
THE COMBAT EDGE
FEBRUARY 1993
Bailey '93

# THE COMBAT EDGE

Air Combat Command Safety Magazine



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ACC SP 127-1 VOLUME 1 ISSUE 9

**ABOUT THE COVER**

One important element of Air Combat Command's Global Power for America is America's ICBM Force. The men and women who operate, maintain, guard and support big missiles have an ironclad contract with the American people to carry out their enormous responsibilities with absolute safety.

# ACCent on Safety

In this issue we conclude our series of articles from the Numbered Air Force (NAF) commanders with an article from Lieutenant General Jameson on safety from the perspective of the ICBM Force. Our sincere thanks and appreciation to each of the commanders for their excellent support and willingness to contribute to improving our ACC culture of safety. Each of these outstanding leaders, by offering their unique views concerning safety and its role in the ACC mission, has enhanced our understanding of why and how safety is a pillar of combat capability. We firmly believe that the key to safety's viability and effectiveness as a force multiplier and capability enhancer is commander involvement. This is true at all levels -- from first level supervisors to the Commander of ACC. When commanders and supervisors "walk the talk" of safety, we have a vibrant, thriving culture rather than an adjunctive program requiring constant attention.

In the future, we will attempt to bring you more articles along the lines of this series. Our leaders are committed to the ACC culture of safety because they are dedicated to the mission and care about their people. If our NAF commanders can make the time and put forth the effort to write articles, how can the rest of us say we don't have the time? Let us hear from you. We all need to "walk the talk."

We've hinted at it before. February is here and with it -- the bad weather. As a matter of fact this month tends to bring some world-class bad weather with it. Now is the time to put into practice all of the appropriate bad weather techniques and procedures that you've just been thinking about up to this point. Don't let the gloomy, overcast days, dark skies, snow, rain and sleet get you down. The good news -- spring will soon be here.

Speaking of inclement weather, this time of year provides an excellent time for daydreaming about warmer, sunnier places and times. That's great, but don't do it while you're working, driving or engaged in any other activity requiring your concentration and undivided attention. Don't endanger yourself or others due to a lack of attention and concentration.


The holidays are long past, and we've all settled back into our normal routines. We made a big push for safe holidays and our first few days back on the job. Last month our emphasis was on preventing problems due to a lack of proficiency. Now the winter doldrums provide the potential for complacency to take over. Don't let it! Be aware of what's going on around you and stay focused on your job. Being aware is the key to defeating complacency.

**Colonel Bodie R. Bodenheim**
**Chief of Safety**

# SPOTLIGHT ON BIG MISSILES

**One important element of Air Combat Command's Global Power for America is America's ICBM Force. The men and women who operate, maintain, guard and support big missiles have an ironclad contract with the American people to carry out their enormous responsibilities with absolute safety.**

*Lieutenant General Dirk Jameson*
*Commander, 20 AF*
*Vandenberg AFB CA*

Missileers have tremendous respect for our comrades who fly and are always impressed with the challenges and hazards of flying. It's probably fair to say that some *Combat Edge* readers don't have a good feel for the complexities, pitfalls and, yes, danger that our missile folks deal with in living up to their contract. One-hundred ton silo doors, 90-foot drop-offs, high-energy propellants, and nuclear weapons combine to demand clear thinking, absolute focus, and great teamwork. Cut a corner and you're dead! I recently learned that a young troop was installing spacer pads in a missile-loaded silo without safing the deadly articulating arms that hold a Minuteman missile in place until launch. These arms work with blinding speed and will impale a corner-cutting technician. Close call? You bet! Ignore it? No way!


What did we do? We aired the dirty linen -- cross talked the close call to all missile units and redoubled efforts to educate and train. The same procedure claimed a life a few years ago -- that was one life too many, and it was preventable. Every day missile troops face the serious potential for danger in the field. They don't have to look for it -- it's there waiting.

Every day missile troops face the serious potential for danger in the field. They don't have to look for it -- it's there waiting.

What compounds the safety challenge for missileers is the remote, rural areas that could be called our "runways" -- the missile fields. Missile wings are spread out, covering up to 23,000 square miles -- that's three times the size of Massachusetts! Just getting safely to and from work sites means an average of over five million miles driven per wing each year. The weather adds to the challenge of operating and maintaining a sophisticated weapon system at an isolated industrial site. Missile people conquer mother nature and get the job done by following rich lessons learned and strict rules.

As a long-time misileer and commander, I have learned to pay close attention to the "rules," to "close calls" and to "lessons learned." Cross talk, education and rigorous training of all three gives our people the best chance to do their very tough jobs safely. My reading of the flying-oriented articles in *Combat Edge* tells me the same applies in the cockpit.

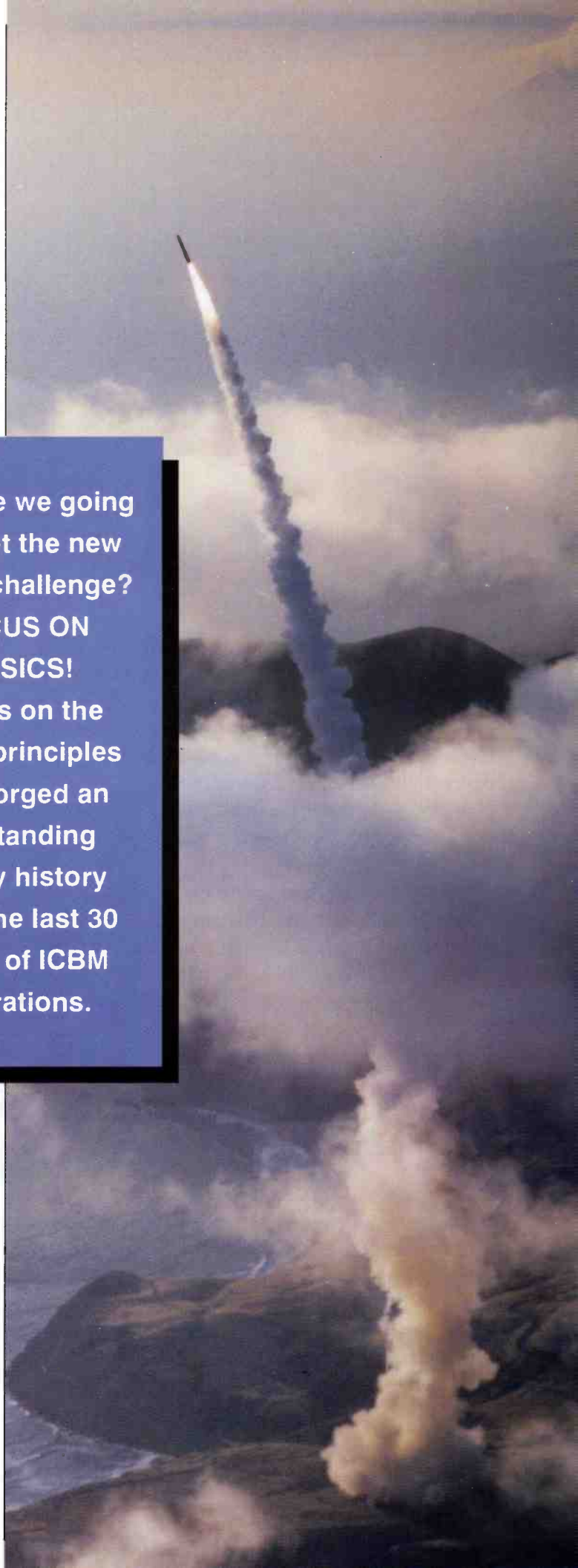
This is a very busy time for ACC's ICBM Team. Deactivation and conversion are major activities that are driving unprecedented levels of activity in our missile wings. In the coming years, we will pull all 450 Minuteman II missiles from their launch sites after returning the nuclear reentry systems by secure convoy. At Malmstrom AFB, 150 launch facilities are being converted to replace the Minuteman II missiles with Minuteman III missiles. Of course, pulling missiles is not new to us, but the pace is faster than ever before. Furthermore, at deactivated sites, dealing with extremely hazardous materials is a daily task as sites are prepared for destruction. At the same time, Minuteman life-extension programs are under way to keep the remaining systems viable well into the next century. We're refurbishing launch sites and control centers

through extensive depot-level repair, replacing potentially dangerous lithium batteries and replacing explosive rocket propellants aboard our Minuteman boosters. From a safety perspective, this all boils down to unblinking focus.

How are we going to meet the new safety challenge? FOCUS ON BASICS! Focus on the same principles that forged an outstanding safety history over the last 30 years of ICBM operations. Missileers have a long-standing reputation for being professionals with a tradition of attention to detail, careful preparation, checklist discipline and strict adherence to technical data and regulations. These principles served us well over the years as more than 25,000 crew members pulled 1.5 million alerts, over 30,000 maintainers kept the alert rate over 97 percent and over 72,000 security police kept a vigil watch over the nation's most powerful nuclear weapons. These basic principles, now more than ever, need to guide our actions over the years ahead.

**How are we going to meet the new safety challenge? FOCUS ON BASICS! Focus on the same principles that forged an outstanding safety history over the last 30 years of ICBM operations.**

I would love to show every person in ACC the exquisite teamwork and complex procedures that move a huge missile from depot to alert -- young professionals who know how to deal, with blizzards and black ice, with a squadron of 50 ICBMs, with a single mach 21 test launch, with standard procedures or with the totally unexpected. I'm sure your overwhelming impression would be one of competence, focus, and assured mission accomplishment. In short, you would be impressed and proud of the way the ICBM Team provides Global Power for America. ■



# ACColades

QUESTIONS OR COMMENTS CONCERNING DATA ON THIS PAGE SHOULD BE ADDRESSED TO HQ ACC/SEA, DSN: 574-3814

| | TOTAL | | | ACC | | | ANG | | | AFR | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DEC | THRU DEC | | DEC | THRU DEC | | DEC | THRU DEC | | DEC | THRU DEC | |
| | | FY93 | FY92 | | FY93 | FY92 | | FY93 | FY92 | | FY93 | FY92 |
| CLASS A MISHAPS | 2 | 6 | 8 | 0 | 3 | 3 | 1 | 2 | 4 | 1 | 1 | 1 |
| AIRCREW FATALITIES | 1 | 5 | 7 | 0 | 4 | 1 | 1 | 1 | 4 | 0 | 0 | 2 |
| * IN THE ENVELOPE EJECTIONS | 1/0 | 4/0 | 3/1 | 0/0 | 2/0 | 2/0 | 0/0 | 1/0 | 1/1 | 1/0 | 1/0 | 0/0 |
| * OUT OF ENVELOPE EJECTIONS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

* (SUCCESSFUL/UNSUCCESSFUL)

# CLASS A MISHAP COMPARISON RATE

(CUMULATIVE RATE BASED ON ACCIDENTS PER 100,000 HOURS FLYING)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ACC | FY 92 | 3.4 | 1.9 | 2.0 | 2.5 | 2.0 | 2.0 | 2.0 | 2.3 | 2.5 | 2.4 | 2.6 | 2.5 |
| | FY 93 | 2.0 | 3.1 | 2.1 | | | | | | | | | |
| 1 AF | FY 92 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | FY 93 | 0 | 0 | 0 | | | | | | | | | |
| 2 AF | FY 92 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | * | 29.1 | 16.4 | 11.2 | 7.8 |
| | FY 93 | 0 | 0 | 0 | | | | | | | | | |
| 8 AF | FY 92 | 0 | 0 | 0 | 0 | 0 | 8.9 | 7.6 | 6.6 | 7.9 | 5.8 | 4.4 | 5.2 |
| | FY 93 | 0 | 11.6 | 4.5 | | | | | | | | | |
| 9 AF | FY 92 | 4.4 | 2.4 | 3.4 | 2.6 | 2.1 | 1.7 | 2.2 | 2.6 | 2.4 | 2.7 | 2.4 | 2.0 |
| | FY 93 | 5.2 | 5.5 | 4.1 | | | | | | | | | |
| 12 AF | FY 92 | 0 | 0 | 0 | 1.5 | 1.3 | 1.0 | .9 | .8 | 1.4 | 1.3 | 1.8 | 2.1 |
| | FY 93 | 0 | 0 | 0 | | | | | | | | | |
| ANG | FY 92 | 0 | 6.7 | 6.3 | 8.8 | 7.1 | 6.6 | 5.6 | 5.5 | 4.9 | 4.9 | 4.9 | 4.9 |
| | FY 93 | 0 | 2.2 | 2.9 | | | | | | | | | |
| AFR | FY 92 | 0 | 10.9 | 7.7 | 5.7 | 4.7 | 3.9 | 6.7 | 8.7 | 7.8 | 7.0 | 8.4 | 7.7 |
| | FY 93 | 0 | 0 | 6.8 | | | | | | | | | |
| TOTAL | FY 92 | 2.3 | 3.7 | 3.5 | 4.3 | 3.5 | 3.3 | 3.3 | 3.6 | 3.5 | 3.4 | 3.6 | 3.4 |
| | FY 93 | 1.3 | 2.6 | 2.6 | | | | | | | | | |
| MONTH | | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |

* (HOURS NOT AVAILABLE)

*Lt Col James D. Teigen*
*HQ ACC/SEF*
*Langley AFB VA*

# Attacking The Human Side of The Mishap Equation

Over the years, safety, operations and maintenance professionals have poured over the wreckage of mishaps and because of their investigations and recommendations, aircraft designs and mechanical systems have been vastly improved. The improvement has been a continuing process and still isn't over; however, through investments in reliability, maintainability and safety, our vast improvements of the past have already affected mishap rates about as much as possible. We've seen the rates drop from 71 mishaps per 100,000 flying hours to the recent 1.66 per 100,000 flying hours (Fig 1).

**USAF AIRCRAFT ACCIDENT RATE**

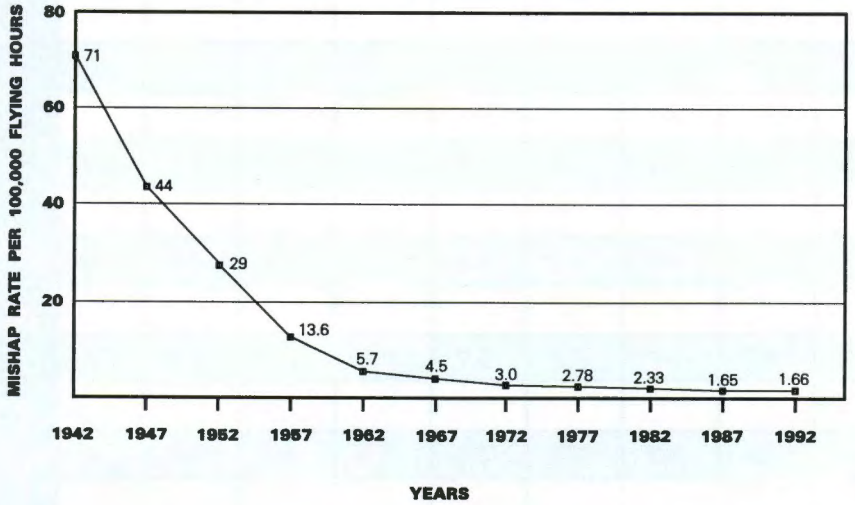



Figure 1

To substantially reduce the mishap rates further and reap the same magnitude of change as we achieved through hardware changes, we now must look inward at the "hidden causes." These hidden causes are human causes -- the side of the equation we sometimes gloss over. The aviators and maintainers out there know of whom I speak. It's always the other person that caused the mishap; "I would never do anything like that." Family Circus, the cartoon feature, always draws the ghost pictures of little ones responsible for actions as "Not Me, etc." Well, now the Air Force and especially Air Combat Command have undertaken the initiative to work on, or rather attack, the human side of the mishap equation. That's what this article is all about, the first steps taken to formulate, create and sustain efforts to solve the Human Factors (HF) causes; the why's, the who's and the how's of the human side of the mishap equation. Human Factors impact both the fighter and multi-place communities. Judgment and decision-making, airmanship and discipline issues continue to challenge us all.

In the fighter world one of the leading concerns is spatial disorientation (SD). There are three types: unrecognized, recognized and recoverable and lastly the recognized but unrecoverable. The first type of SD - unrecognized, is task saturation, inattention, channelization,

misorientation or misprioritization. These forms of SD are the true killers and have killed several of our fellow aviators since the formation of ACC. You aviators know about the recognizable and recoverable type of SD; it's the leans, coriolis effect, those insidious traps to instrument flight that if not guarded against can and have led to mishaps. They are taught in Introduction to Fighter Fundamentals (IFF) and at the altitude chamber. The last type of SD is recognized but unrecoverable, mainly due to the magnitude or severity of sensation. So what does that leave us with? The first type of SD, the unrecognized disorientation, is the real killer that must be our target.

The history of HF caused mishaps is included in figures 2-4. Pretty impressive statistics/charts, aren't they? It makes you wonder what took the Air Force so long to target HF causes and first type SD caused mishaps. Possibilities are that sometimes the aviators are too proud, too macho, too stubborn or whatever, to attack the problem; but now it is time for action. ACC and its two MAJCOM predecessors (TAC and SAC) knew of the importance of HF causes and the need to target and fix the problems. Now that ACC has formed and the initiatives are folding together, let's look at the HF safety program. The ACC Human Factors Safety program is a multifaceted approach to getting our arms around this group of hidden causes. ACC is presently utilizing numerous methods/initiatives to focus on the broad range of HF causes. The ACC programs include: Aircrew Attention Awareness Management Program (AAAMP); Cockpit Resource Management (CRM); Video Notams; Realistic Training Review Board; Flight Safety/ Supervisory Conferences and total Commander involvement. Let's look at each and how it relates to the whole HF safety program.

AAAMP got its start back in February 1990 when a need for formal cockpit attention and task management training was identified to Air Force Systems Command by USAFE. Within months, Tactical Air Command was tasked as the OPR; and the AAAMP program was developed and fielded.

It is a three tier approach encompassing IFF, formal training units (FTU) and continuation training. The basic tenants of the three include a common approach for all types of aircraft, use of a building block approach and the judicious use of professional instruction remembering that it must be mission specific. The instruction includes: decision and judgement, attention failure modes, concepts of airmanship, time management, aircrew personalities and the process of human attention. The basic courses have been fielded and are in place as you read this. This is not a stagnant process or a "still life" type of program. Since its value is only improved as it evolves, it requires constant upgrade. Making this process work also requires complete supervisor involvement. Training for specific modules is being developed, like one for LANTIRN, etc. Supervisor and continuation programs are to be completed this quarter. With the fighter/attack program reviewed, let's move into the realm of the multi-place aircraft and its setup.

The multi-place aircraft program has gone by many names before, but it's called Cockpit Resource Management (CRM) in ACC. HF caused mishaps are just as prevalent in multi-place aircraft, and the statistics prove it, (see Fig. 5). HF caused mishaps run about 70% in multi-place aircraft whether it's commercial statistics or KC/RC/EC-135 or B-52 data. A strong CRM type program has borne fruit for many organizations inside and outside the military over the years; HF caused mishaps

**HUMAN FACTOR CAUSE FACTORS**

TAF CLASS A CAUSE FACTORS FY85 - FY92

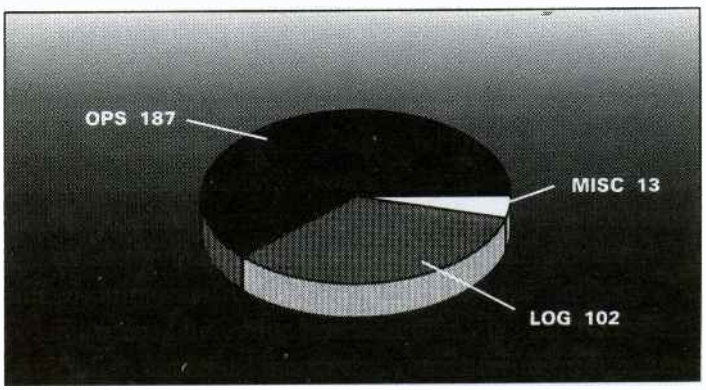



Figure 2

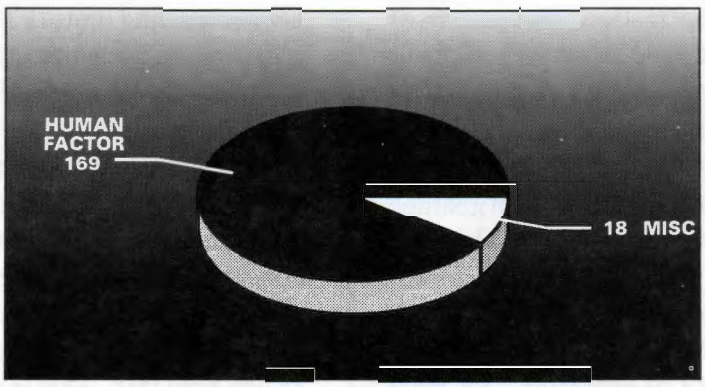



Figure 3

have decreased anywhere from 28 to 81 percent from a non-CRM to a CRM culture.

The ACC CRM program traces its roots back to 1989 when Hernandez Engineering, Inc., was contracted for and developed the CRM program for the B-1, B-52, KC-10, KC/EC/RC-135 and E-4 aircrews. The focus of instruction is on the crew through a non-attribution program. No evaluation of crew performance is accomplished and there is no pass-fail criteria. The thrust of the curriculum is on increasing mission effectiveness through the application of CRM principles. The CRM course tries to change behavior patterns and attitudes of crewmembers. It accomplishes this by focusing on crew communications, behavior styles, stress management, situational awareness and mission management. There are 3 phases of the initial program: prework on a computer, a CRM practice and feedback workshop and a reinforcement training session in a simulator. There is a CRM staff course available for approximately 20 senior staff attendees, which has been taught 32 times and has included staffs at numbered air forces. This basically covers the hands- on aviator programs. Now, let's look at the special side programs designed to work the HF mishap cause problems.

One idea that keeps the focus on the problem is the ACC Video Notam program. It's managed by the ACC/DO and encompasses many different approaches to the HF causal problem. Video Notams have focused on Human Factors and mishap causes numerous times. It is an excellent opportunity for each and every aircrew member to see and hear the command leadership and gain a common perspective of the views or comments of the ACC leadership. The Video Notam program also provides lessons learned from mishaps. Future Video Notams will focus more on the big concerns of judgment, decision making, airmanship and discipline.

Another program which addresses the HF cause/effect and the needed solutions is the ACC Realistic Training Review Board. This may be the key element, the "golden BB," the foundation of the ACC HF safety program. For those of you that are not familiar with it, it was formed at the direction of COMACC. It has been charged with reviewing the entire spectrum of training in ACC. The beauty of this system is that it gathers together experts to look at the training program from many different perspectives. The Realistic Training Review Board meets semi-annually at Langley with representatives from the entire command. The board reviews not only the current training program, the one you are training with today, but also looks ahead to the future and the planned requirements for the next training period. It reviews the Designated Operational Capability (DOC) statements for each unit and ensures we're all headed in the same direction. The IG team develops appropriate scenarios tied to unit DOC statements. Probably the most important aspect of the Realistic Training Review Board is that it really is the final "sanity check" for the way we train because if our training doesn't match up with how we'll employ our forces in conflict, then disconnects can result in more losses as aviators try to comply with the orders and requests.

The ACC Flight Safety conference was held last September at Langley. The thrust of the conference was Human Factor mishaps in ACC, what the trends were and the recent efforts were to reduce HF mishaps in ACC. We brought together experts from the Air Force in Life Sciences, Air Force Safety Human Factor experts and field level expertise to work the tough issues. We sought field level inputs to solve or reduce HF mishaps in ACC. Several

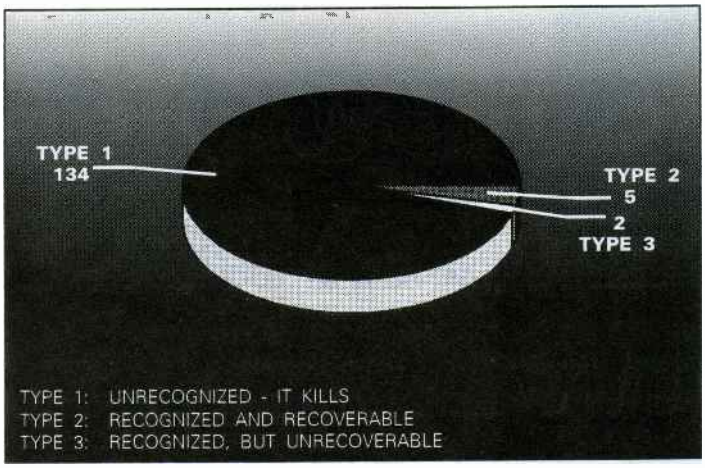



Figure 4

initiatives were adopted with the most notable being field level inputs on the LANTIRN and its display which are being worked now. The focus of the conference was so successful we are proposing in Jun 93 to host an expanded ACC safety conference of flight, ground and weapons field experts to come to Langley and work HF safety issues in their respective specialties. The reduction of HF caused mishaps is not a flight only problem; it is pervasive across our entire spectrum of all disciplines. Together, we can all make a difference. We also take each and every opportunity to brief all supervisory and leadership conferences on the Human Factor trends in the command and how they are the vital link in the process. They must become aware and involved in reducing the HF caused mishaps and the adverse trends associated with command controlled mishaps.

The final, and certainly not the least important aspect of the ACC HF safety program, is complete and total commander involvement. It has to start at the top, and it has. As I was about to speak at the world wide HF safety conference in October 1992, the speaker before me was concluding on how responsive Air Force Material Command was to the other commands' needs. The briefer flipped up 2 viewgraphs on requests for human factor initiatives that had been requested through General Loh on behalf of Air Combat Command. Each and every line item related to a specific mishap recommendation or evolved from a mishap or problem in the cockpit for his aircrews. The briefer said that COMACC obviously had the big picture and knew that HF causes must be targeted; he only hoped that the other commands would follow our lead. Improvements in cockpit design, cockpit layout, aircrew equipment, switchology and future technology were the basis of the changes; and ACC was on the fast track. It made my briefing so much easier, especially when an unsolicited testimonial is given by someone else, it shows how the commander is totally involved.

I hope through this article you have come to understand that the ACC Human Factors safety program is a multifaceted approach which attempts to get our arms around this group of hidden causes, the Human Factor causes. ACC presently utilizes numerous programs/initiatives to focus on the broad range of HF causes. The ACC programs include: Aircrew Attention Awareness Management Program (AAAMP); Cockpit Resource Management (CRM); Video Notams; Realistic Training Review Board; Flight Safety/Supervisory Conferences and total Commander involvement. Remember, together we can attack the human side of the mishap equation and drop our mishaps rates further! ■

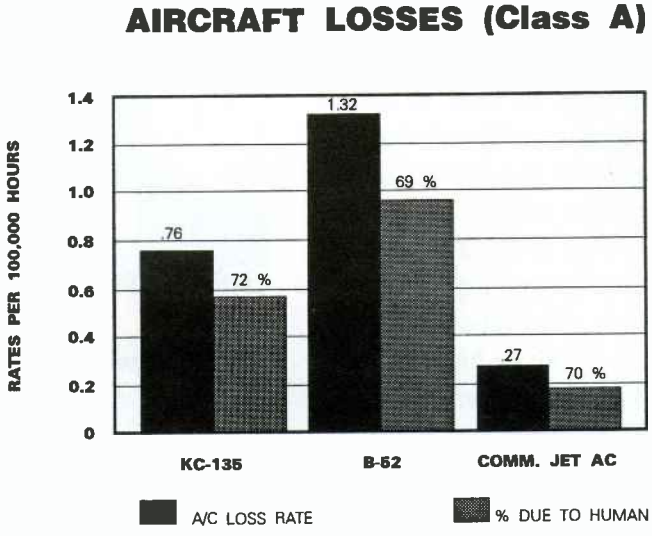
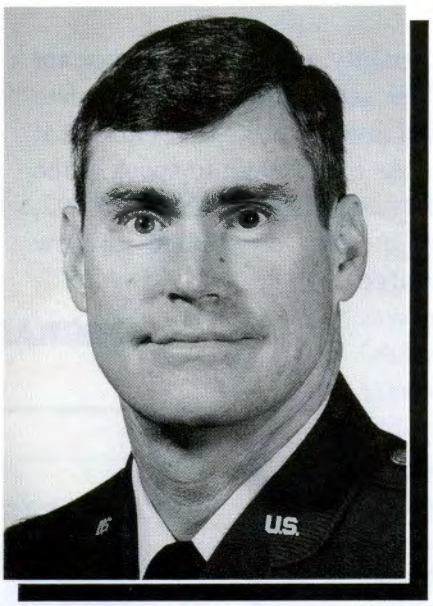



Figure 5

# Pilot Safety Award of Distinction

Lt Col Woodward was the flight lead of a two-ship of F-16s on a Surface Attack Tactics sortie. He performed a single-ship afterburner takeoff. Immediately after becoming airborne, he heard several loud bangs and felt the aircraft beginning to decelerate. Instinctively, he snapped the throttle to military power and noted the RPM rolling back to 85% - a setting that would not maintain level flight with the aircraft's heavyweight configuration. Lt Col Woodward expertly lowered the nose to maintain minimum flying speed while descending through 300 feet AGL. He quickly jettisoned his external stores and selected EEC-off. With the aircraft still in a descent, he prepared to go to BUC in a final attempt to restore thrust when he saw the RPM beginning to increase back to military power. He was now able to begin a shallow climb after bottoming out at 100 feet AGL. Lt Col Woodward continued the climb to high key and declared an emergency. Approaching high key, he accomplished all applicable checklist items, coordinated with the SOF for an immediate landing, and flew a flawless flameout pattern and landing. Lt Col Woodward's timely actions and exceptional flying skills prevented the possible loss of life and saved a valuable aircraft.



*Lt Col Ronald D. Woodward*
*314 FS, 58 FW*
*Luke AFB AZ*

# Aircrew Safety Award of Distinction

About 50 minutes into an emergency procedure training sortie in their UH-1N, the crew began practice autorotations. Capt Brown performed the first straight ahead autorotation and all aircraft systems operated normally. The next straight ahead autorotation was performed by Capt Scritchfield. He entered the maneuver from 500 feet by rolling both throttles to the flight idle position. At approximately 250 feet above ground level, descending at 2000 feet per minute, the number two engine speed (Nf), and rotor RPM (Nr) began climbing rapidly. SSgt Dill alerted the crew of the rapidly rising engine and rotor RPM. This uncommanded increase in rotor RPM caused a violent 30 degree left yaw. Capt Brown reacted quickly by taking the controls and increasing the collective to control the rotor speed. He then increased the number one throttle to full open, while directing the crew to shut down the number two engine. Converting to single-engine operation allowed the crew to arrest the descent rate at approximately 30 feet above ground level. At this point, the aircraft was in a favorable position for Capt Brown to perform a minimum power, single-engine, slide landing. Prior to touchdown, SSgt Dill notified Air Traffic Control of the emergency situation and the crew's intentions. After landing, the crew performed an emergency shutdown. Quick analysis and timely reaction allowed the crew to turn an otherwise critical emergency into a controlled landing with no injuries or damage to the aircraft.

***Capt Matthew S. Brown II***
***Capt Ken Scritchfield***
***SSgt Jeff Dill***
***72 HS, 1 FW***
***Langley AFB VA***

# ICBM Crew Safety Award of Distinction

During an alert at Launch Control facility Charlie-01, the squadron command post, Capt Bojo and 2Lt Johnson were monitoring a pneudraulics maintenance team performing a removal and replacement of a V-3 valve on shock isolator number three. The launch control center (LCC) floor was already supported with lifting jacks in preparation for the maintenance. The assistant team chief was directly performing the maintenance task on the V-3 valve and the team chief was standing near shock isolator number three. Lt Johnson and Capt Bojo were at their respective consoles observing the maintenance procedure. Suddenly, there was a cracking sound and the LCC floor collapsed at shock isolator number three. As the assistant team chief quickly jumped away from the shock isolator, Capt Bojo grabbed him and pulled him away from the falling capsule floor, saving him from being crushed between the isolator and an equipment rack. The assistant team chief had several scratches and bruises on his head, hands, and arm. Judging that injuries did not require immediate medical attention, they inspected all equipment racks and power sources to determine if normal cooling air was still available and if any overheat or fire condition had occurred. Initial damage assessment revealed the capsule floor was listing at a 30 degree angle that extended to the LCC tunnel junction. In addition, the pistons on shock isolator number two and three were noticeably bent. They notified the other four squadron LCCs and ensured all appropriate agencies were informed of the incident. In addition, they determined their emergency war order (EWO) capability was severely impaired and proceeded to transfer their timeslot and performed LCC emergency shutdown to help the squadron maintain optimum nuclear surety and status monitoring of their 10 ICBMs. They also ensured all EWO and mission critical communications responsibilities were properly realigned. Within two hours of the incident, a maintenance investigation team was dispatched by helicopter to Charlie-01 and the injured assistant team chief was evacuated to the base hospital for treatment. This mishap investigation revealed the lifting jack under shock isolator number three had failed, causing one side of the LCC floor to drop violently. The heroic alert actions and superb leadership of Capt Bojo and Lt Johnson, in response to this mishap, averted loss of life or serious injuries to an Air Force member and attest to their exceptional proficiency and professionalism as a missile combat crew.

*Capt Rainier R. Bojo*
*2Lt Marcus Johnson*
*740 MS, 91 MW*
*Minot AFB ND*

# Crew Chief Excellence Award

Following a local employment exercise during weekend duty on Saturday, November 21, 1992, SSgt Kavanagh was helping another crew chief with his preflight. The temperature was around freezing with a wind chill of about 15 degrees Fahrenheit. Using his experience as an F-15C crew chief at other bases, SSgt Kavanagh found several finger seals in the augmentor liner that looked like they had heat damage. SSgt Kavanagh promptly notified squadron supervision and the aircraft was removed from the flying schedule. After engine tear down, further heat damage and a failed balance segment were found underneath the augmentor liner. The visible damage when the engine was installed was negligible and could have been easily overlooked by anyone doing a preflight by the work cards. It wasn't until the augmentor liner was removed that it was evident that if the aircraft had flown another sortie it would have almost assuredly suffered a catastrophic augmentor burn-through jeopardizing the aircraft and pilot. SSgt Kavanagh's expertise and attention to detail were instrumental in preventing an Air Force mishap.

***SSgt Dennis J. Kavanagh***
***390 FS, 366 WG***
***Mt Home AFB ID***

*AIFC Staff*
*Castle AFB CA*

# Standardized Approach Callouts

The following is an updated version of our article that first appeared in the October 1990 *Combat Crew.* The Air Force reorganization has significantly changed our cockpit experience level. Landing in weather conditions at minimums has always been one of the most dangerous procedures aviators perform. This article focuses on crew coordination during the instrument approach. The procedures that follow are being used by all AMC and ACC units here at Castle.

## INSTRUMENT APPROACH PROCEDURES

Aircrews frequently fly instrument approaches in adverse weather conditions. While tech orders contain basic guidance for crew coordination during the approach and landing phase, this article suggests additional aircrew procedures for all instrument approaches, regardless of weather conditions.

Clear communication is an important principle of crew coordination. To safely complete instrument approaches and landings, aircrews must use standard terminology to communicate precise meaning and intent. Concise callouts inform the entire crew of altitude, aircraft performance and visual information as it becomes available.

During an instrument approach, aircrews are concerned with at least three categories of infor-

mation: altitude, aircraft performance (heading, course, KIAS, VVI, etc.) and visual information. Each category, as it relates to aircrew procedures, will be discussed.

ALTITUDE -- Two callouts should be made in addition to the mandatory tech order callouts.

1. The other crewmember's acknowledgement of descent to DH/MDA will include groundspeed and drift information.

2. At 100 HAT (as read on any barometric or radar altimeter), the pilot not flying the aircraft will announce "100 feet" and the pilot flying the aircraft will state his intentions. If the approach is not stabilized at this point, if the aircraft is not in a position to land safely or if the pilot flying the aircraft cannot see the visual aimpoint on the runway, a go-around will be initiated.

AIRCRAFT PERFORMANCE -- These callouts inform the pilot flying the aircraft (and the entire crew) of aircraft performance from FAF/GS intercept to touchdown. At anytime during the approach, if aircraft performance exceeds the criteria listed, the pilot not flying the aircraft or other crewmembers must bring the deviations to the attention of the pilot flying the aircraft. The pilot flying the aircraft will acknowledge performance callouts.

## PERFORMANCE DEVIATION CRITERIA

1. Airspeed: -5/+10 knots.
2. Course: +/- one half dot.
3. Glidepath: +/- one half dot (ILS only).
4. Altitude: (Non-precision) +100/-50 feet from FAF, any intermediate level-off point and MDA.
5. Descent rate: +/- 300 fpm from briefed descent rate prior to DH/MDA.
6. Groundspeed: +/- 15 knots from original call at FAF/GS intercept.
7. Drift: +/- 5 degrees from original call at FAF/GS intercept.

NOTE: On PAR approaches, glidepath and course deviation calls may be deleted. On ASR approaches, course deviation calls may be deleted.

VISUAL INFORMATION -- The pilot not flying the aircraft will inform the pilot flying the aircraft of all sightings of the runway environment. Be as specific as possible (i.e., "strobes, 11 o'clock," "approach lights, 12 o'clock"). This information helps the pilot decide whether or not to descend below DH or continue a non-precision approach. The runway environment is defined as one or more of the following: approach light system, threshold markings/lights, runway end identifier lights, visual descent path indicator lights (VASI, PAPI, PLASI, etc.), touchdown zone markings/lights, runway/markings/lights.

Visual acquisition of these cues allows the pilot flying the aircraft to continue the approach while seeking sufficient visual references to actually land the aircraft. Make these callouts as soon as sightings are made.

Use the term "visual" when enough lateral and vertical guidance is available to safely land the aircraft. Before a "visual" call can be made, the pilot must see the visual aimpoint on the runway and have enough other cues for a good perspective of the runway.

On a precision approach, when the RVR is 2400, it is likely that the runway threshold will not be in sight at decision height; however, elements of the runway environment should be in view which may allow continuing the approach below decision height.

On a non-precision approach, do not depart the MDA until the runway aimpoint is in sight and a normal glidepath to a landing can be accomplished.

ANTICIPATING SOME QUESTIONS -- We've tried to anticipate some of the questions most likely to be surfaced.

**Why add more callouts? Isn't current guidance on approach callouts enough?**

No, it isn't. Our tech orders direct that "Each crewmember will be constantly on the alert and should notify the responsible crewmember of

any deviation or discrepancy which affects successful accomplishment of the mission." Experienced pilots routinely brief their crews on what speed or altitude deviations they are expected to call out. But some pilots do not solicit the help of their crews, which leaves two or three trained aviators out of the loop.

Stating those performance deviations which require a callout and response will ensure the pilot flying is definitely advised of significant deviations. We expect it will eliminate those situations in which a less than confident copilot or nav says nothing because he is uncertain how it will be received by the pilot. One of the primary emphases in UPT is building a sense of self-sufficiency, but some pilots never develop the ability to take constructive input in high task situations that can help them do their jobs better.

The idea that "I'm the pilot, leave me alone" or "If I weren't good enough, I wouldn't be the pilot" is misplaced in our cockpits. Standardized callouts are a part of responsible crew behavior in practically every civilian and military flying organization **we** know. We looked at approach procedures from AMC, ACC, PAN AM, American Airlines, United Airlines and Scandinavian Airlines System. These procedures are a good minimum for operating to 2400 RVR.

**What do you mean this is more than a callout package? All I need is more direction!**

Well, you got it! There are a couple of items that are new. They are: if you cannot see your aimpoint on the runway (the fixed distance markers) at 100 feet above the touchdown zone elevation **YOU MUST GO AROUND!**

**What's the big deal about 100 feet HAT?**

An inexperienced or fixated pilot, searching for outside references, or locked on to an inappropriate instrument, could fly the aircraft into the ground because the crew trusted his judgment to continue the approach. The 100 foot call ensures coordination of intent or requires action.

From the time you pass through the DH you're in a nebulous world of composite flight. You may not be flying totally out the window because the cues aren't good enough. Crew coordination must be precise here. If you're doing the flying, you must depend on the gauges with crosschecks outside for the info you crave but don't have yet. How long are you going to wait? The 100 foot point is good for three reasons.

First, a CAT I ILS is certified for use down to approximately 100 feet above the threshold height. Second, if the pilot can't see his visual aimpoint at 100 feet, slant range visibility is **less** than 1,900 feet. In fog at 100 feet that would indicate, at least on the section of the runway in front of you, the visibility is well below 2400 RVR. Finally, pilot reaction time and engine spool-up time will cause the aircraft to descend below the go-around altitude.

**Aren't we talking about a second "decision height"?**

Not exactly. Nothing in this procedure changes the meaning of decision height found in the AIM, FLIP, or AFM 51-37. Those sources say the decision height is the point where a decision is made to "continue the approach or go-around" depending on whether we have visual reference with the runway environment. We're simply saying that below decision height, the crew is constantly making decisions based on cue availability. By 100 feet, you must see the aimpoint, have good visual cues - especially for vertical guidance - and have the aircraft in a position to land safely. If those things are not set, go around.

Experts in aviation training say that at least 300 to 500 feet of runway must be visible for the most talented and proficient pilot to manually land an aircraft. Considering the reduced amount of flying we do and the number of

times we face serious weather, we can see the necessity to have the touchdown aimpoint in sight at 100 feet.

These procedures specifically define the runway environment. AFM 51-37 provides a general definition. We've taken what the FAR's call "runway environment" and made it the definition for our crews as well.

These procedures also forbid crews from departing the MDA on a non-precision approach if the runway aimpoint is not in sight. Departing the MDA with only the approach lights in sight is dangerous because it leaves you without a means to measure your descent angle.

**You're right. There are a lot of new ideas here. In defining "visual" you say the pilot has to have "...enough cues to have a good perspective of the runway." What's that mean? "...enough cues" "...good perspective"?**

Good Question! What's "good" or "enough" for me may not be for somebody else. Most important, I think, is getting the vertical cues down, which means using your sense of perspective of the runway - how the edges converge in the mist or fog, how bright the paint job looks, where the aimpoint is in the windscreen - so you can say, "in my experience this looks about right." Experience is a big key.

Some things we can mandate, like don't go below 100 feet without your aimpoint in sight; some we can only talk about. Your "Wing King" pays all you aircraft commanders that big AC bonus each month for your experience and good judgment. He assumes you have decent technical skills.

I bet you pay more attention to your copilot's landings than you do your own. Yours are probably "automatic." When the co flies, you're making mental measurements all the way down final. Start concentrating now on how the runway tilts or how the paint job looks. (How wide is the paint job? Does it vary from runway to runway?) Are you sitting up high enough to get the optimum downward vision angle? B-52 pilots are notorious for sitting too far down to really see well.

Go ahead, try it. Use the simulator and practice what **we** are using at Castle. Iron out your crew coordination. We have put over 1300 students through AIFC's low visibility training in the simulator and two trends occur routinely. One, pilots tend to "go visual" before they can fly visually. Two, their aircraft control goes down the tubes when they go visual. It's not that the weather is necessarily so bad, but they start flying outside too soon and lose the nice stable approach that at least got them down to the lights.

We think these procedures will keep all our crewmembers involved in the flying of instrument approaches, because now they have specific responsibilities. There will be no more, "should I say anything?" worries. Do it. It's your job and it could be your life.

If you want more info or have questions give us a call. (DSN 347-4571) Till next time.

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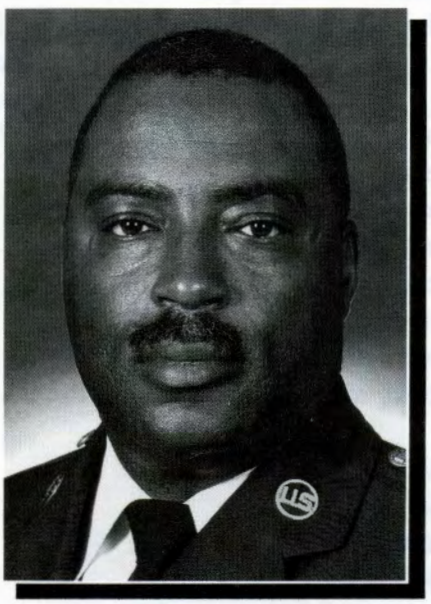
# Flightline Safety Award of Distinction

After compliance with applicable safety directives, SSgt Mackey proceeded with an egress system maintenance task on an F-16D aircraft. A short time later, he became nauseous from what seemed to be JP-4 fumes. SSgt Mackey halted the egress system maintenance and conducted a closer inspection of the entire aircraft. He discovered a small puddle of fuel underneath the aircraft centerline fuel tank. SSgt Mackey alerted the line expediter who immediately called for a fuel system specialist. After troubleshooting, the fuel system specialist confirmed a definite fuel leak and found the whole gun bay area of the aircraft was saturated with fuel. Both the senior fuel system specialist and the quality assurance weapons inspector confirmed this was a very dangerous condition. Had this condition gone undetected, it would have definitely posed a serious flight safety condition. An electrical spark from the gun assembly or any of several pieces of avionics equipment would have triggered a chain of events which could have lead to total aircraft destruction. This event, no doubt, could have threatened the lives of the aircrew. Specific actions by SSgt Mackey ensured the avoidance of such a tragedy. Going one step further, SSgt Mackey exemplified the true meaning of aircraft systems professional.



***SSgt Jackie R. Mackey***
***347 CRS, 347 FW***
***Moody AFB GA***

# Ground Safety Individual Award of Distinction

As Sgt Brent Landrus was operating a multi-vacuum sweeper on the airfield, he had to wait for several aircraft to taxi by so he could continue sweeping. While waiting, he noticed an unknown object on the taxiway. After the aircraft had passed, he went to pick up the object. In doing so, he noticed the object was hot to the touch and he immediately notified Airfield Operations. The taxiing aircraft were stopped prior to takeoff and an investigation started. Subsequently, it was found that the object was a fan blade from the number two engine of one of the aircraft. It was also found that additional blades were on the verge of breaking off. This aircraft was to be the lead plane of the group. Had they actually taken off, the potential for engine failure in the lead aircraft was very high. Additionally, the lead aircraft could have caused foreign object damage to the trailing aircraft on takeoff. As a direct result of Sgt Landrus' alertness, quick thinking, and safety conscious attitude, a tremendous loss of money, equipment, and possible loss of life were prevented.

***Sgt Brent A. Landrus***
***27 CES, 27 FW***
***Cannon AFB NM***

# Weapons Safety Award of Distinction

There I was delivering munitions on the flight line during a local exercise called NOMAD HOP 93-1. I observed another munitions delivery driver in a bobtail vehicle, towing two munitions trailers in tandem. As the bobtail drove by me, I noticed the M-9 trailer adapters holding AIM-9 missiles on the second trailer hanging down on one side of the trailer. I quickly flagged down the driver of the vehicle to stop. I immediately enacted my emergency action checklist, which includes notifying ammo dispatch. I inspected the M-9 trailer adapters and discovered them to be severely cracked, with two live tactical AIM-7 missiles. I instructed the driver of the bobtail to remain with the trailer, while I returned to the munitions storage area for another trailer to cross load the missiles on to. Upon returning to the flight line, we cross loaded the missiles to another trailer. These actions prevented a potential explosive accident without damage to the missiles, aircraft, equipment, or personnel. This incident has led to an inspection of all welds on M-9 trailer adapters in the munitions storage area, and an initiative to strengthen the M-9 adapters with a threaded metal rod, replacing the four bolts.

***Amn Tracy W. Price***
***33 MS, 33 FW***
***Eglin AFB FL***

# Unit Safety Award of Distinction


The 325th Communications Squadron, comprised of 176 military and 37 civilian personnel, had the overall highest safety ratings in the 325th Support Group during its annual inspection. Consecutive "Excellent" ratings on Annual Safety Inspections, conducted by the 325th Fighter Wing Office of Safety, attest to the emphasis the squadron places on safety with the spectacular result of zero mishaps in FY92. Commander, supervisor and safety personnel involvement is apparent throughout the squadron and evidenced by a constantly improving safety environment. The Commander, Safety Officer and Safety NCO provide safety briefings at all monthly commander's calls. The briefings include past mishaps, squadron safety goals and current safety statistics. Everyone in the unit is kept informed and involved. In addition, the squadron conducts quarterly Safety and Health Council meetings, though not required by regulation. This ensures all safety monitors, element commanders and the commander know the complete status of all safety programs as well as providing a forum to discuss safety concerns. The unit safety office has outlined specific safety responsibilities and duties in the squadron OI for the commander, ground safety officer/NCO, section safety monitors, radiation protection monitors, supervisors and workers alike. Everyone knows what is required. Several innovative safety approaches have resulted in mishap reduction and increased safety awareness throughout the unit. The squadron has a "Safety-Birthday Policy" letter, in which squadron members submit a safety topic or story, and in return, they get their birthday off. The topics are then distributed throughout the squadron providing safety information to the entire unit. To ensure dormitory residents are not forgotten, the safety officer goes with the First Sergeant and performs a room inspection on all squadron personnel. This ensures dorm residents apply safety rules and regulations to their room, and at the same time, protects government property. Good communications throughout the unit and between the 325th Communications Squadron and the 325th Fighter Wing have resulted in the 325th CS being awarded the ACC Unit Safety Award of Distinction.


***325 Communications Sq***
***325 FW***
***Tyndall AFB FL***

# Driving Values Shouldn't Change With Time

Have you ever heard or used the words "It happened in a flash" when describing a mishap? Only 2 percent of all mishaps happen in a flash. The other 98 percent of the mishaps are the result of a series of events occuring over several months. To demonstrate the validity of my claim, let's examine the operation of motor vehicles.

Most motor vehicle mishaps are the result of 2 factors, complacency and overconfidence. When drivers first obtain their licenses, they obey all the traffic rules. Speed is at or below the posted limit, turn signals and visual checks are religiously used, and following distances are observed. After about 6 months, vehicle operators become familiar with the task of driving. You could even say the "fear" of driving is replaced with the confidence of youth. Operators begin to push the speed limit, initially edging 2 or 3 miles per hour over the posted limit. Following distances are reduced because the driver knows he/she can stop in time, and turn signals and visual checks are normally replaced with an arm around a date and a look at the cassette tapes on the dashboard. After about 1 year behind the wheel, new drivers are enamored in the belief that they can handle any driving situation. The squeal of rubber becomes common for starts and stops, and speed is only relative to whether or not the driver is late for work, school, or a date. This is the time that the driver begins to swerve in and out of traffic for the optimum position, and avoidance of a fender bender can be measured in layers of paint. If you think I'm describing how your first year of driving developed, you're not alone.

After a new driver has been behind the wheel for a year or so, other changes start to occur, the first of which is getting to a destination without remembering going through an intersection or around a specific turn during the drive. This is because the driver is now so familiar with the task of driving that he places his attention on "more pressing matters." The second change is how often the oil, tires, and other equipment on the vehicle get checked, mostly due to the increased confidence in the driver's ability to handle the chariot. Finally, and quite often the last big change, the new driver starts to show off. It is very important to a new driver to earn the respect and admiration that comes from showing peers just how well one can handle their automobile.

At about the 2-year point of vehicle operation, most drivers grow out of the show off stage. Unfortunately, the other changes in driver attitudes don't revert to the original safe driving practices. Speeds remain high, and following distances remain close. That is until the day that the car in front of them stops and the fender bender occurs. Yes, the car stopped in a flash. But, had the driver not become complacent over the past 6 months or more, stopping distances would most likely have been adequate to avoid a collision. So as I first stated, "Mishaps DON'T happen in a flash" - think about it.

*MSgt James K. Kivell*
*HQ ACC/SEG*
*Langley AFB VA*


Fleagle
HEY, KNOW WHERE I CAN GET SUM VALENTINES CHEAP?
SILO POLISH
BIG PLANE PARTS
IS HE FER REAL?
WELL MOLE, THINGS IS KINDA TIGHT MONEY-WISE.
WIRE
BUT, HE'S STILL GETTIN PAID THE SAME AMOUNT.
STILL, YA CAN'T BLAME A GUY FER TRYIN TO SAVE A LITTLE MONEY.
HEY, I WASN'T LOOKIN FER A ECONOMIC DEBATE, JUST SOME CHEAP CARDS!
GET LOST!! YA MOTH-EATEN OLE TIGHTWAD! NOBODY WANTS YER VALENTINES ANYWAY!
BOY, I GUESS IT JUST DON'T PAY TO DO SOME THINGS CHEAP.
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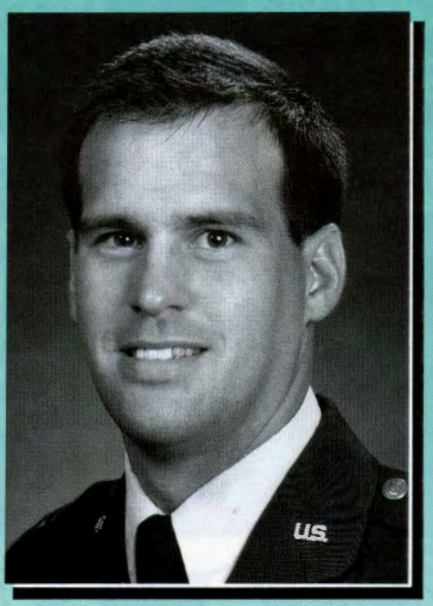
HARDISON

# Flight Safety Award of the Quarter

As 57 FW Chief of Flight Medicine, Captain Mavity's actions repeatedly contributed to our Flight Safety program. Among his most significant contributions were the development and implementation of an innovative system of information flow to wing aircrews called "Flight Surgeon NOTAMS," educating them on critical issues ranging from flight physiology to basic physical fitness and his unique instrument refresher course briefings, emphasizing physiological issues and how thy relate to recent mishaps. Captain Mavity responded, organized recovery and served as an interim Mishap Investigation Board member for a recent fatal Class A flight mishap. Based on lessons learned during response, he authored new mishap response guidelines and updated response checklists, improving everything from immediate actions to notification of and relations with local civilian authorities. Captain Mavity has translated his lessons into numerous section rewrites of mishap response operating instructions. An intangible contribution to our Flight Safety program was Captain Mavity's support of the mishap crewmembers' families, handling a delicate situation in a professional and supportive manner. His advice and expertise is willingly provided to other medical professionals through numerous aerospace medical journal articles dealing with, among other subjects, how to most effectively perform in the midst of the dichotomy that exists in the role of a unit flight surgeon as both a friend/colleague and one who responds to fatalities in the unit. All of these accomplishments, over and above his "normal" exhaustive duties as Chief of Flight Medicine, are unquestionable contributors to our Flight Safety program and make Captain Mavity uniquely qualified for the ACC Flight Safety Award of the Quarter.



*Capt Mark E. Mavity*
*57 TSS, 57 FW*
*Nellis AFB NV*

# Ground Safety Award of the Quarter

Ms King is a highly motivated, experienced leader and manager whose unique combination of technical proficiency and dynamic leadership style set standards others can only hope to reach. The results speak for themselves: National Safety Council's "Outstanding Ground Safety Performance" award; ground safety mishaps reduced 50 percent from 1991; greatly increased visibility through her wide-ranging unit safety inspections; enhanced relations with state/local police and other safety associated organizations to achieve 100 percent seat belt usage. When a shortfall developed in the wing's confined space training program, Ms King contacted a local university, arranged for technician training and developed a base program that is now the command standard. The wing's annual summer safety briefing had become stale and irrelevant. Ms King developed a new summer safety briefing and personally briefed over 1,000 people in less than three weeks. Her outstanding effort and dynamic leadership were recognized by the Wing Commander as saving lives and protecting increasingly scarce Air Force Assets. During the McConnell open house, Ms King was the definitive "Safety Professional" and a key member of the open house team. All 3,300 base residents, as well as all of our visitors, benefitted from Ms King's work -- the open house was mishap free. Ms King is an innovative leader who sees a problem, develops a solution and implements that solution. She has more than earned the ACC Ground Safety Award of the Quarter.

***Ms Jane King***
***384 BW***
***McConnell AFB KS***

# Weapons Safety Award of the Quarter

Sgt Thomas was performing recovery of an F-15E aircraft when he noticed aircraft 87-169 had returned to its parking spot without going through end-of-runway safing procedures; which is normal procedure when all munitions are expended in flight. He quickly approached the aircraft to ensure all munitions were expended and noticed several technicians preparing to perform maintenance on a Code 3 broken aircraft. He identified 15 flares and 30 chaff still on the aircraft and immediately told the technicians to postpone the maintenance. He safed the chaff and flare systems before aircraft engine shutdown and maintenance was performed. His efforts prevented inadvertent dispensing of chaff and flare which could have caused severe injury or death to anyone in the immediate vicinity. The fuel trucks in the immediate area could have been ignited had the flare not been safed by Sgt Thomas prior to engine shutdown. Additionally, Sgt Thomas established a hazardous communication training program, which explained in detail, who the office of primary responsibility for hazardous communication in the 461 FS is and what procedures to follow when encountering problems or questions concerning material safety data sheets. His outstanding weapons loading abilities were instrumental in his weapons load crew achieving a 100 percent pass rate on five evaluated munitions loads performed for the weapons standardization section. His superb performance of weapons maintenance on 461 FS assigned aircraft was evident by his maintaining a zero discrepancy, 100 percent pass rate on all Quality Assurance inspections. These accomplishments played a key role in his load crew being selected as the 461 FS Load Crew of the Quarter for Jul-Sep 92 and 461 FS Load Crew of the Month for Aug 92. Another of Sgt Thomas' attributes is his deep concern for matters which affect the safety climate of the squadron which is why he was appointed as the alternate weapons and ground safety NCO. In this capacity, he is responsible to the commander for the safety awareness of 130 personnel. He briefs the commander on safety issues and plays a key role in preventing accidents or incidents. Sgt Thomas identified and corrected several problem areas that existed in the 461 FS Weapons Flight Initial Evaluation and Safety Continuity book ensuring that newly assigned personnel were properly briefed and acclimated to the operation of the 461 FS weapons flight. Also, this quarter, he assisted in reconfiguring and performing all weapons operational checks for six F-15E aircraft which deployed to Nellis AFB NV, from 18 Jul-1 Aug 92, for Red Flag 92-4. His preparation of these weapons systems resulted in a 98.7 percent weapons release rate and zero hung ordnance which greatly contributed to the success of the deployment.

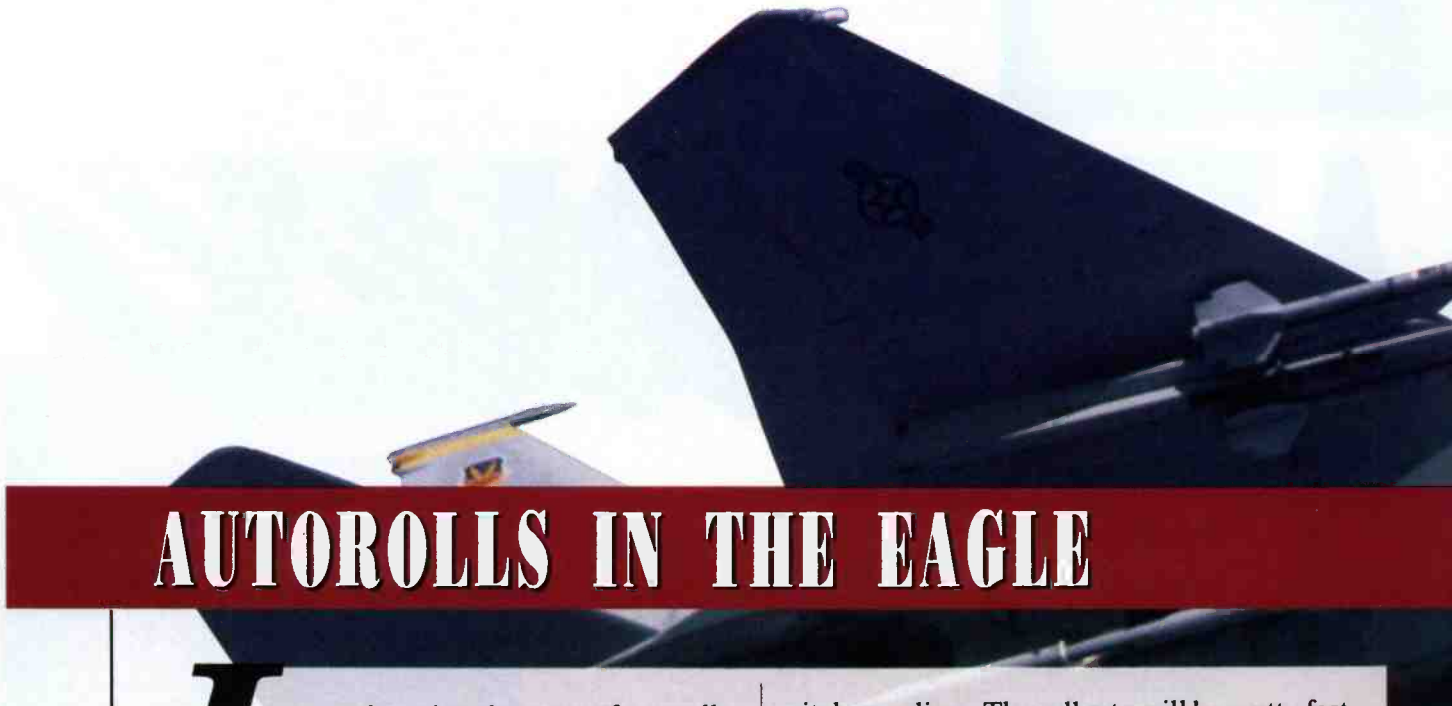
*Sgt Robert D. Thomas*
*461 FS, 58 FW*
*Luke AFB AZ*

*Major Pat Tank*
*HQ ACC/SEF*
*Langley AFB VA*



# AUTOROLLS IN THE EAGLE

The autoroll is one of the most misunderstood phenomena in the F-15. The autoroll is not unique to the F-15; other aircraft, such as the F-111, autoroll very easily. An autoroll can be stopped with very little energy or altitude loss.



# AUTOROLLS IN THE EAGLE

Let's review the cause of autorolls. The Dash-1 says an autoroll is a sustained combination of rolling and yawing motion. The rolling and yawing motion is sustained by a residual rudder surface deflection and inertial coupling which may continue after the controls are neutralized. An autoroll can consistently be entered from a specific set of flight conditions and control inputs:

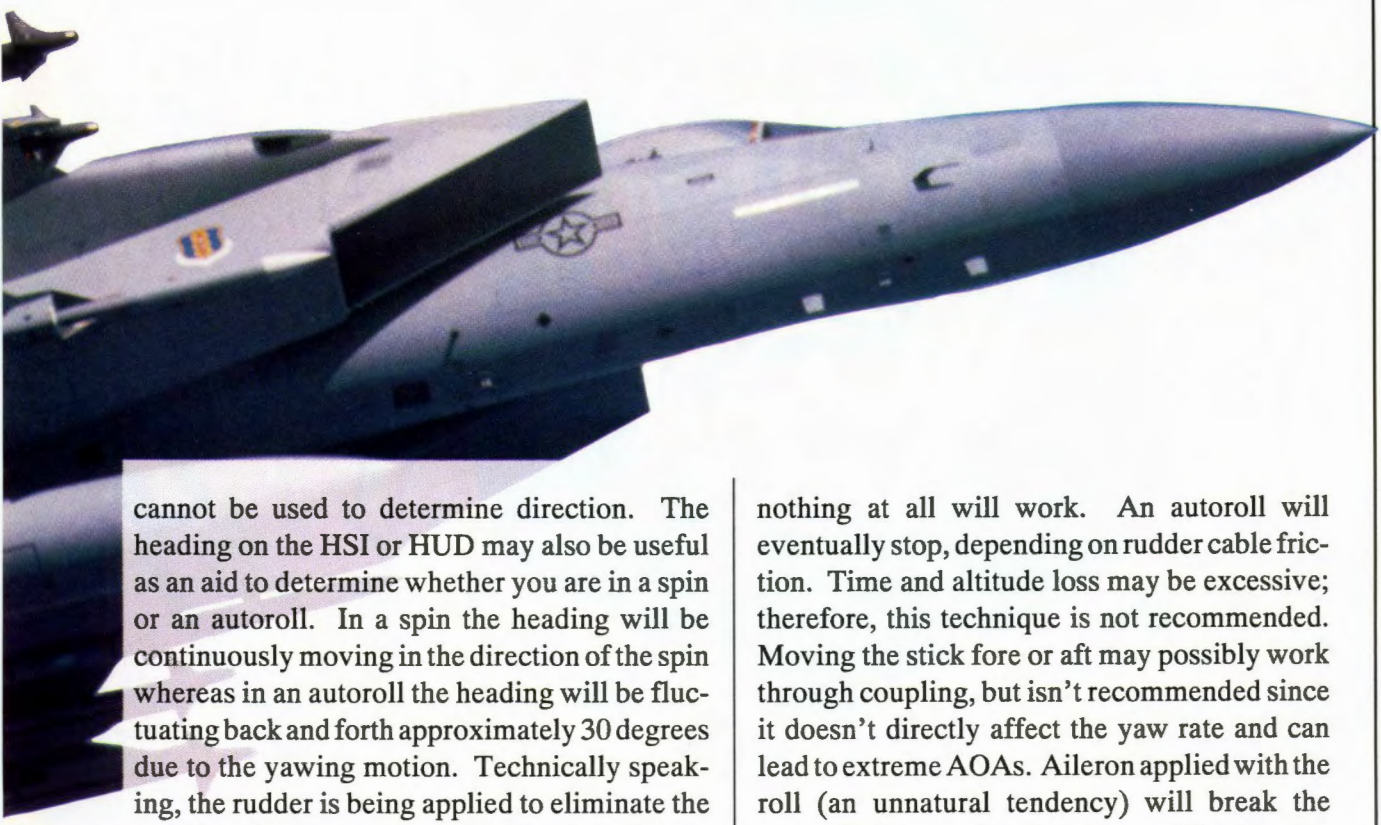
* Airspeed in the 200-300 KCAS range
* 20 - 30 units AOA
* Roll and yaw initiated with a rudder input
* Relaxing of aft stick to induce coupling

An autoroll differs from a spin in that it is primarily a rolling maneuver with a small yaw rate and AOA of 20 to 25 units. The wing is not stalled during an autoroll.

The aerodynamics of all this are complex. The following technical information is provided by Mr Glen Larson, Senior Experimental Test Pilot, McDonnell Aircraft Company. The first principle is the dihedral effect which causes the initial roll due to yaw; then easing of aft stick inertially couples pitch and roll to produce a yaw acceleration. During an autoroll, the airspeed is well above the stall speed and the AOA is held in the 20 - 30 unit range through inertial pitch coupling. The roll rate will be pretty fast, approximately 150 degrees a second, and the flight path will be ballistic.

During entry to an autoroll, inertial coupling will appear to the pilot as an increase in the roll rate as the stick is eased forward. Although the primary motion apparent to the pilot is roll, there is a yaw rate present (around 30 degrees a second). The yaw rate warning tone may be on or off during the autoroll. The CAS aileron rudder interconnect gets in the act during the entry phase because it works as a function of AOA and roll rate and applies rudder to coordinate roll. This rudder deflection is in the direction to get into an autoroll, but fades in a few seconds and will not keep the aircraft in an autoroll. If friction in the rudder cables is high, the rudders will tend to stay slightly deflected in the direction of the roll and that will tend to keep the autoroll going. An aircraft with little or no rudder friction or rudder displacement will not stay in an autoroll. In any event, it's easy to recover.

The best way to recover from an autoroll is to neutralize the controls and apply rudder opposite the roll. The roll direction should be obvious; however, if in doubt, use the ADI. The turn needle will fluctuate from side-to-side and



cannot be used to determine direction. The heading on the HSI or HUD may also be useful as an aid to determine whether you are in a spin or an autoroll. In a spin the heading will be continuously moving in the direction of the spin whereas in an autoroll the heading will be fluctuating back and forth approximately 30 degrees due to the yawing motion. Technically speaking, the rudder is being applied to eliminate the sideslip; however, it's easier for the pilot to determine roll direction, so referencing recovery procedures to roll direction makes more sense. The more rudder applied, the faster the recovery. As soon as the roll stops, neutralize the rudder and be ready to come in with a little aft stick to counter the "nose tuck" that follows. This nose tuck is caused by inertial coupling. The severity of the negative G pitch over is a function of the rate of recovery and is worse if pitch CAS is off. An abrupt application of rudder may cause a pitch over of up to two negative G's. To minimize negative G pitch over and aid in pilot orientation, slowly apply rudder to the deflection required to stop the roll. For a negative G autoroll, neutralizing the controls is sufficient to terminate the maneuver.

Other recovery techniques do exist, but are of academic interest only. For example, doing nothing at all will work. An autoroll will eventually stop, depending on rudder cable friction. Time and altitude loss may be excessive; therefore, this technique is not recommended. Moving the stick fore or aft may possibly work through coupling, but isn't recommended since it doesn't directly affect the yaw rate and can lead to extreme AOAs. Aileron applied with the roll (an unnatural tendency) will break the autoroll phenomenon, but the transition from an autoroll to an aileron roll is impossible to detect. Aileron against the roll (normal reaction) is definitely not recommended since it is a pro-spin control and it is possible to get into a spin in as little as four seconds. There is plenty of warning from the departure tone and aircraft motion that things are going from bad to worse.

Aircraft configuration has no effect on getting in or out of autorolls. Weight asymmetry doesn't affect autoroll entry or recovery, but does make it easier to spin out of an autoroll if the wrong recovery technique is used. Hopefully this will refresh your memory on the autoroll phenomenon and maybe you now understand it a little better. Remember an autoroll can be stopped with very little energy or altitude loss as long as you recognize it and take the appropriate action. FLY SAFE AND GOOD LUCK! ■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TWENTIETH AIR FORCE