35	40	Change in eating habits	15
20	Mortgage over $10,000	31	41	Vacation	13
21	Foreclosure of mortgage or loan	30	42	Christmas	12

Life style as distinct from the life events in Table One also plays a part in a person's predisposition to error. An intolerable burden may develop when life events are coincident with changes in life style, as per Table Two.

TABLE TWO

Life Style	Mean Value	Life Style	Mean Value
Marital separation	65	Change in residence	20
Change in responsibility at work	29	Change in recreation	19
Change in living conditions	25	Change in social activities	18
Revision of personal habits	24	Change in sleeping habits	16
Change in working hours or conditions	20	Change in eating habits	13

NOTE: Pilot/co-pilot relationships should compensate for these threats to appropriate performance
J.L.

demand that complete authority be vested in the captain. My colleagues have often reminded me of "The Caine Mutiny," a classic on marine authority, by Herman Wouk, where a subordinate assumes command of a naval vessel to avoid possible disaster while it is under the control of the captain.

Navy regulation Chapter 8, article 0867, apparently permits this if the cognitive incapacitation of the captain is "obvious and clear." This will be discussed later. Of course, the copilot of an airplane is there to take command when the captain is physically disabled. Worldwide, about 25 accidents have occurred in the past 30 years as a result of physical incapacitation — mostly fatal (Figure 1). Perhaps the copilot in some of these accidents should have taken over.

In several cases, both pilots were incapacitated. In one by nitric acid fumes, in another by alcoholism, in another by carbon dioxide fumes. A number of pilot physical disablements have had favorable outcomes because the other pilot took over, i.e., during a U.S.

continued

continued

Federal Aviation Administration (FAA) flight check the pilot in the left seat suffered a heart attack just at take off rotation. Because of prior incapacitation training, the corrective action by crew and FAA check pilot was automatic and successful.

Possible Example

In the case of a captain's questionable cognitive disability, however, it has been difficult to ascertain if an accident could have been avoided by copilot takeover in situations where the copilot was killed. Judging by the cockpit voice recorder, the fatal crash in Washington, D.C., January 13, 1982, is an example of a flight that would probably not have taken off if the copilot had been in command.

The captain had acknowledged the copilot's apprehension about the power available for take off but took off. Was this a case of cognitive incapacitation?

On the other hand, psychological pressures exerted by management or by personal compulsions may overcome apprehension. This is exemplified by an accident at Anchorage, Alaska. The captain of a DC-8 had returned from an attempt to taxi to take off. Ice made the taxiway dangerously slippery. Then, his home office telexed that curfew laws would prevent landing at his overseas destination unless he took off promptly. He tried again, slipped off the taxiway. It cost over $20 million to make repairs.

Psychological pressures may overcome good judgment and therefore induce cognitive incapacitation, though it may be stretching the concept as defined before. These situations pose a conflict between organizational and personal discipline. Murphy's Law applies to mental decisions as well as to hardware. The U.S. National Transportation Safety Board (NTSB) report on this accident recommended that management should refrain from exerting psychological pressures on the crews.

Specific Instances

Specific instances which are in closer agreement with the definition of subtle cognitive incapacity follow. Suggestions for dealing with the problem will be added.

First, a caveat. Several of my observations are based not on the written record but on discussions with knowledgeable people involved in the incidents.

- A few years ago during stormy weather, the captain of a DC-8 had to abort his approach to an airport. On the go-around, he was warned by the copilot that he was heading into a mountain. This was collaborated by the flight engineer.

The captain's response was, "I'm in command!" The copilot promptly asked the flight engineer, "If I take command, will you support me?" The flight engineer assented. The copilot then ordered the engineer to "take care of the captain while I fly the airplane."

At headquarters, the captain demanded the discharge of the copilot and flight engineer. But the flight data recorder and the charts supported their actions. The captain insisted upon their discharge until the day he retired.

- In 1971, the captain and 29 others were killed when an airplane struck several houses on the approach to an airport. The copilot and two passengers survived. The captain's conduct on other segments of the flight had been so disconcerting that the copilot had considered leaving the airplane at its previous stop a short time before. He did not want to jeopardize his future, so he stuck. On the final leg, he repeatedly warned the captain of his dangerously low approach. The

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E-3A and KC-10

MAJOR ARTHUR P. MEIKEL, III

■ The E-3A fleet has now flown 93,000 hours without a Class A or B flight mishap. Even we nonmath majors can figure the rates for the 27 aircraft per 100,000 flight hours. The E-3A has flown approximately 28,000 hours per year. NATO now has five aircraft which are not included in our figures.

The trend in Class C mishaps is toward physiological problems. Some have been induced by the aircraft pressurization system while others result from large crews in TDY status. Keeping a large crew healthy is tough, and mission oriented crewmembers want to get the job done. They fly while TDY when they might be DNIF if at home station.

Failure of engine bleed valves has been a major problem. Bleed valves on the PW TF 33-P 100 engines tend to stick. At least seven of these have resulted in high EGTs, engine flameouts, engine shutdown, or — in one case — an engine fire. The source of the problem is chrome plating which is flaking because of a corroded ring seal. Crews have handled the emergencies well, even though some failures have occurred during critical phases of flight. Valves are now being checked after each flight.

The E-3's operating environment presents additional hazards. The ground environment is always important. In 1982 three ground damage incidents occurred — none were serious. The ramp at Tinker is filled almost to capacity with E-3s. While an additional ramp is being built, wing personnel have avoided costly errors which can easily occur on a crowded ramp. Also, a "Tornado Plan" has been devised for this Oklahoma ramp full of E-3s.

Another hazard the E-3 encounters is the cold weather and runway icing at Keflavik, Iceland. There have been two incidents in the past when RCRs were improperly reported or applied. One aircraft went off the runway and another almost did.

The last, and one of the most serious hazards, is the possibility of midair collisions. The E-3A often operates in special use airspace. As far as the FAA controller is concerned, the E-3A is MARSA (military accepts responsibility for separation of aircraft).

There have been several instances of breakdown in coordination or oversaturation of military controllers. In these cases, during exercises, airspace becomes filled with aircraft. Deteriorating weather does not help the situation.

People seem to expect the E-3 to provide its own separation. However, during aircrew training and multiple events, the aircraft does not always do this. Plans should be established to ensure that the AWAC crew is aware of the responsibility to keep clear of other traffic when the situation arises. Planners and controllers should not make a fatal assumption. ■

■ The KC-10 is flown approximately 6,500 hours a year. Our 14-aircraft fleet is based at March AFB, California and Barksdale AFB, Louisiana. All major maintenance and repairs on the aircraft are performed by the contractor.

Contractor maintenance is working out well, and there have been no major problems with the basic aircraft. Air refueling equipment which is unique to military operations has undergone some modification. The problem of air refueling nozzle separation during refueling operations has been eliminated by stronger attachments. There have been several reported cases of drogue problems. The automatic hose retract mechanism has failed to work properly, and slack in the hose has caused oscillations. In one case, the whipping motion caused the basket to separate from the hose. The receiver recovered normally with the basket.

The home base locations of the KC-10 have also proved hazardous. March AFB is in a high density traffic area where reduced visibility is often a problem. Last year, 20 HATRs (18 near midairs) were submitted by March AFB including such hazards as balloons, gliders, parachutists, light aircraft, and ultralights. Barksdale's hazardous traffic is in the form of flocks of small birds, prevalent during some winter months.

Two minor ground mishaps occurred last year — both during contractor operations. There were 11 Class C mishaps reported last year; five involved air refueling. Others included an antiskid problem, a blown tire, jet blast damage, a crushed taxi light, a birdstrike, and an engine problem. There have been no Class A or B mishaps reported in the history of the aircraft. Concerns for major aircraft mishaps include the possibility of costly system malfunctions causing damage that could reach the dollar criteria for the larger classes of mishaps. ■

"SAFETY TROPHIES"

for distinguished contributions during 1982

CHIEF OF STAFF INDIVIDUAL SAFETY AWARD

Presented to Air Force personnel who made significant contributions to safety during the previous calendar year.

FIRST LIEUTENANT ROBERT L. FRENZA

Strategic Air Command

As Weapons Safety Officer, 92d Bombardment Wing, Fairchild AFB, Washington, Lieutenant Frenza successfully met strict inspection standards on five different occasions from higher headquarters agencies, and identified, staffed, and solved problems involving primary nuclear airlift support and weapons handling equipment. Under his leadership, Class C missile mishaps were reduced 50 percent as compared to the previous year.

MASTER SERGEANT JAMES W. TOBEY

United States Air Forces In Europe

As Superintendent of Safety, 50th Tactical Fighter Wing, Hahn Air Base, Germany, Sergeant Tobey implemented and revitalized safety programs that eradicated workplace safety hazards and unsafe work practices. Under his leadership, the wing did not experience a single ground mishap fatality during 1982, and reportable mishaps were reduced 33 percent compared to the previous year.

MASTER SERGEANT DAVID W. BRYAN

Air Force Communications Command

As Additional Duty Safety Noncommissioned Officer, 2006th Communications Group, Incirlik Installations, Turkey, Sergeant Bryan organized and established safety program elements for hazard abatement, first aid, and cardiopulmonary resuscitation that significantly enhanced safety for Air Force personnel in Turkey.

TECHNICAL SERGEANT ROBERT S. CARRIER

Alaskan Air Command

As Chief of Safety, 11th Tactical Control Group, Elmendorf AFB, Alaska, Sergeant Carrier was instrumental in developing and establishing the first three-wheel, all-terrain cycle safety course in the Air Force. Under his leadership, the safety program of Alaskan Air Command remotely located radar sites were significantly improved and resulted in a 70 percent reduction in reportable mishaps as compared to the previous year.

THE KOREN KOLLIGIAN, JR. TROPHY

Awarded to the Air Force person who most successfully coped with an inflight emergency. Captain Wilson was navigating an RF-4 when a large bird struck the aircraft, gravely injuring the pilot. Faced with darkness, low altitude, high speed, close proximity to mountainous terrain, an unconscious pilot, and his own helmet visor and instrument panel damaged, Captain Wilson took control of the aircraft and climbed to a safe altitude. Although he had no pilot training or experience, Captain Wilson, without regard for his own personal safety, flew the damaged aircraft to a night formation landing from the rear cockpit, and saved a valuable aircraft and the life of a fellow crewmember.

Captain Frederic G. Wilson

124th Tactical Reconnaissance Group (ANG)
Idaho Air National Guard, Boise, Idaho

THE COLOMBIAN TROPHY

Symbolic of excellence in military aviation safety for tactical flying operations, the Colombian Trophy for 1982 was awarded to the 20th Tactical Fighter Wing. The wing flew more than 19,900 hours and 7,275 sorties in F-111E aircraft without a mishap. This flying safety record was accomplished while performing a high-risk, demanding, and realistic combat training mission in one of the most challenging low level flying environments in the world.

20th Tactical Fighter Wing (USAFE)

RAF Upper Heyford, UK

THE SICOFAA TROPHY

Awarded by the System of Cooperation Among the Air Forces of the Americas for excellence in aircraft accident prevention for wing-level organizations involved in defense, airlift, training, rescue, refueling, bombardment, strategic reconnaissance, and airborne control operations. The wing is the first organization to repeat as winner of this prestigious award since it was established in 1976. During 1982, the wing participated in some of the Air Force's most hazardous and dangerous rescue missions, and was credited with saving 80 lives.

403d Rescue and Weather Reconnaissance Wing (AFRES)

Selfridge ANG Base, Michigan

HOW IT WENT . . .

MAJOR JOHN E. RICHARDSON
Editor

■ There is a popular song with the refrain "It was a very good year" that sums up the USAF flying safety record for 1982. The records and achievements have all been documented, but as a reminder: In 1982 the Air Force achieved the lowest Class A mishap rate in its history.

At the same time the fighter/attack rate, the major driving force in the overall rate, was also the lowest in history. Such achievements are particularly significant in light of the challenges of realistic training, unit conversions to new aircraft, and the ever changing mission environment.

None of these challenges have abated in 1983.

Now that the first half of 1983 is past, it is worthwhile to look at how we have done and compare that to last year.

Figure 1 is a comparison of last year's numbers with our experience so far this year.

Figure 1

	1983 Through June	1982 Through June	1982 Total
Total Class A's	33	45	78
No. Destroyed	31	44	78
Pilot Fatals	18	27	50
Total Fatals	38	89	131
Class A Rate*	1.9	2.6	2.33
Flying Hours	1,708,385	1,688,073	3,349,991

*Rate per 100,000 flying hours

In the first six months of 1983 we flew a little over 1.7 million hours and experienced 33 Class A mishaps. This is well ahead of the first six months of last year. To a large extent this very satisfying rate of 1.9 can be credited to the record-setting first quarter in which the Air Force went 53 days without a Class A mishap. The three quarters from July 1982 through March 1983 show a marked improvement in both number and rate of mishaps over previous quarters. The entire year — July 1982 through June 1983 — was below the previous level of 21 to 24 Class A's per quarter.

The Class A's can be further broken down by aircraft type. Here are the numbers and rates for the various types. The increases in

Figure 2

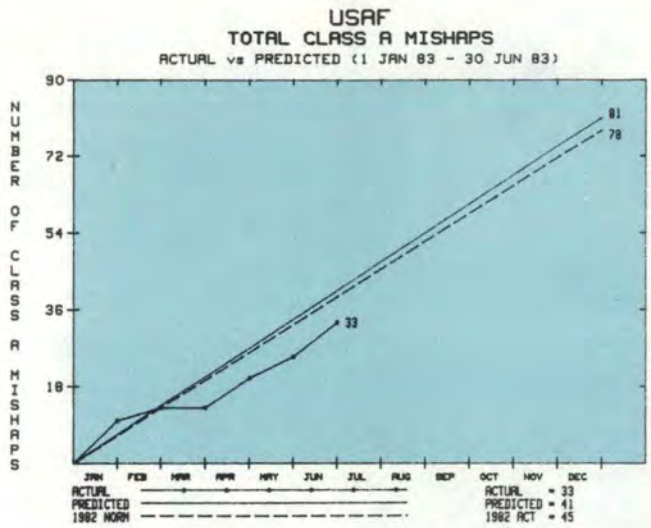
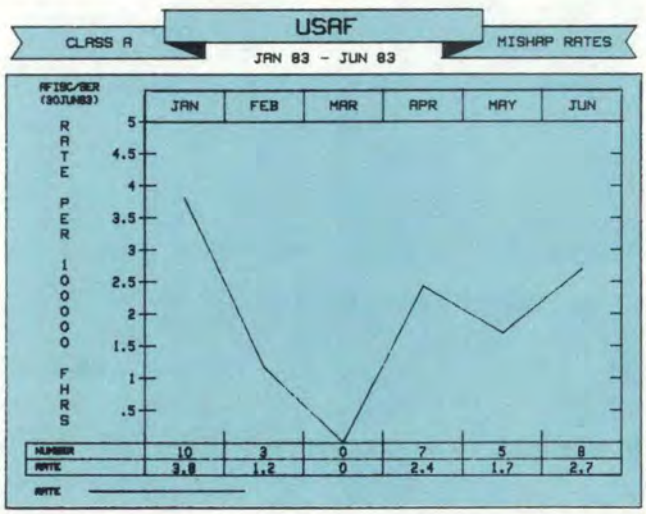


Figure 3



1983

Figure 4

	1983 Through June	1982 Through June	1982 Total
Fighter/attack	25/4.21	33/5.87	54/4.81
Bomber	2/3.19	0/0.0	2/1.44
Cargo	1/0.18	5/0.87	6/0.51
Trainer	5/1.28	3/0.78	8/1.07
Observation	0/0.0	1/2.67	3/4.23
Helicopter	0/0.0	3/6.78	5/5.81

Figure 5

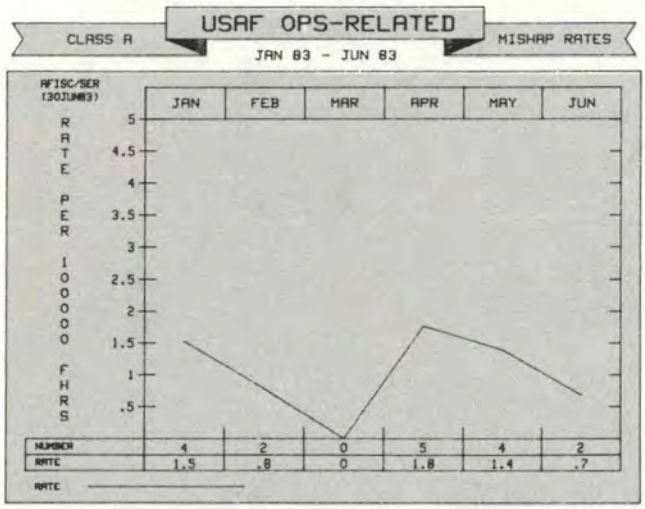
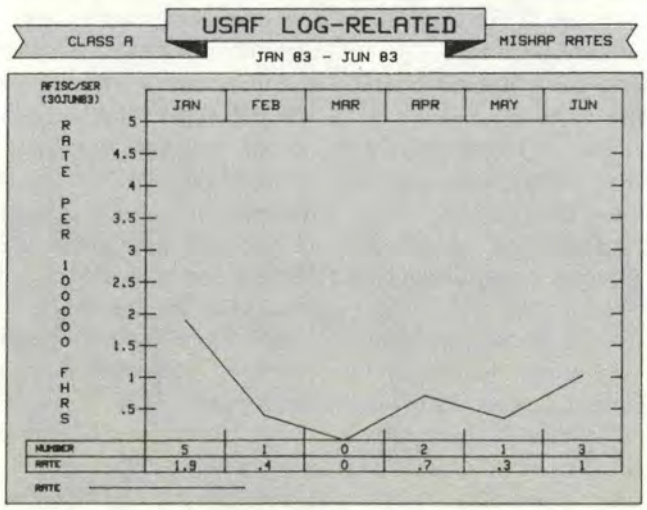


Figure 6



bomber and trainer rates were offset by reductions in all other categories.

The mix of operations and logistics related mishaps returned to the traditional balance of 55 - 60% operations and about 40% logistics after last year's reversal.

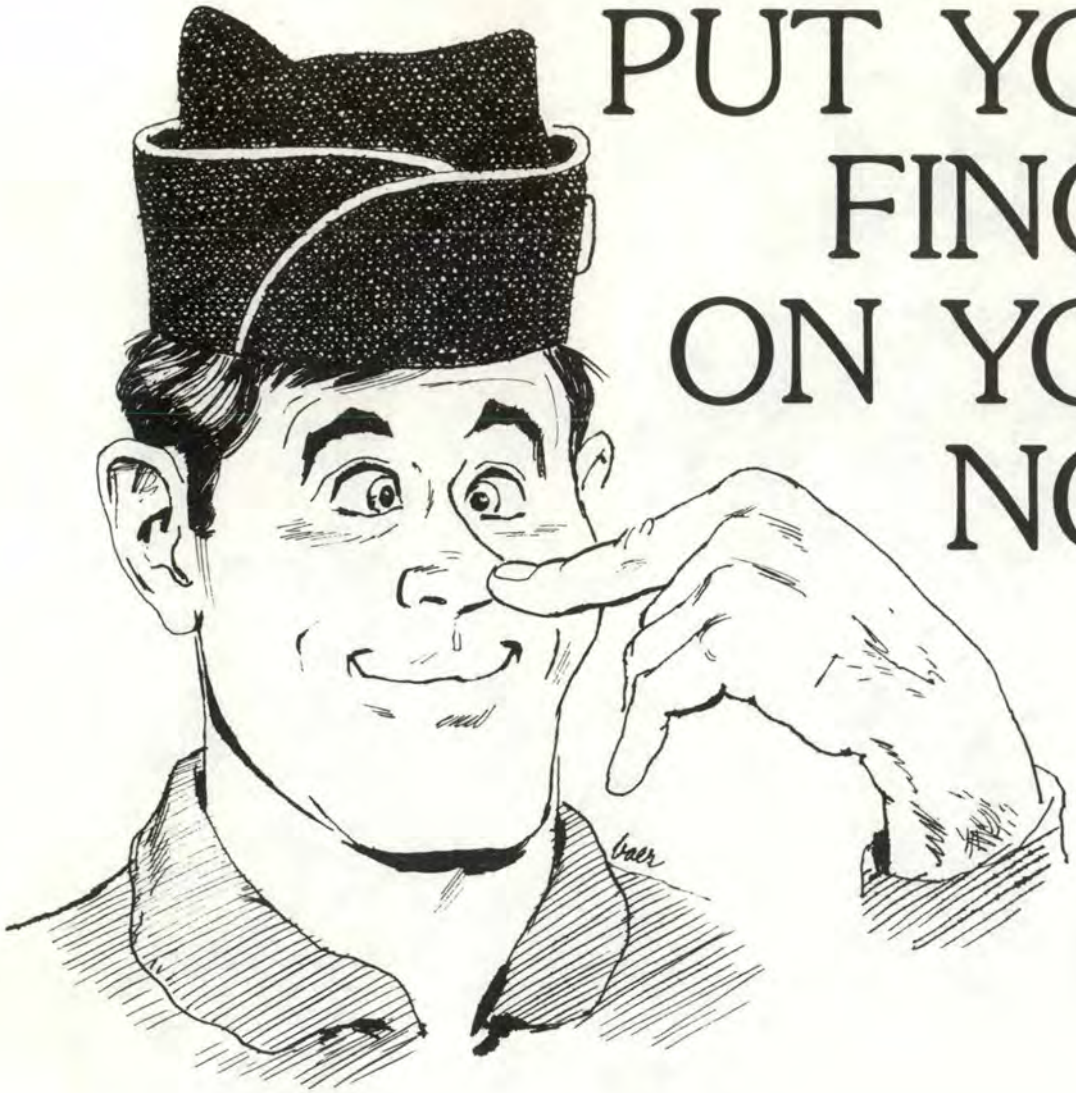
There were no real surprises in the categories of ops related mishaps. In eight mishaps, loss of control was a key factor. In two cases it appears that the pilot may have lost consciousness under Gs. Everyone who flies high performance fighters should be aware of the hazards of rapid onset of G forces.

There were two midairs in the first six months of 1983 and one instance of unauthorized maneuvering at low altitude. There were also four mishaps in which weather helped to get the pilot in trouble. In one case, the crew broke out of formation, became disoriented, and crashed. Three times crews tried to fly in IMC with degraded equipment or used VFR procedures.

Engines continued to be the biggest logistics related problem with half the mishaps engine related. Fires were also a problem — five mishaps involved actual fires. Flight controls accounted for two mishaps.

So far, 1983 has been a good year. At the end of June we had a rate of 1.9 Class A's. The challenge is to look at our successes in this period and capitalize on them. We can, with effort, continue to push the mishap rate down. We cannot afford to do otherwise. ■

PUT YOUR FINGER ON YOUR NOSE



LT COL GARY L. STUDDARD
Directorate of Aerospace Safety

■ In 1982, the Air Force experienced its lowest Class A mishap rate in history. While working my buns off for the last 4 years in the Safety Center, I'm proud to have been around when this feat was accomplished. Thankfully, 1983 is looking like a good (possibly better) year also. Being on the staff, one can appreciate the taskings which come down the pipeline when things are going bad.

"What are the present trends? How can we improve our rates? Let's take action to reverse this! Do a study to find why!" These are examples of some of the comments we safety people live with daily.

Fortunately, now that we are doing better, no one thus far has asked the question, "How come we are doing so good in our major aircraft mishaps?" I really thought the question would come when we went 53 days (another all-time record) this year without a Class A mishap. I doubt if I'd get the same answer twice if I asked all the project officers here at the Center. Well, if the boss asks me, I've had time to contemplate the hypothetical question, and I'm prepared. I have the answer already thought out. (This is opposed to the suggested answer of one of my co-workers. He has reportedly been spreading the word that the next guy

who jumps out of an airplane will trade places with him.)

My explanation is much more simple. Place your index finger on the bridge of your nose. You are now pointing toward the reason and the most important factor in the reduction of the Air Force's mishap rate to the lowest in history. So, congratulations! Take the other hand and pat yourself on the back. (Don't press your luck by trying to chew gum during all this pointing and slapping.) But, this is as it should be. Today's Air Force aviator is a mature, reliable individual who should be thoroughly capable — a real pro! And, we've come a long way in establishing this impression.

It hasn't been many years since the image of an aviator was one of an intrepid, scarf-in-the-wind individual who thrived on danger. He was measured by his valorous spirit and by his willingness to demonstrate a complete lack of fear. There was never a bridge with a span so small he could not fly under it, nor a target so tough he could not destroy it. Between his colleagues and him there was never a dare too large nor a wager too meager to gamble for.

To win a drink of bourbon, he would gamble with his life — many times he lost. But, even in death his hero image lived on. Ballads were written of his exploits, and toasts were made in esteemed remembrance. It made little difference whether his death resulted from an act of heroism or a vain attempt to prove the impossible. He was a member of an elite and forgiving group. His era has passed.

It's a strange heritage which decrees that we aircrews are courageous only when we disregard caution, established procedures, tested methods, or other rules which enhance safety and mission accomplishment. But each year, there are instances where our aviators ignore all the training and education which has been pumped into them and deliberately go beyond their own and their aircraft's limits. All of us can easily recall accidents where the pilot continued to press the engagement well past the established ROEs until finally he ran out of ideas, airspeed, and the airplane finally said, "I quit."

Or remember the one where the pilot flying a low level decided to go quite a bit lower than authorized and then did an aileron roll when he overflew a location where his friends were working? The show was spectacular as well as heartbreaking for the people on the ground.

As a group, we aviators feel we are capable of handling any maneuver at any altitude, or if we continue to press for just one more second, we can put the pipper smack dab in the middle of our opponent's helmet. The very nature of our profession requires this confidence, for without an aggressive outlook our combat capability would be seriously degraded. I've never been in a squadron yet (and hope I never am) which didn't feel that it had the very best of pilots — and heaven forbid someone admitting he might be the weak link in the chain. Aggressiveness, when directed toward mission accomplishment, is an essential trait in any Air Force officer, especially aircrews. However, the term aggressiveness cannot be condoned as rationalization for irresponsible conduct, failure to accept responsibility as a wingman or leader, or violations of regulations.

I am convinced the most important characteristic of military aviators is their attitude. It's true that a keen eye, a steady hand, a quick mind, and a reliable inner ear are essential. But, those are usually proven attributes by the time the silver wings are attached. The matter of attitude is much more difficult to detect or qualify and yet is the determining factor in every way by which an Air Force aviator is measured. Along with attitude comes acceptance of responsibility. The two go hand-in-hand.

The pilot is ultimately accountable for the conduct of the mission. Each time we pull back on the stick, we should carry the awareness of this responsibility foremost in our thoughts. Performing reckless, chance-taking maneuvers is definitely not characteristic of a responsible attitude.

So put your finger on your nose again, and maybe you, like me, will be convinced that the real business of safe flying is up to you and is in your hands — not in we safety types, higher headquarters weenies, or any other mythical "them" that inhabit the Air Force outside the squadrons. You are "where it's at" and in the best possible position to influence the safety record. So far for 1983, you're doing a fine job, but we still have many challenges ahead. How we do depends on the person at the end of your finger. ■

continued from page 12

captain acknowledged but persisted. It later developed that the captain had acquired a reputation among his peers for being obstinate and erratic. Some felt he had suicidal tendencies. The legs of the copilot had to be amputated.

The NTSB recommended to the FAA that "it establish a procedure to require air carrier management to establish and implement a system that would provide a method for continued assessment of the pilot-in-command's performance in executing management operational control responsibility."

The NTSB then observed that "The FAA is firm in their stand that adequate information is available and published, which, if implemented, will assure continual assessment of pilots' operations control responsibility."

Not every form of substandard performance should be attributed to cognitive incapacity. Adherence to discipline is also a vital factor.

■ In 1978, the captain of a jet air transport carrying 77 occupants and completing a precision approach in daylight visual flight conditions passed over the runway threshhold at more than 60 knots above reference speed. He landed nose wheel first at more than 40 knots above normal touchdown speed at a point almost halfway down the runway. A go-around was not attempted. The airplane was badly damaged after hitting a ditch. There was no fire, no fatalities. One passenger was seriously injured.

The copilot had failed to make the required callouts during the approach, nor had he alerted the captain about his deviation from correct practices. The NTSB could not determine the reason for the captain's lack of awareness of airspeed, vertical speed and performance on the approach, nor why the copilot failed in his duties. Was the copilot aware? Timid?

Physical and psychiatric examinations did not uncover adequate explanations for the captain's performance.

However, the report did not mention that the captain was concerned about his ailing wife, that he had tried to arrange his schedule so that he could be with her every night. He had recently expressed inordinate concern about an imminent check flight that would require him to be away from home for at least two days. It is not difficult to infer how such emotional distraction could lead to cognitive incapacitation.

The NTSB ended its report by reiterating a statement it had made in connection with the accident in which the apprehensive copilot lost his legs:

"The Safety Board is concerned with the first officer's failure to call the captain's attention to the excessive deviations from approach speeds and rates of descent and to take corrective action when he recognized that a dangerous situation was developing. The first officer's flight experience, and particularly his experience in the BAC 1-11, should have led him to more actively monitor the approach's progress and should have led him to recognize the need for immediate corrective action when he saw the aircraft's excessive speed during the approach. As the Board stated in a previous accident:

'The concept of command authority and its inviolate nature, except in the case of incapacitation, has become a tenet without exception. This has resulted in second-in-command pilots reacting diffidently in circumstances where they should perhaps be more affirmative. Rather than submitting passively to this concept, second-in-command pilots should be encouraged under certain circumstances to assume a duty and responsibility to affirmatively advise the pilot-in-command that the flight is being conducted in a careless or dangerous manner. Such affirmative advice could very well result in the pilot-in-command's reassessing his procedures.

'The regulations prescribe that the pilot-in-command, during flight time, is in command of the aircraft and is responsible for the safety of the passengers, crewmembers, cargo and airplane. In this regard, he has full control and authority in the operation of the aircraft.

'The second-in-command is an integral part of the operational control system in flight, a fail-safe factor, and as such has a share of the duty and responsibility to assure that the flight is operated safely. Therefore, the second-in-command should not passively condone an operation of the aircraft which in his opinion is dangerous or which might

compromise safety. He should affirmatively advise the captain whenever in his judgment safety of the flight is in jeopardy.' "

■ On February 9, 1982, a DC-8 on the glide path to a major airport suddenly started a steep descent 10 seconds from impact with the water of an adjoining bay.

The cockpit voice recorder reported warnings from the ground position warning system. The copilot pleaded, "Captain, stop it please." The captain and copilot survived; 25 passengers were killed.

The thrust levers for Numbers 2 and 3 engines were found in reverse-thrust position. The Number 4 engine power lever was in the idle position, the other was in full forward position; Number 2 fire shut off lever was in "agent discharge" position.

The captain, age 36, who had 6,098 hours and had been with the airline 13 years, did not recall any particulars of the accident sequence. He was seen in civilian clothes in a rescue boat but did not take part in the rescue effort.

Factors identified during the investigation seemed to describe a classic example of cognitive incapacity. Unknown to management, the captain had been under psychiatric care for a year prior to the accident.

■ On June 8, 1982, a B-727 approaching an airport during night VFR conditions was cleared to descend from FL 350 and to report passing FL 100. The airplane was not cleared below 5,000 feet but continued descent. Passing 3,800 feet and again at 2,300 feet, the copilot warned the captain, "There are hills ahead." The second warning was acknowledged by the captain with a "Rumph" — 128 passengers and nine crew were killed when the airplane struck a hill. Again, factors identified during the investigation seem to indicate cognitive incapacitation.

The (U.S. National Aeronautics and Space Administration) NASA/FAA Aviation Safety Reporting Service, Quarterly Report No. 13, September, 1981, page 11, relates several incapacitation incidents. The prelude states, "The problem of recognizing and responding to a serious performance failure is a difficult one. No professional pilot takes over control from another lightly, especially if the incapacitated pilot is in command of the airplane. Yet, there are clearly cases in which it is (the) necessary margin of safety." One of the ASRS reports by a copilot is a poignant and fitting conclusion to these cases of cognitive incapacitation.

The copilot had known the captain for 28 years. They had logged more than a thousand airline hours together. He regarded the captain as a fine human being. His confidence in him and his ability was "unshakeable." Several incidents, however, aroused concern.

On the trip described, the copilot observed several incidents where the captain committed serious breaches of flight discipline — all for unexplained reasons. For example, on one leg the captain, in response to an ATC request for a 180 turn for a delaying vector, rolled into a 60-degree bank and allowed the aircraft to develop a high sink rate.

On another leg, he failed to apply a known 10-degree drift correction despite advice from the copilot and course correction vectors from ATC.

In other instances he busted descent clearance limits and twice allowed the airspeed to decay to a point where the stick shaker was activated.

The copilot reluctantly reported the captain's unusual action to management. The captain was found to be suffering from a brain tumor.

continued

In every case, the pilot corrected before a mishap occurred, but only after conditions of flight grossly exceeded normal safe parameters. At no time did the copilot take over, but as he says: "Had I been flying with anyone else I certainly would have been a great deal more aggressive in demanding correction. But don't forget that this man had been my friend for 28 years . . . and confidence like that is hard to shake."

Here is a case where the copilot proposes taking control. The flight data recorder would probably have supported such an action. If the FDR had been routinely checked, as some European airlines do, the captain's aberrant flight behavior would have been discovered (earlier).

The examination of flight data recorders (FDRs) to uncover departures from good practice should be productive but done with great discretion and with the cooperation of the pilot group. No one likes to have management peer continually over one's shoulder.

In a successful operation, the data are scrutinized by a respected retired airline captain whom both management and the pilots trust. When he discovers less than acceptable performance, he deals with the captain or crew involved. If the discrepancies develop a pattern, he reports it to management, as it then becomes a system problem which may call for an improvement in flight training.

Another corrective measure is the establishment of pilot professional review committees to act confidentially on cases involving aberrent behavior. Pilots want to be accepted by their peers. Peer pressure is probably more effective than management pressure in securing obedience to good practices.

Ombudsman

In the case of psychiatric or emotional problems, the pilot unions of several airlines have committees to which a distressed pilot may appeal. This borders on the ombudsman concept. If the ombudsman arrangement is adopted, it should be carefully explained to the pilots and other employees, his duties clearly defined, his efforts periodically reviewed. It is important that he be kept clear of petty gripes. An airline is trying it.

Every organization of any size has a medical station with a nurse or doctor on duty. Employees who are ill or injured are encouraged to report there for treatment. A similar facility with a psychiatrist in attendance to treat employees with emotional problems probably should prove cost effective.

Crews of the East German airline Interflug are reported to undergo brief psychiatric review prior to their take off for the day's flights. This may be to discern any tendency to flee the country! Incidentally, the pilots of Aeroflot, the Russian airline, undergo a brief physical check before take off.

A U.S. Navy "Fact Sheet" for November-December 1982, published by the Naval Air Systems Command reports optimistically on the measurement of brain waves to assess and predict human performance. This research at the Navy Personnel Research and

Development Center (NPRDC), San Diego, included follow-up performance of "event-related brain potential" (ERP) records.

These ERPs are produced by sensory stimulation, rather than by the ongoing brain activity measured by encephalography (EEG). The NPRDC has found consistent relationships between ERPs and job performance. Incidentally, EEGs and brain scans would indicate brain tumors.

Two airlines in Europe have routinely applied EEGs on flight crews for research purposes. Dr. C.W. Sem-Jacobsen, of the EEG Research Institute of Norway, has produced several controversial but promising papers describing his affirmative research on the use of computers coupled with electrocardiograms (EKG) to ascertain operator alertness and responsiveness. He has worked with the Norwegian Air Force, oil platform divers and inspectors in the North Sea. He has developed a direct brain/computer communication system and claims "there is no question that this direct connection between the operator's brain and the computer will greatly improve the reliability of the data transferred between the system and the operator and greatly reduce the possibility of human errors. . . ." Pilots may resist this type of examination.

Simulator Practice

However, the most promising effort to reduce the danger potential of cognitive incapacitation is to practice for it in the simulator. This requires consent by the captain that the copilot may take command if he, the captain, does not respond to warnings, either by action or by adequate explanation of his conduct. It removes the stigma of mutiny because the captain has given prior consent for the copilot to take command.

There are indications that airlines are considering such simulated training, with the emphasis on assertiveness training. Several airline captains with whom I've discussed this favor the concept of transfer of command if they are cognitively disoriented. Aer Lingus, the Irish National Airline, "has developed specific criteria and instructions for the pilot not flying to take over the airplane regardless of relative cockpit rank . . . and suitable exercises are included in their recurrent training," according to a paper by Harry Orlady, who, incidentally, is now with ASRS. He believes that "Aer Lingus deserves a great deal of credit." And I agree. The criteria for transfer, of course, are all important.

It is doubtful whether the concept of copilot takeover in emergencies will be acceptable in certain cultures where respect for authority is of overriding societal importance. However, in one such accident, press reports indicate that the copilot attempted to take corrective action, but too late.

Conclusion

The records indicate that subtle pilot cognitive incapacity should be recognized as a major safety problem that calls for prompt industry-wide attention.

Further research is needed to devise a system to detect incipient cognitive incapacitation in time to prevent accidents.

The air transport industry should be very grateful to Captain Orlady, Dr. Harper, Dr. Kidera, of United Airlines, for recognizing the problem of incapacitation and for initiating corrective procedures. The emphasis, however, has been on physical incapacitation. The problem of cognitive incapacitation is often elusive and, therefore, more organizationally sensitive to and inhibited by traditions of command. Acceptable suggestions that could improve on these corrective measures would be welcome.

— Adapted from Flight Safety Foundation Inc., Accident Prevention Bulletins. ■

CARE PROGRAM

A rash of recent coronary incidents involving relatively young officer and enlisted personnel, has caused us to do some serious reviewing and presenting to local staff members. We didn't develop the CARE program and we're not self-appointed experts, but it seemed that some of the answers researched would be of interest to readers of *Flying Safety.*

Coronary Artery Risk Evaluation

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■ In September 1981, the research and development phase for the HEART program was completed. Under the guidance of Colonel Rufus M. DeHart and Lieutenant Colonel Charles K. Maffet, of the USAF School of Aerospace Medicine, the CARE program evolved. An earlier study had reported that "risk factors" are associated with heart disease. The CARE Program has been established to identify members of the USAF with increased risk, and provide information that will motivate them to reduce the risk on their own behalf!

A practitioner-patient oriented program has thus augmented the Air Force physical examination system, and presently active aircrew personnel have had at least one CARE assessment as a part of either a complete or alternate year physical examination.

What Are the Symptoms That Could Forewarn an Aircrew Member of an Imminent Heart Attack?

The changes that occur in coronary vessels are gradual, and the relationship between physical narrowing and symptoms produced are quite variable. Early symptom recognition is important because a full blown heart attack causes permanent modification of the heart muscle.

Angina pectoris is a medical term used to describe chest pain resulting from oxygen deficiency in the heart. The symptoms of angina include tightness, heaviness, or pressure, in the chest. The pain may radiate into the neck, arms, back, jaws or teeth. Among those who are prone to this condition, heart attack with or sometimes without pain, is often associated with exercise, emotion, cold or hot exposure, reduced oxygen availability (as with altitude or environmental contamination) or after eating a large meal.

Aircrew members should always report *any pain* or untoward symptom to their associates. Also, when flying on a waiver for a condition with prescribed medication, they should always have the medication with them.

Because hyperacidity and esophageal reflux (heartburn) sometimes present similar symptoms, aircrew members should be especially careful to consume light, easily digestible meals before they fly or drive long distances on the highways.

How Serious Is the Problem?

Heart disease affects more than 700,000 Americans each year! About one-third of all deaths result from coronary artery disease. Almost all older people have some impairment of the coronary artery circulation. One out of ten males will develop symptoms of heart disease around the ages of 40 or 50. In over half, the first symptom will be a heart attack, and 50 percent of these men will not survive.

The American Medical Association reports that an average of 47 people die each year aboard scheduled domestic commercial aircraft.

Heart disease is the leading non-accidental cause of death in the Air Force. The Air Force has about 30,000 rated crew members (20,000 pilots) who are medically qualified for flying. Statistically, up to 20 percent of pilots presently in the force could have a significant degree of coronary atherosclerosis. There have been eight mishaps (1969-1983) where the possible cause was attributed to heart attack. Coronary heart disease (CHD) rightfully has a high priority for preventive medicine efforts.

We're Flyers! Tell Us How to Reduce Our CARE Index Before Our Next Physical (without a lot of statistical or laboratory jargon).

Each year try to become a bit more determined to take care of what you have left — call it hygiene, health practices, wellness fever, or here's a new one "*biological deterrence."

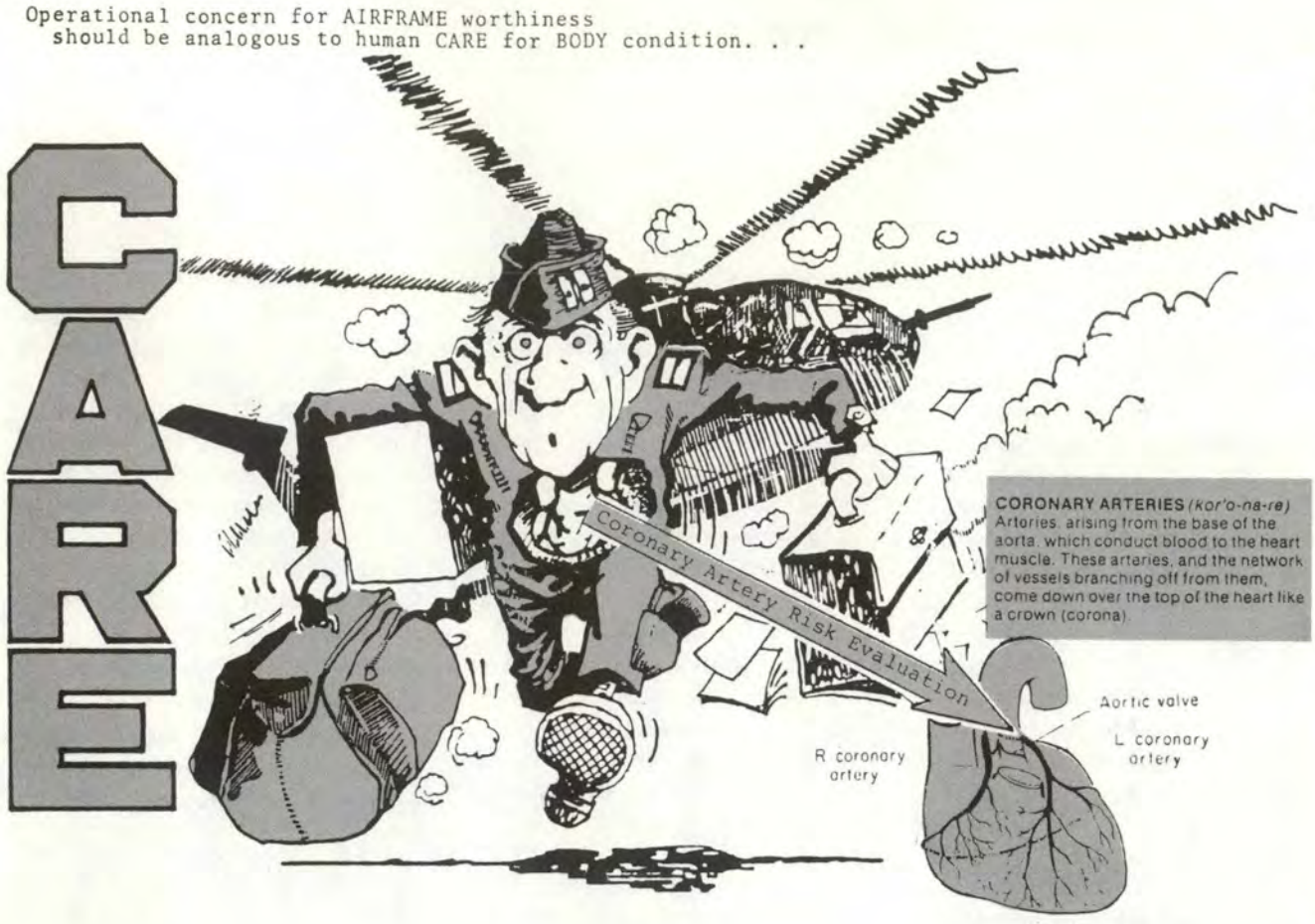
Man or woman — grow for it! While women are statistically less likely to have a heart attack before menopause, they still suffer one out of every seven heart attacks. Recently, an all female Air Force crew flew a trans-Atlantic C-141 mission. Increasingly, women will be in operationally stressful crew positions. Our first lady astronaut recently completed her first orbit mission. Currently, research shows that working women have blood characteristics more like men than housewives.

Within the CARE program, age and sex are unchangeable factors. On the other hand, certain risky practices affect all humans young or old, man or woman.

If your aircraft fills with smoke

*The average human wellness or vitality of an operational force as *complementary* to the technology and equipment it manages.

continued



CARE PROGRAM

continued

you do something about it — correct? If you smoke (anything), stop. Select a method of quitting that fits your personality. A year ago Fidel Castro vowed, in the presence of other people, to stop smoking. Show the world you have more guts than Fidel. Stop smoking in the presence of yourself. Complete withdrawal provides a 50 percent coronary artery risk reduction within two years!

If your resting blood pressure is over 140/90, you have hypertension. It is very important to keep your blood pressure at near normal levels, i.e., 120/80. If you noticed high fuel line pressure in an aircraft you would want to determine the cause and correct it. You don't have to become an anorexia nervosa stick or a marathon runner, but normal weight and moderate daily exercise will help. F-16 drivers and other

high performance flyers should combine about 30 minutes of variable exercise with weight lifting for CARE concern and increased G tolerance. A one-on-one talk about exercise with the local flight surgeon never hurts.

If you have a medication for lowering your blood pressure, make a point never to leave your quarters without it — and especially when you're going to be at altitude.

Of course, diet and salt intake are important factors.

Watch the fat in your diet. There are lots of ways to prepare delicious meals without frying everything. Select lean meats and learn which places offer salad bars and fresh fruits. Avoid foods high in cholesterol. A saturated fat diet increases blood cholesterol by 15 to 25 percent. You would not want an overly rich fuel supply for your aircraft engines — in practice, you're sure to get exactly the right fuel servicing. You can be just as selective in the way you eat.

How can we stay within weight standards without suffering?

MEN		WOMEN	
Height (inches)	Weight	Height (inches)	Weight
60	153	58	126
61	155	59	128
62	158	60	130
63	160	61	132
64	164	62	134
65	169	63	136
66	174	64	139
67	179	65	144
68	184	66	148
69	189	67	152
70	194	68	156
71	199	69	161
72	205	70	165
73	211	71	169
74	218	72	174
75	224	73	179
76	230	74	185
77	236	75	190
78	242	76	196
79	248	77	201
80	254	78	206
		79	211
		80	216

Chronic stress also raises blood cholesterol. Here are a few simple ways to reduce flight line stress (more valuable perhaps if you lean toward type "A" behavior); no wheels to pick you up? Consider walking. Also, bikes are great for office hopping, without so many parking problems. About one-third to three-fourths of the energy used each day by the normal active person goes into muscular activity. Sitting at a desk, or in the cockpit (or in front of the TV), can cause energy to "pile up."

Would you cargo haulers fly an overloaded aircraft? Of course not! Get serious about body overload. Find a diet that enables you to slowly reduce your weight.

Obesity by itself is not heavily correlated with an elevated serum cholesterol or increased incidence of CHD. However, it intensifies the danger of hypertension and diabetes.

Perhaps the most common psychogenic factor contributing to obesity is the prevalent idea (often initiated by overly solicitous parents) that healthy eating habits include three square meals a day, and that each meal must be filling.

When more energy enters the body than is expended, body weight increases. While the scientific community has identified psychogenic, hypothalamic, genetic, and childhood overfeedings as possible individual or interacting causes of obesity, treatment basically amounts to decreasing food input below translated energy expenditure. A word of caution, however: whether the individual diets, increases exercise, or changes eating habits, it is important to prevent essential protein, vitamin, and mineral deficiencies during these periods.

Also, take it easy on the alcoholic sauce; it is high in calories. There's an increasingly important, new twelve-hour rule (it's not official, but it makes good sense). If you have anything alcoholic to drink don't fly, or drive for twelve hours.

Finally, in the flying safety realm, alcohol or drug abuse to the point where you have a hangover can be considered equivalent to bad aircraft electrical problems which result in erroneous electrical signals to instruments in onboard computers, or the autopilot. Diet, weight control, substance abuse avoidance, and physical conditioning on a regular basis, are equivalent to fine tuning the performance capabilities of your engines and the avionics equipment carried onboard modern aircraft.

The CARE program is a once-a-year evaluation of your individual coronary artery risk compared to the desired optimum for your age. Perhaps to be equivalent to a program of preventive maintenance for your aircraft, the CARE program could be more extensive and more often, but it is a very important first step. It is an evaluation of the physiologic functioning of your body and the way you are treating it. The program can be contrasted with the physical examination by a flight surgeon, which is an evaluation for pathology before it becomes symptomatic or clinically evident.

Both the physical examination and the CARE program can be compared to scheduled maintenance or preventive maintenance for evaluation of aircraft defects. Your best procedure is to begin a program of risk reduction, before symptoms develop. Charity begins on base. Send yourself a CARE package before your next physical! ■

WHAT NOW T-39?

SQN LDR MARK A. LEWIS, RAAF
Directorate of Aerospace Safety

Photo Courtesy of Capt. Steve Behr

■ The recent safety record of the T-39 has been excellent. The last Class A flight mishap occurred in October 1979. This safety record reflects the dedicated efforts and professionalism of the T-39's maintenance crews and aircrews.

However, most of the T-39 fleet is probably going to be replaced. The Air Force is currently pursuing a lease/buy contract for T-39 replacement aircraft for a turbo jet/turbo prop mixture as yet undetermined. The details should be made public in September or October of 1983. The exact replacement schedule will be announced after it is finalized, but the first of the new aircraft should appear in FY 84. Because of this replacement aircraft, our safety record is in danger of being blemished. We are entering a potentially hazardous phase in the operating history of the T-39 — the replacement phase.

Why is this phase of operations potentially hazardous? The T-39 first joined the inventory 23 years ago. Its original safe life was 11,250 hours. Compare this with average airframe hours of 17,858 and the high time airframe of 21,508 in January 1983, and the first problem area is obvious. The aircraft systems are approaching twice their designed life of type.

How are the electrical components, flight instruments, engine components, and all of the other systems absorbing these extra flying hours? A review of 1982 Class C and HAP data reveals that the rate of occurrence of incidents in most areas is increasing steadily although not alarmingly.

For example, the fleet had 27 in-flight engine failures in 1981 and 38 in 1982. This is not perfect by any means, but in 1982 we flew around 80,000 hours for those 38 shutdowns. A variety of individual component failures caused these shutdowns. This lack of recurrence is encouraging. Many components need to be replaced — over 150 in the landing gear system alone. Since many of these will not be replaced, our flying will become more hazardous. Let's look at some of the reasons for not replacing these components.

Spares and replacement components are difficult to obtain for funding reasons but also because many of the original components are no longer being produced. Once replacement components have been identified, there is the problem of long lead times for procurement. Lead times in excess of 12 months are common.

Even if procurement were initiated today the T-39 will be out of service, or nearly so, before some spares and components will be available. There will probably be little money to spend on the T-39 from now until it is taken out of service. This will not apply to aircraft which are not going to be replaced. Expensive safety modifications are no longer cost effective because the aircraft would be retired soon after installation of the modification. If a modification program has not already begun, it is not likely to begin at all. Modifications you have been looking forward to are just not going to be made. For example, we are unlikely to see a standby attitude indicator fitted as a fleet-wide modification.

Despite these problems, it is up to you to continue working within the excellent standards which have given this aircraft its enviable safety record. Now is the time to ensure that your knowledge of aircraft systems is at its peak. If you need help in achieving your mission, ask for it.

Let's work together to keep our people and our aircraft safe through the difficult times ahead. We can do that and still complete the mission — with your help. ■

☆U.S. GOVERNMENT PRINTING OFFICE: 1983 — 683-026/10

UNITED STATES AIR FORCE

Well Done Award

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

FIRST LIEUTENANT

Gary D. Peppers

9th Tactical Fighter Squadron
Holloman Air Force Base, New Mexico

■ On 14 September 1982, Lieutenant Peppers was flying an F-15A on an Air Combat Training sortie. While separating from the first engagement, Lieutenant Peppers began having serious flight control problems, and at 20,000 feet, his aircraft began a nose down, uncommanded, rapid roll to the left. Lieutenant Peppers put in full right aileron and full right rudder but the aircraft continued in a left roll. Each time the aircraft rolled through wings level flight, Lieutenant Peppers attempted to break the descent. After seven consecutive rolls and a loss of over 6,000 feet, he successfully got the nose of the aircraft above the horizon, reduced airspeed, and slowed the roll rate. At 180 KIAS, he regained marginal control, declared an emergency with the controlling agency, and turned back towards Holloman AFB. The leading edge of Lieutenant Peppers' left horizontal stabilator was full down, and he determined that 180 KIAS was the maximum controllable airspeed after several more uncommanded left descending rolls. Lieutenant Peppers reviewed all applicable checklist items and set up for a controllability check. As the landing gear was lowered, the aircraft again began several uncontrollable left rolls. Lieutenant Peppers retracted the gear and regained control. He increased airspeed slightly, relowered the gear, attempted another controllability check, and was able to maintain control at 160 KIAS. He then began a long, straight-in approach for an approach end cable engagement. On short final Lieutenant Peppers was forced to execute a go-around when the aircraft again began to roll left with full right controls. He accelerated to 170 KIAS, and regained adequate control. After confirming the narrow 170-180 KIAS controllable range, it was determined that the best option was a straight-in approach to the opposite runway. The landing was accomplished, and the approach end cable was successfully engaged at 160 KIAS. Postflight investigation revealed that the stabilator mechanical input shaft had broken, causing the stabilator to drive to the full leading edge down position. The superior airmanship of Lieutenant Peppers saved a valuable aircraft and prevented possible loss of life. WELL DONE! ■

GOT A PROBLEM?

As Soon As You Land . . .

WRITE IT UP