
flying
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SPECIAL ISSUE
USAF
FLYING
SAFETY
WEEK
MAY 17-21
U.S. AIR FORCE

GENERAL LEW C. ALLEN, JR

A FLYING SAFETY WEEK
Message From The Chief of Staff

■ Last year we achieved the second best aircraft mishap record in our history — and we did it under some of the most realistic and demanding training conditions ever. Each and every one of you played a key role in that achievement. It was your skill, your dedication and your discipline that made it possible. Despite those efforts, we still lost people and resources needlessly — many from causes clearly under our control. Losses we cannot afford. We need a strong, professional commitment in '82.

Our 17-21 May Flying Safety Week will be dedicated to Safety Awareness — a time for all of us to make a special review of our operations and insure that safety is an integral factor in our Readiness equation. If we are to fight and win against today's threat, we can ill afford to lose talented people and precious equipment through oversight or cutting corners. Your alertness and dedication will be the key. You met the challenge well in '81 — we must continue in '82. ■

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flying

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SPECIAL ISSUE

In support of Flying Safety Week, this issue of *Flying Safety* has a different look. In addition to messages from the Chief of Staff and Director of Aerospace Safety, experts from various divisions within AFISC have provided analyses of the USAF mishap experience in 1981 and their projections for 1982. All of these articles are designed to provide you, the aircrew member, with information you can use to better prepare yourself to actively participate in Flying Safety Week 17-21 May 1982.

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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A NOTE TO THE OPERATORS, MAINTAINERS, AND LOGISTICIANS

BRIG GEN LELAND K. LUKENS
DIRECTOR OF AEROSPACE SAFETY

■ It is satisfying to look back on US Air Force accomplishments in reducing aircraft mishaps during 1981. Not only did we have the second lowest aircraft mishap rate in Air Force history, but the fighter/attack community achieved the lowest rate ever, proving that realistic training does not inevitably lead to more mishaps. Losses due to engine related problems were also at an all-time low. We also finished 1981 with four consecutive years of reduced aircraft accident rates. These achievements are not taken lightly, as we all know that much effort and exceptional leadership were required from many of you. Thank you.

As good as 1981 was, we are always looking for ways to save lives and decrease aircraft losses. We have many problems still to be tackled, and I know we are all working them hard. By now many of you have had an opportunity to participate in the survey phase of the Chief of Staff-directed BROAD LOOK effort. We believe that this program can pay big dividends in providing the information we need to fine-tune our prevention efforts.

But even before BROAD LOOK was initiated, there were areas which we knew needed attention. For instance, flight control malfunction accidents were up, and the traditional "fire in flight" problem plagued us during the early part of the year. Additionally, our operations-factor mishaps increased in 1981. Of special concern are the 17 mishaps which involved breakdowns in discipline. Accidents caused by breakdown in aircrew discipline are preventable and should not happen. Preventing that discipline mishap should be high on our priority list for 1982.

During Flying Safety Week, each of you will have the opportunity to think about your role, your responsibility to yourself, to your flight mates, and to your leaders. Take an especially hard look at your judgment and self-discipline. Be aware of the subtle traps which lead to pressing and overcommitment. We in the Safety Center have established a goal of less than 2.2 Class A aircraft flight mishaps per 100,000 flying hours for 1982. We think this is an achievable goal. We think operations-factor mishaps will be the determining factor in achieving that goal.

We have challenged ourselves and challenge each of you to use Flying Safety Week to launch an all-out effort to reduce maintenance and operations-factor mishaps in 1982. Thanks for your interest and support. ■

1982 AIRCRAFT MISHAP FORECAST

THE WAY IT WILL BE?

LT COL JOHN R. ALBERTS

■ The 1982 aircraft mishap forecast predicts that the Air Force will have 82 Class A mishaps and that 76 of the aircraft involved will be destroyed. Of the 82 Class A mishaps, 48 will result from operational factors, 32 from logistics factors (part failures, maintenance, etc.), and two from miscellaneous/undetermined causes. Fighter/attack aircraft will experience 34 of the 48 operations mishaps and 25 of the 32 logistics mishaps. Nineteen F-4s will be destroyed in 18 mishaps, and 11 of these will be due to operations factors. These things, among others, will happen this year if the 1982 aircraft mishap forecast is correct (Figures 1-5).

The 1982 aircraft mishap forecast is, like its predecessors, a reflection of the mishap potential that currently exists in the way we support, maintain, and operate our aircraft. The forecast is based on three basic assumptions: (1) that we have accurately defined the types of mishaps our aircraft are likely to have, (2) that we have accurately assessed current trends, and (3) that nothing changes in the way we support, maintain, and operate our aircraft in terms of procedures, policy, tactics, etc. It also presupposes that we will fly the 3,377,020 flying hours programmed for 1982 (PA 83-3, USAF Aerospace Vehicles and Flying Hours).

In spite of some past accusations, the forecast is not derived by a room full of fortune tellers with crystal balls, nor is it totally computer generated. It is rather the product of a logical, scientific process, the first step of which involves assessing mishap potential for each type mishap for each type of aircraft based on its historical signature or profile. Without going into a treatise on cumulative probabilities, suffice it to say that historical data are biased as a function of recency; i.e., the more recent the data, the more weight it is given. This is the only purely mathematical part of the process and involves some 11,232 separate calculations (48 aircraft x 26 mishap types x 3 mishap classes x 3 sample time periods). The weight given recent history is further biased by the aircraft's age, as newer aircraft such as the F-16 are still on the exponential part of their historical curve and do not exhibit the stability of older aircraft. Expressed as a rate, the potential is then compared to each aircraft's programmed flying hours for the year being forecast. For example, the F-15's weighted

(Data based on 3,377,020 Flying Hours)

Figure 1
FORECAST
1982 MISHAPS

	Rate	Number
Class A	2.4	82
Destroyed	2.2	76
Class B	0.8	28
Total Class A and B	3.2	110

Figure 2
1982
CLASS A FORECAST

Type Mishap	
Operations	48
Logistics	32
Misc/Undet	2
Total	82
Rate	2.4

Figure 3
1982 CLASS A FORECAST
BY TYPE AIRCRAFT

Type Mishap	Bomber	Cargo	Ftr/Att	Trainer	Util/Obs	Helicopter	Total
Operations							
Control Loss (PLT)			11	3	1		15
Collision/Ground	1	1	11	1	1		15
Range			5				5
Midair			3				3
Landing/Takeoff (PLT)		3	2	1			6
Ops Other			2		1	1	4
Total	1	4	34	5	3	1	48

Figure 4
1982 CLASS A FORECAST
BY TYPE AIRCRAFT

Type Mishap	Bomber	Cargo	Ftr/Att	Trainer	Util/Obs	Helicopter	Total
Logistics							
Engines	1		9	3			13
Flight Controls			5	1			6
Landing Gear		1	1	1			3
Fuel			2				2
Bleed Air			1				1
Hyd/Pneumatic			1				1
Electrical			4				4
Structural							0
Log Other			2				2
Total	1	1	25	5	0	0	32

Figure 5
1982 CLASS B FORECAST
BY TYPE AIRCRAFT

Type Mishap	Bomber	Cargo	Ftr/Att	Trainer	Util/Obs	Helicopter	Total
Operations							
Landing/Takeoff		1	3	1			5
Ops Other						1	1
Total	0	1	3	1	0	1	6
Logistics							
Engine	2	1	7				10
Engine FOD			1				1
Landing Gear		2	4				6
Electrical			1				1
Log Other			2				2
Total	2	3	15	0	0	0	20
Miscellaneous							
Birdstrike			2				2
Combined Total	2	4	20	1	0	1	28

control loss potential for 1982 is 1.09 per 100,000 flying hours. 1.09 x 147, 435 hours programmed for 1982 equals 1.61 mishaps; hence, we forecast two F-15 control loss mishaps, resulting in two destroyed aircraft.

Other significant changes this year were the changes in Class A, B, and C dollar loss thresholds. This was taken into account by converting previous years' history into the new criteria. The effect of the changes is most clearly seen in the decreased number of Class B mishaps forecast in 1982 — 28 vs the 55 we actually had last year. Fallout was most significant in the number of Class B birdstrikes and engine FOD forecast versus previous experience under the old criteria.

When this is done for all aircraft by type mishap, we then turn to our Class C mishap trending programs to see if any particular aircraft systems are exhibiting increasing or decreasing mishap potential and apply these trends to further determine areas of risk. Along with current trends, we further bias the mathematical projections as a function of our knowledge of current tactics, restrictions, mission, proposed/ongoing modifications, and special interest areas. For example, the F-111 has a 1982 control loss Class A mishap potential of .86, but due to completion of the stall inhibitor system modification, we have forecast no F-111 control loss mishaps. Some of the other factors that influence the 1982 forecast include a significant increase in the programmed F-16 flying hours from that flown in 1981, the reduction in the F-105 inventory, and ongoing ANG and AFR A-10 conversions.

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

Remember, *the forecast is by no means a goal*. The objective is to beat the forecast by additional prevention efforts in those areas identified as having high mishap potential. We at the Safety Center believe that you, the operator and maintainer, are going to do just that in 1982, and have adopted "under 2.2 in 82" a goal to shoot for. Success will mean a more effective operation and preserve our combat capability. ■

UPS AND DOWNS

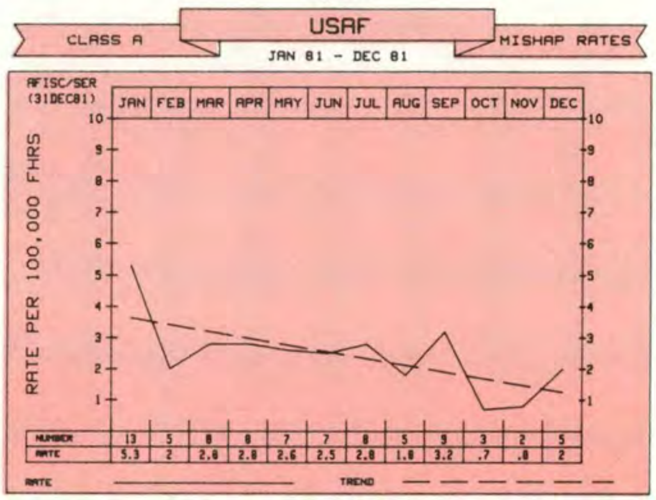
LT COL JOHN R. ALBERTS

■ 1981 had its ups and downs in the flight safety arena (see Figure 1). The good news was we flew over 3.2 million hours with the second lowest rate in USAF history — 2.4 accidents per 100,000 flying hours. The bad news was the loss of 74 aircraft and 122 lives in the 80 Class A accidents in 1981.

Overall, 1981 was a good year — especially when compared to the previous two years. The continued significant decrease from the 3.16 rate in 1978, 2.92 in 1979 and the 2.57 rate in 1980 shows we are heading in the right direction, and all the effort focused on performing the mission — safely — *is* paying off.

■ The payoff was particularly gratifying in the fighter/attack forces, which ended the year with the lowest rate in their history — 4.9 — also a significant decrease from the 7.2 rate in 1978, 7.5 in 1979 and 5.5 in 1980.

Figure I.



■ Mishaps involving bomber and helicopter aircraft also decreased, and the number of observation mishaps remained the same.

■ On the other side of the coin, the number and rate of cargo and trainer aircraft Class As increased slightly.

■ Operations-related accidents increased from 42 in 1980 to 46 in 1981 while flying about 136,000 more hours in 1981.

■ Control losses decreased significantly from 20 in 1980 to 13 in 1981, the first decrease in this type mishap in years.

■ Collision with the ground or water, where a good aircraft is flown into the ground, increased by five in 1981 from 10 to 15.

Control losses and collision with the ground or water historically account for the majority of our operations mishaps, and 1981 was no exception. They accounted for 60 percent in 1981 as compared to 71 percent in 1980.

Most people immediately associate con-

UPS AND DOWNS

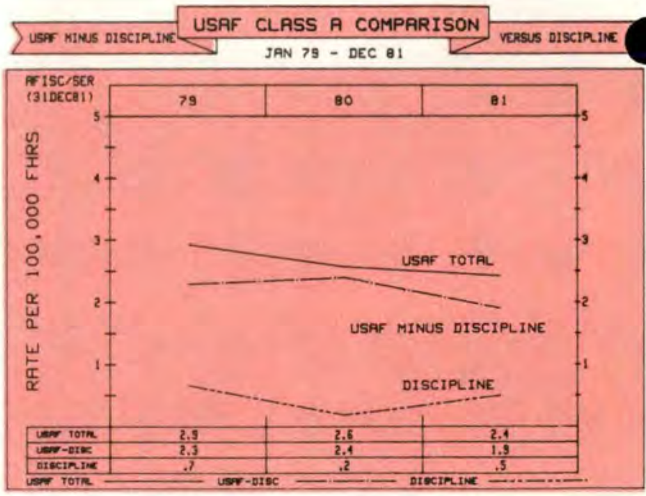
continued

trol loss and collision with the ground mishaps with the fighter/attack forces who have the highest exposure to these types of mishaps. However, everyone got a piece of the action in these two operational categories: bomber, two; cargo, one; trainer, five; observation, one; helicopter, one; and fighter/attack, 18.

Mishaps involving logistics factors were down slightly, and the log community had their second best year ever. Thirty logistics-related mishaps were experienced in 1981 vs 34 the previous year and 27 in 1979 which was the best year ever, logistically, for the Air Force making three consecutive, exceptional years for the logistics community. Of real significance was the decrease in engine-related accidents — six vs 16 in 1980 — however, increases occurred throughout the fleet in flight control, landing gear, and electrical system accidents.

So, from merely looking at the numbers, 1981 was not too bad a year. However, it sure could have been a lot better if those accidents involving discipline breakdowns, which ranged from subtle to gross, had not happened. We had 17 accidents in 1981 involving some sort of discipline breakdown (see Figure 2). This added .5 onto our mishap rate. *In other words, we had one discipline-related accident every 200,000 flying hours!*

Figure 2



The type of breakdowns ranged from plain old buzzing to violations of crew rest and rules of engagement to flight lead overcommitment of a novice wingman during ACM. Some were deliberate; most were subtle and occurred during the "heat of battle," or whatever, and, I'm sure, seemed like the thing to do at the time.

To eliminate the few gross violations we experience, flying supervisors at all levels must really supervise, make their policies clear, and *lead by example*.

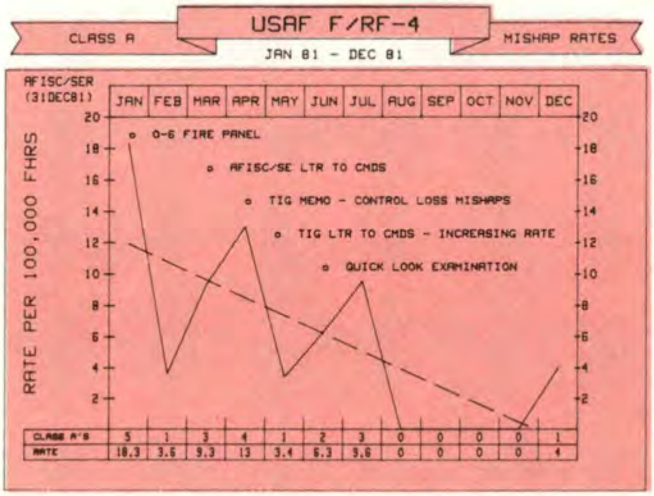
The same corrective actions also work for those subtle breakdowns in discipline which lead to accidents. The subtle breakdowns are harder to combat because they don't always lead to mishaps, so they don't get the

visibility and high-level attention which they deserve. Good people working hard to perform the mission sometimes get a little carried away; but when they do, they're significantly increasing their chances of breaking themselves, their aircraft, or both.

There is no direct way to quantify the role that peer pressure, unit prestige and pride, etc., play in such mishaps without reading between the lines of the accident reports. A grass roots change of attitudes is what is needed. It is everyone's job to try and change the attitudes that drive us to try and "beat the camera" (or adversary) with unsound maneuvers, or press an attack beyond common sense survival abort parameters, or fly too low for the terrain *or the threat*. We had too many mishaps from each of these in 1981 as well as previous years.

Although 1981 had its ups and downs, I mark it as the year which proved the impact that command, supervisory, and individual involvement at every level can have in reducing accidents. The F/RF-4 record in 1981 is one example.

Figure 3



- F/RF-4 aircraft have experienced from 18 to 22 accidents per year for the last four to five years. We at AFISC forecast 18 in 1981. We had 19 through mid-July!
- The high number of losses did not go unnoticed.
- Figure 3 shows but a few of the actions which transpired to identify and solve the problems. The trend line shows the effect of that emphasis. As a result of a great deal of hard work that went on at every level, we experienced only one accident the last five and one-half months of the year.

Similarly, we experienced a significant reduction of mishaps the last six months of 1981 as compared to the first six months (32 vs 48). I don't believe this happened by chance. To me, it proves that sustaining the emphasis on performing the mission — safely — can continue to lower the rate, and, more importantly, reduce our losses of aircraft and people.

1981 was not all that bad a year — we thank you! Under 2.2 in '82? ■

The Fighters

F-16

MAJ BRUCE COX

■ The fighting "Falcon" is a truly international fighter. F-16s are currently in the inventories of six nations. The US Air Force continues its schedule for bringing F-16 units up-to-speed. Like many advanced aircraft, the F-16 has had its problems, but they are being worked very hard, and solutions are coming. One very encouraging fact, through 1981 the F-16 has the lowest cumulative destroyed rate of any fighter/attack aircraft in Air Force history.

Problems with the F100 engine have received a lot of attention in the past. There have been five Class A mishaps attributed to engine problems as well as instances of stall/stagnations requiring inflight engine shutdowns and restarts. There are fixes in the works for several problems.

- Fuel system reliability may be enhanced through addition of a back-up fuel pump or an improved design main fuel pump.

- BUC airstart model is being incorporated in F-16 simulators and will provide needed pilot training.

In addition, Pratt and Whitney is looking into a new automated BUC start with procedures similar to a unified fuel control start. For F-16 jocks, the current Dash One discussion on airstarts is good information, and a thorough knowledge of that material is your best insurance for lighting the fire again when you have to.

In the area of flight controls, we've had some problems. As you know, once the F-16 departs controlled flight it can get into a deep stall condition from which recovery is difficult. Although the later F-16s have a manual pitch override feature which helps recovery, pilot technique is critical. One F-16 mishap was the result of improper recovery technique.

A new, larger tail has been incorporated in production aircraft to improve flight characteristics. With this mod it appears that the F-16 is less susceptible to departure, and if departure occurs the "big" tail aids in recovery. There are still some problems with this mod which are being worked.

As a result of investigations of F-16 mishaps, a modification program was started which centered on known EPU problems and also other flight control system changes. These modifications had to be completed before the grounding order was lifted.

There are several actions ongoing in the F-16 community to fix known problems. Emphasis on engine improvements will continue. Other programs in OFTs, automatic BUC airstart sequencing and flight control modifications are in progress.

The other big problem in the fighter/attack business is "ops" related mishaps. The majority of USAF aircraft destroyed are fighter/attack. The F-16 does not lead the pack in mishaps, but the message of the other aircraft types is clear. The problems of control loss and collision with the ground are just as valid for the F-16 as for the F-4 or A-10. Discipline, supervision, training, and event proficiency are all items each of us can address. Last year was a good one in the fighter business. Let's make '82 even better. ■

F-15

LT COL
EDMOND N. DUROCHER

■ There were six Class A mishaps and four Class B mishaps in the F-15 fleet during 1981. Looking at the causes, the F-15 experience is pretty evenly divided between people problems and material factors.

For the Class B mishaps, two involved failure of an aircraft component, one an engine bearing, and one a speed brake. The other two are classic people factors. In one case, a bolt was incorrectly installed and Murphy's Law prevailed. The bolt went into an engine, and we had a Class B FOD mishap.

The other Class B had a real element of luck. That is, we were very lucky that it was only a Class B. The set-up for this mishap, to quote an old Paul Newman movie, was "a failure to communicate." In this case, a wingman changed position without a signal from Lead. Then, while the wingman's attention was diverted to a radio change, Lead made a turn into the wingman — result — two dinged wing tips.

Midairs cost us two Class A mishaps in 1981. In one case, a pilot reentered a DACT engagement without element integrity and without a grasp of the relative position of the other aircraft in the fight. As a result, two aircraft collided and we lost two good jocks and two good airplanes.

Channelized attention was the culprit in two other Class As. In one case, the pilot was mentally locked into a landing despite a poor base leg position and a botched up final turn. The result was a short landing and a destroyed aircraft.

In the second case, the wingman may have "padlocked" on Lead during a low altitude, high G turn and failed to recognize the danger until too late to prevent ground impact.

One mishap involved loss of control from a material problem and one other, although undetermined, may have involved a loss of pitch authority.

In other areas of concern, proposals for a fix to the blown tire/braking problems are encouraging. One such proposal would put a brake pulser on the normal system. This mod incorporates a brake pressure pulsating device which repeatedly cycles the brake pressure if the antiskid protection is lost. This same proposal includes restrictors to desensitize the emergency system. Something we've wanted for a long time. The results of testing so far have been good and, the restrictors should mean fewer blown tires and/or approach end engagements.

The landing gear problems are still with us. The special reporting in 1981 helped identify the problem, and a fix has been developed. However, it will be late 1982 before the retrofit is complete. Work is continuing on a possible interim fix.

As far as engines go, there is both good news and bad news. On the good side, the trend in stall/stagnations is down. The recent performance complaints are recognized, and ASD is working hard on fixes. The not-so-good news is that the problems will be with us for a while.

From an operator viewpoint, the biggest safety problem in the Eagle is pilot attention. If we eliminated those from our total in 1981 we would have reduced the mishaps by two-thirds. The 1982 mishap forecast for the F-15 is that there will be six Class A mishaps and five destroyed aircraft. It is heavily weighted toward operator factor mishaps.

1982 Forecast — F-15

Control loss	2
Collision with the ground (Non-range)	1
Midair	1
Landing	1
Flight controls	1
Total	6

Channelized attention cost us in 1981. A good objective for 1982 might be no channelized attention mishaps in the F-15. ■

F/RF-4

MAJ GARY L. STUDDARD

■ The F/RF-4 is an all-weather multirole aircraft which remains an effective element in the USAF tactical inventory. The 1696 aircraft are programmed to remain in the inventory at least until the year 2000. Therefore, many modifications to improve the aircraft's capability and reliability are still being accomplished.

The F-4 fleet accomplishes roughly 400,000 flying hours a year and has an overall 6.5 cumulative Class A major mishap rate from 1963 to date. But, if we talk sheer numbers and rates the F-4 accounted for 38 percent of the fighter/attack Class A's in 1981 while flying 34 percent of total fighter/attack hours. In 1979 and 1980 the F-4 community experienced 19 Class A flight mishaps. In 1981, 20 Class As occurred.

Breaking these mishaps into the two main categories of operations factors and logistics factors shows operations to be relatively constant with 12, 10, and 11 operations factor Class As experienced during 1979, 1980, and 1981. The logistics Class A trend is up with 7, 8, and 9 mishaps occurring during this same period. (Note: one mishap in 1980 was a birdstrike and is categorized as a miscellaneous cause.)

A breakdown of the operational mishaps, shown in the following table, reveals the two main categories which account for the pilot caused mishaps are loss of control and collision with the ground (non-range).

The added capabilities we are building into the F/RF-4, coupled with more realistic training and changing tactics may help explain some of these occurrences. However, in a majority of our operation factor mishaps, second-level cause factors such as distraction, pressing, overcommitment, or breaches of flight discipline were often identified. While we must ensure our training programs are realistic, aircrew must understand that any performance which results in undue risk is unacceptable. "Training like we plan to fight" cannot evolve into a tendency for aircrews to exceed their own capabilities or our supervisors to demand too much, too soon from some crewmembers.

In the logistics arena, pinpointing the main contributors of our mishaps is not as easy. The following breakdown shows basically random occurrences.

OPERATIONS FACTOR MISHAPS

	1979	1980	1981
Control Loss	3	6	6
Coll w/G-non-range	6	2	2
Coll w/G-range	1	2	0
Midair	1	0	1
Landing	0	0	0
Miscellaneous/other	1	0	[illegible]
	12	10	11

LOGISTICS FACTOR CLASS A MISHAPS

	1979	1980	1981
Flight controls	1	0	1
Gear	2	0	0
Fuel system	1	1	2
Engine	2	3	1
Hydraulic/pneumatic	0	1	0
Electrical	0	1	3
Structural	1	0	0
Bleed air	0	0	1
Undet/Misc	0	2	1
	7	8	9

All of our logistic mishaps are being aggressively worked to prevent recurrence and usually hardware changes or increased inspections can alleviate the problem. Unfortunately, we still have the "human error" factor in some of our logistic mishaps due to improper assembly, installation, or inadequate inspections. All in all, the F-4 remains a very busy system in the logistic area. Many safety related programs are ongoing, too many to mention all, but here are a few of the more significant ones.

■ A structural integrity program has been implemented to identify air frame structural problems before they result in failures. This program searches out critical weaknesses and determines what to inspect and what is necessary to fix the problem.

■ In order to provide aircrews better warning on the proximity of the ground, a voice warning system is now being developed to interface with the present radar altimeter. Modification will start this year.

■ The present fire warning system is prone to false indications and results in unnecessary engine shutdown. A new system which operates on pneumatic change principles in response to temperature change and is less susceptible to corrosion and crimping is now being installed.

■ The F-4 has been approved for conversion to a new hydraulic fluid which has better fire resistance characteristics than the present fluid. The conversion is presently ongoing.

■ Because of possible misrouting, entanglement, or weakening of the present ejection seat rocket-motor firing lanyard, a modification has just been approved to install a gas-fired rocket motor. Kit delivery will start this year.

■ As a result of an increase in engine bay fire/chafing occurrences, an engine bay integrity modification has been released. This mod reroutes or repositions components to obtain more clearance and also includes reclamping several fluid lines and wire bundles in the engine bays. All aircraft should be completed next year.

■ The nose wheel electrical steering control system has been implicated as the primary or related cause of directional control mishaps for a number of years. Installation of a hydromechanical steering system is now being accomplished and is nearing completion.

■ Chafing and other deficiencies noted in the aft fuselage fuel vent line system have resulted in leaks which wet the tail of the aircraft. The potential for a fire then exists. A change in the configuration has been approved which will move the vent line pencil drain, install brackets to stiffen the vent line, and enlarge bulkhead holes through which the line passes.

In conclusion, there are a great many special programs involved in maintaining and operating the F-4 to ensure our missions are conducted as safely and effectively as possible. It is clear the F-4 will remain the backbone of the Tactical Air Forces for many years to come. ■

F/FB-111

MAJ BRUCE COX

■ 1981 was another year of intensive operations for the −111 fleet. In the 15 years since the first "A" model rolled off the assembly line, the "Aardvark" has participated in virtually every form of combat and training role. Both the tactical and strategic models have proven their worth at Red Flag, Maple Flag, and numerous other exercises.

Despite the enviable record established during this time, new initiatives for improvements in system safety have been required and are being actively pursued by users and supporting agencies. The modifications proposed should result in increased effectiveness and aircrew safety.

During 1981, a special egress study and modification proposal was briefed to all using commands and the Air Staff. Designed to preclude entanglement between the two parachutes on the crew escape module, the project will include rocket-sled testing of new devices to provide severance of the module's stabilization-brake parachute. Computer simulations have shown that these devices can significantly improve crew survival in low-speed, high yaw angle ejections.

Special engineering studies are currently underway to solve the problem of wheel-well fires. Inspections of fuel, hydraulic and electrical line security have revealed problems with chafing by the holding clamps. Emphasis on proper installation and inspection of these areas will minimize the probability of a mishap while improved clamping systems are developed.

An increase in the number of uncommanded flight control maneuvers prompted research into cause factors. In the initial stages, improvement in the reporting and analysis of incidents was emphasized. Studies into the precise components causing the maneuvers are underway at depot and contractor levels. Improved field-level troubleshooting procedures are being formulated for dampers and servo valves. Electronic components are receiving close attention, and improved test stations are being developed for component validation.

Other areas that are being investigated for improvement are vertical stabilizer delaminations, alternate gear extension reliability, terrain following radar (TFR) malfunctions, and engine reliability. Overall, continued engineering and safety efforts are underway to improve reliability and effectiveness of the weapon system. Your help in highlighting any areas needing improvement is the key to success. ■

A-7

LT COL DOUGLAS M. CARSON

■ The A-7 is an all-weather attack aircraft which first entered the USAF inventory in 1968. Approximately 370 A-7D and K model aircraft are currently in service with the Air National Guard. The fleet flies about 100,000 hours per year and will reach the million hour point about mid-summer of this year. The A-7 has one of the best, if not the best, air-to-ground capability of any aircraft in the inventory and will continue to see service with Air National Guard units for several more years.

We have experienced 71 Class A major mishaps with the A-7 from 1968 through the end of 1981 which has yielded an overall Class A major mishap rate of 7.4. This compares favorably with other USAF fighter/attack aircraft. It has the fifth lowest overall Class A major mishap rate (out of

14 different fighter/attack aircraft), which is even more significant when the low altitude environment in which it continually operates is considered. The 71 Class A major mishaps have resulted in 71 destroyed aircraft and 28 fatalities.

Figure 1 shows the Class A major mishap rate from the first mishap which occurred in 1970 through the end of 1981. This is the "big picture," but to make it more meaningful, let's break it down into operations-related and logistics-related mishaps. We'll look at ops and logistics, especially over the last five years, and then go into more detail with last year's Class A mishaps.

There have been 41 operations-related mishaps through the end of 1981. The largest single category involved collision with the ground. Unfortunately, the fatality rate in this type of accident is rather sobering. Eighteen aircraft were destroyed, and 16 pilots were killed. Thirteen of the mishaps occurred on air-to-ground ranges, and five were non-range collisions with the ground. Loss of control, the second largest category, was responsible for the loss of 14 aircraft and eight lives. Not surprisingly, most departures from controlled flight occur in air combat tactics (ACBT). Six aircraft and three pilots were lost on ACBT missions. Midair collisions claimed five aircraft and two lives. Miscellaneous causes accounted for the four remaining ops-related aircraft losses.

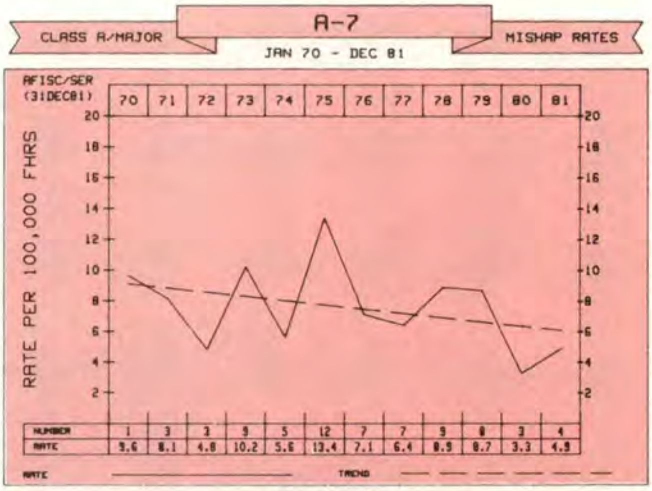


Figure 1

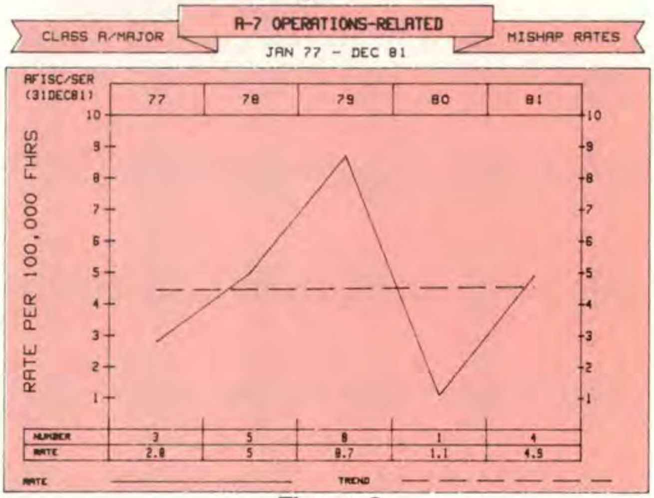


Figure 2

Figure 2 shows the operations-related mishaps and the trend for the last five years. The trend indicates that ops-related accidents will probably remain constant (at about four to five mishaps per year) unless we make some changes in the way we do business. Hopefully, as ANG units gain experience with the A-7, this curve will show a definite downward trend.

Now let's take a look at Class A mishaps which were attributed to logistics. Logistics-related mishaps accounted for 28 destroyed aircraft, but only two fatalities.

The TF41 engine was the biggest single problem we had in the A-7. Twenty-two aircraft have been lost, and many close calls were experienced. The major problem areas included compressor vanes, turbine vanes, bearings, and oil system. Engine modifications (Block 76 mods), which incorporated several fixes in weak areas, were evaluated in a lead-the-force program. Thirty engines were placed in operation for a specified time with no restrictions. At the end of the time period, the engines were evaluated. The mods proved successful, and a program was started to modify all engines in the

A-7
continued

fleet. The corrective action appears to have licked the problem. The engine fixes are about 95 percent complete, and there have been no engine-related Class A mishaps for the last three years.

The actual aircraft structure has presented no problems with the exception of the canopy. Canopy losses/failures caused three accidents and one fatality. Inadvertant ejections resulted when the wind blast pulled out the face curtains. Canopy failures were caused by two separate problems — improperly drilled holes and air bubbles in the lamination of acrylic and fiberglass. The improperly drilled holes were fixed through a one-time inspection, and ultrasonic inspection fixed the lamination problem. Defective canopies were purged from the system.

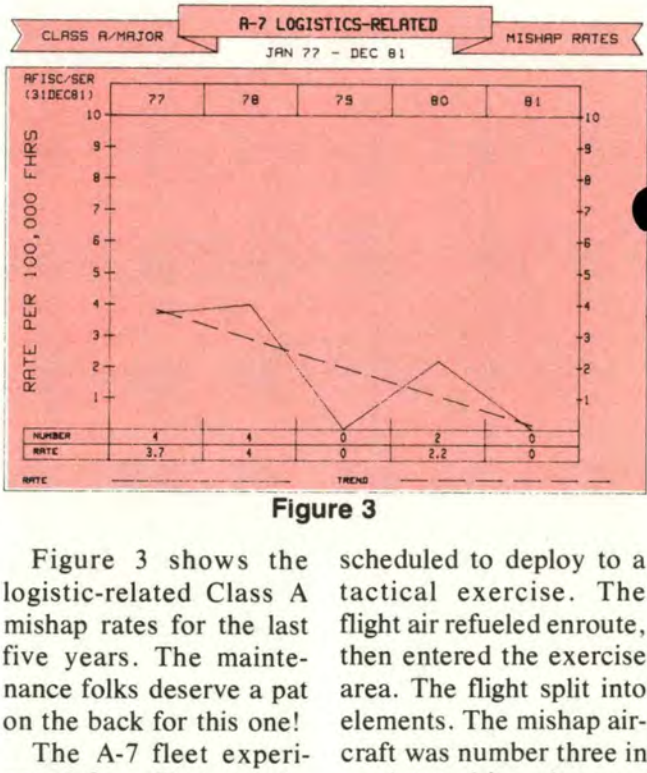


Figure 3

Figure 3 shows the logistic-related Class A mishap rates for the last five years. The maintenance folks deserve a pat on the back for this one!

The A-7 fleet experienced four Class A mishaps in 1981. All four aircraft were destroyed and two pilots were fatally injured. The following mishap descriptions are listed in chronological order.

▪ The mishap aircraft was a late addition to a six-ship flight which was scheduled to deploy to a tactical exercise. The flight air refueled enroute, then entered the exercise area. The flight split into elements. The mishap aircraft was number three in a three-ship element. Twenty-five minutes after beginning the low level orientation portion of the mission, the mishap aircraft impacted a small hill and was destroyed. The pilot made no attempt to eject and was fatally injured.

■ The mishap aircraft was number two in a three-ship flight on an air-to-ground training mission. After completing the training, the flight returned to the home station. The weather was deteriorating so the flight took spacing for visual straight-in approaches to the runway. The mishap aircraft struck the ground 150 feet short of the overrun. The soft ground sheared the landing gear, and the aircraft slid down the runway. After the aircraft stopped, the pilot successfully ground egressed with minor injuries. The aircraft was destroyed due to impact and fire.

■ The mishap aircraft was number two in a flight of two on a scheduled low level/air-to-ground mission on a range. Both aircraft completed the low level portion of the mission and two LAB deliveries on the range. The lead aircraft flew a box pattern, made a LALD delivery, and turned crosswind. When he looked back, he saw smoke at the downwind to base turn point. The number two aircraft had impacted at a shallow angle and was destroyed. The pilot made no attempt to eject and was fatally injured.

■ The mishap aircraft was number four in a flight of four on an ACBT mission. On the fourth engagement, the mishap aircraft was engaged by number two, who made a simulated AIM-9 shot. The mishap pilot honored this call with a break. During the jinking following the break, the number four aircraft departed controlled flight. The pilot attempted to recover, then made a timely decision to eject at approximately 5,000 feet AGL in a negative G rolling maneuver. The pilot sustained moderate injuries which required hospitalization for about two weeks. The aircraft impacted in an open field and was destroyed.

That's a brief rundown of the mishap experience for the USAF A-7 fleet. In recent years, the maintenance folks have really got a handle on things, so most of the Class A mishaps are ops related.

The analysis guys are forecasting that we will have five class As this year in the A-7. Four will be ops-related and one logistics.

1982 Forecast — A-7

Control loss	1
Collision with the ground (Non-range)	2
Collision with the ground (Range)	1
Engine	1

Let's prove them wrong. ■

A-37, T-37, T-38, F-5 AND T-33

MAJ ERNEST A. BRIGGS, CF

■ All weapons systems in the Air Force have special areas of concern for safety officers. These concerns are shared by many others: operators, maintainers, and supervisors, to name a few. One of the prime areas of emphasis in safety is you — the operator. Many words have been written on this subject and, for now, I will leave it alone. Making the machine as safe as possible to operate is another factor of interest to all. This article will highlight some of these problem areas on the A-37, T-37, T-38, F-5 and T-33 weapons systems.

A-37

Instrument locations are not standardized nor the same as other USAF aircraft, and this makes crosscheck during instrument flying more difficult. A proposal to standardize the A-37 instrument panel is underway.

The new HBU-X lap belt is of interest to many weapons systems besides the A-37. Work on an advanced aircrew restraint system has been pursued for some time. At present, a contractor has been chosen, and the program has been expedited to produce results in the field by the fall of this year.

T-37

Reliability of the 250VA inverter is less than ideal. Special operating procedures are being used in an attempt to prevent possible overloading and to increase reliability; however, the overall solution to this concern is the future replacement with a 500VA inverter.

The failure of the inducer blades on the J69 engine compressor has caused continued interest. As an interim measure, inducer blades are being shotpeened, a procedure used to increase the strength of the metal. We are still having problems in this area, and a new thick blade design inducer is being procured.

T-38

Failures of the displacement gyro have caused problems in the T-38 world. NASA has helped develop an improved slow speed gyro with a much better performance. These new gyros will be fitted in the T-38 and other weapons systems this year.

A study on canopy strength and aging with a look at the effects of ultraviolet, temperature, and stress on the acrylic material has been completed. This study has established a maximum life of 15 years for T-38 canopies, and the information learned in the study will be used to improve birdstrike resistance and canopy reliability in many similar type aircraft.

F-5

During sequenced ejection, the inertia reel spring has been known to fail and prevent the pilot from being hauled back and restrained properly. This problem was identified by the supplier during test and the inertia reel and spring have been reworked. A program is now underway to modify operational aircraft.

Nondestructive inspection (NDI) of wing fasteners in the F-5 fleet caused concern because the present rotoscan procedures would not do a good job with the protruding-type wing fasteners. A new rotoscan technique is being developed to cure this problem.

T-33

The T-33 is an old aircraft and structural service life of the airframe has been reviewed. Utilization of the aircraft in the basic fighter maneuver (BFM) training mission is very demanding on the service life of this machine. A structural review of the T-33 was completed this past summer, and the basic conclusion is that the T-33 is still a sound aircraft. The T-33 is expected to be in service for some time to come and is capable of providing the Air Force with many more useful flying hours, providing the users treat the fine old lady with the care and respect she has earned.

These are only a few examples of the many programs and concerns involving safety. Some are resolved quickly, and some take a great deal of time and money to complete. All safety-related concerns are addressed at many different levels throughout the USAF to provide the safest environment possible, but YOU, the operators, are still the most important safety link in the safety chain. ■

1981 EJECTION RESULTS IN USAF

RUDOLPH C. DELGADO

■ The ejection survival rate for the United States Air Force for calendar year 1981 was 79 percent. Of the 72 ejections experienced, 57 were survived and 15 were not. This 79 percent, although 10 percentage points higher than the previous year, did not relieve the depressed condition which the survival rate has been in for the past six years. Before 1976 this rate averaged 82 percent. Since then, however, it has averaged only 75 percent.

Ten of the 19 ejection fatalities in 1981 were attributed to that old nemesis that has been hounding aircrews since ejection seats have been in existence — ejection outside the safe escape envelope (O/E). This 66.7 percent O/E rate closely parallels the 71.2 percent O/E rate we have experienced over the past six years. Generally, the older the aircraft and its escape system, the less capable it is. This usually means more time required to operate. But no system is absolutely foolproof. Two of the 10 O/E ejections in 1981 were with the highly capable ACES II seat. This reemphasizes that no matter how capable the escape system, it still requires a certain amount of time to operate properly.

Of the remaining five ejection fatalities for 1981, three were attributed to system deficiency. This category connotes that these fatalities may not have occurred had the escape system used not been deficient in certain capabilities, i.e., better seat stabilization, better seat/man separation, better parachute deployment. The two remaining 1981 fatalities were due to material failure and missing/drowned. Material failure means exactly that, a piece of egress equipment failed in some way and caused an ejection fatality. Missing/drowned is how we categorize a crewman we know ejected over water but are unable to find him.

Also worthwhile noting in the 1981 experience is the fact that, even though we now are having some

Figure 1
Ejection Experience
1976-1981

Year	Ejections	Survived No.	Survived Rate	O/E No.	O/E Rate
1976	64	50	78%	8	57%
1977	70	54	77%	12	75%
1978	79	63	80%	11	69%
1979	79	54	68%	19	76%
1980	71	49	69%	17	77%
1981	72	57	79%	10	67%
TOTALS	435	327	75%	77	71%

Figure 2
Ejection Fatality Causes
1976-1981

Cause	Number	Percent
Out-of-Envelope	77	71.2%
Missing/Drowned	7	6.5%
System Deficiency	6	5.6%
Material Failure	5	4.6%
Escape System Damage	3	2.8%
Other	10	9.3%
Total	108	100.0%

Figure 3
Ejection Injuries by Aircraft

Aircraft	Injury Classification: Fatal	Major	Minor	Minimal	None	Total
A-7		1				1
A-10	1			1		2
F-4	7	9	5	11	3	35
F-15	2					2
F-16	1		2	1	1	5
F-102			1			1
F-104				3		3
F-106				3		3
F-111				2	2	4
T-33	1	2	1			4
T-37	1		1	1		3
T-38	2	1	4	2		9
	15	13	14	24	6	72

ejections from our new aircraft such as A-10, F-15, and F-16, the old F-4 workhorse still accounts for a lot of ejections. It had 35 with 28 survivors for a respectable 80 percent rate. For comparison purposes, Figure 1 shows the total number of ejections by year, including survival rates and out-of-envelope rates, for the past six years. Figure 2 shows a breakdown of the ejection fatality causes for this same period. Figure 3 shows the 1981 ejection experience by aircraft and the injury classification.

The 1981 ejection experience pretty much followed the same pattern it has followed in the past six years. Of the 72 crewmen who ejected, 21 percent did not survive, 18 percent received major injuries, 19 percent received minor injuries, 33 percent received minimal injuries, and 8 percent were not injured. Of the 21 percent fatalities, 66.7 percent were due to ejection outside the envelope. ■

The Heavies

C-130

MAJ JOHN J. COLSCH

■ The C-130 is a durable and versatile aircraft. In 1956, the Air Force received its first C-130. In 1981, eight new C-130Hs were delivered to the Air National Guard (ANG) at Savannah, Georgia. This last delivery brought the total C-130 fleet for the Air Force, including ANG and Air Force Reserve, to 719.

A fleet of aircraft ranging in age from 27 years to brand new has its problems, but this is where the people portion of the success story appears. As weaknesses were discovered and better designs realized, changes were made in the production of new aircraft and old aircraft were modified.

We often talk about the airframe as if it had a personality of its own. We talk about its abilities to do many jobs and missions. I do not disagree with the many praises for the C-130, but for this article I will divorce myself from the many things done with the aircraft and address the people portion of the C-130 accomplishments.

First, the people who designed the C-130 did a good job. The versatility of this aircraft is a direct result of mating turboprops with this airframe. From the time the first aircraft was produced up to the present, improvements and modifications continue to be built into the new aircraft and the older aircraft modified.

The constant and continued effort to find weaknesses and correct them is a large portion of the C-130 success story. This effort is not limited to the designers and producers only. The people who manage and maintain the aircraft have worked at improving it through better maintenance procedures, inspections, and repair.

Instead of aircraft age becoming a liability, it has been used to improve the whole fleet. The stresses and fatigue that can ground a whole fleet of aircraft produced over a short production period are discovered on a relatively small sample of C-130s. When these age weaknesses are discovered, they are repaired and the other C-130s are programmed for specific inspections and repair as they approach the stress or fatigue point. The range of ages and hours on these aircraft allow an orderly flow of aircraft through overhaul and depot repair facilities. The effort of detecting, inspecting, and repairing is a people ef-

fort, not an aircraft quality.

In 1981, Air Force, ANG, and AFRES C-130s passed the nine million flight hour mark. That milestone is a credit to the designers and producers, but more specifically a credit to every person who has contributed his or her time and effort in managing, maintaining, and flying these aircraft.

1981 C-130 Flight Mishap Record

Class A Flight Mishaps = 4 Aircraft Destroyed = 3
Class A Flight Mishap Rate Per 100,000 Flight Hours = 1.09
Class B Flight Mishaps = 2
Class B Flight Mishap Rate Per 100,000 Flight Hours = 0.54
Class C Flight Mishaps and High Accident Potential (HAP) Mishaps = 225.
Class C and HAP Rate Per 100,000 Flight Hours = 61.27
NOTE: Rates are based on the estimated final flight time for 1981.

Safety Concerns For C-130s In 1982

Three prime safety concerns for the C-130 in 1982 are: uncommanded flight control inputs, total or partial power loss on two or more engines, and lightning/bird strikes.

Uncommanded Flight Control Inputs

In 1981, 12 C-130 uncommanded flight control input mishaps were reported. Although not a significant increase over previous years, the number of these instances that remain unsolved is disturbing. In some instances, the causes of the uncommanded inputs are clearly defined trim malfunctions, autopilot malfunctions, improper rigging, or malfunctioning boost packs. In others, the causes remain undetermined. In several cases, the cause was thought to be a particular component, but teardown of the suspected part did not reveal any deficiency.

The C-130 system manager in cooperation with Lockheed has completed a study of the flight control cable tension regulators. Tension regulator inspection procedures that will allow them to be checked for proper operation while installed on the aircraft should be distributed soon.

Warner-Robins Air Logistics Center, in cooperation with Lockheed, are developing a flight control analysis team that can deploy to any location where an aircraft has experienced an uncommanded flight control input. This combined team of experts will do analysis of the flight control system to isolate the cause(s) of the uncommanded inputs. I do not yet have a firm date on when this team will be operational.

What can we do to isolate the causes of flight control malfunctions? When encountered, the crew's prime concern is getting the aircraft safely on the ground, not troubleshooting the whole flight control system. Once safely on the ground, notify your flight safety officer and give him (and maintenance) the complete description of the malfunction.

Maintenance and safety, in a coordinated effort, will submit the mishap or high accident potential (HAP) reports and CAT I Materiel Deficiency Reports (MDR). Common mistakes made on the CAT I MDR are lack of cross-reference to the mishap report submitted on the malfunction and inadequate description of the difficulties the aircrew experienced in handling the malfunction. The safety officer must assist maintenance in providing an adequate narrative for the CAT I MDR. He has the information needed since he must provide a narrative for the mishap report. Only a concentrated team effort of aircrew, safety, and maintenance can put an end to C-130 uncommanded flight control inputs.

Total or Partial Power Loss On Two Or More Engines

In 1981, we had 14 reports of power loss on two or more engines. Although several of these power losses occurred during landing or taxi, there were a significant number of two engine shut downs in flight.

Basic to any emergency condition is maintaining basic aircraft control. Sound judgment must be used anytime power is lost. Should a previously shut down engine be restarted? Should shutdown be delayed until more favorable conditions exist or until configuration can be completed? You, as aircraft commander, are the one who must make these decisions with the advice of your crew. The Dash One statement on the use of sound judgment is particularly applicable in multiple power loss situations.

In light of the multiple power losses in 1981, aircrews must be thoroughly familiar with engine-out procedures, especially air minimum control speeds.

Birdstrikes/Lightning Strikes

I have combined these two types of mishaps because the prevention procedure is the same for both. *Find the areas of increased strike potential and avoid them as much as possible.* Strike prevention does not rest solely with the aircrew. Supervisors must provide alternatives to them when these hazards exist.

Twenty-seven C-130 birdstrikes were reported in 1981. Birdstrikes occurred in every month of the year. Five resulted in engine damage.

How do we prevent birdstrikes? First, take a look at the low level routes. If they follow rivers and streams, there will probably be conflicting waterfowl migratory routes. When bird concentrations are spotted in a particular area or along established routes, report your observations to the squadron and wing supervisors. When bird concentrations are reported, supervisors should assist crews by rerouting if possible.

If that is not possible, then terminate the low level for that portion of the route with increased bird activity. Effective birdstrike prevention requires aircrew reporting of bird concentrations and supervisors not only advising other aircrews of where the bird concentrations are, but suitable alternatives for them.

We are fast approaching two years since the last Class A mishap with suspected lightning involvement. In 1981, we had 21 reported lightning strikes to C-130s. This represents a 40 percent increase over 1980's reported lightning strikes. I don't think the increase is due to improved reporting. I feel the number of lightning strikes is directly related to the effort made to avoid high lightning potential areas and to how the crews perceive the hazard.

If I am in an exercise and the three aircraft in front of me have penetrated an area of high lightning potential, why can't I? All the regulations in the world won't stop C-130 aircrews from flying through these areas of increased risk unless supervisors divert, delay, or cancel missions to prevent lightning strikes. Once the aircrews are convinced that the supervisors are interested and supportive in avoiding strikes, I feel they will take the measures needed to avoid lightning strikes.

To see hazardous operations and allow them to continue is a statement that aircrews do not have to avoid areas where they may be struck.

Of the 21 lightning strikes we had in 1981, all but one damaged radomes. The one that did not burned several holes in a wing tip. Had that strike attached several feet inboard, we probably would have had another Class A and one less crew and aircraft. We were lucky!

This year, installation of blue fire suppressive foam in the fuel tanks will begin. Installation will not be completed until 1984 — two years to go before we all have this protection. The need to avoid high lightning potential areas does not end with the installation of foam. We can not afford to lose 20 radomes plus other assorted antennas, radars, and electrical components each year.

C-130 Improvements/ Modifications

In 1986, C-130B/E and HC-130s will begin being modified with the H model outer wing. This will substantially increase their wing life. Likewise, the C-130 system manager is working a plan to repair C-130A center wings in an effort to extend the aircraft life. AFRES, ANG, and AFISC are documenting C-130A/B flight instrument failures in an effort to obtain updated flight instruments/autopilot for these aircraft.

Aeronautical Systems Division (ASD), Warner-Robins ALC, and San Antonio ALC are all working C-130 life raft configuration in an effort to end inadvertent life raft deployments.

In 1981, we discovered the cause of two main gear-up landings which occurred on a C-130H. Removal of water from a landing gear component and filling of the cavity with a non-expandable material should prevent recurrence of this type of mishap.

Modification of the C-130A gear warning system will help prevent gear-up landings, but the ultimate responsibility for assuring gear down for landing still rests with the crew. Experience shows the only aircraft assured of not landing gear-up are those with fixed gear. Anticipated completion of the C-130A gear warning system modification is March 1983.

Present plans call for modification of the C-130 fleet with quick donning oxygen masks. This mod will provide C-130 crews the same ease and availability of oxygen masks as already possessed by C-141 and C-5 aircraft.

The emergency locator transmitter (ELT) modification was completed in February 1982. This mod replaces the previous crash position indicator (CPI) which was removed from most C-130s in 1978.

Present plans call for installation of cockpit voice recorders beginning next year. Eventually, the C-130 will also be modified with a flight data recorder which will augment the cockpit voice recorder in providing information for mishap investigation.

The C-130 is a great aircraft. Its greatness is the result of a coordinated team effort. The people who build, manage, overhaul, maintain and fly the C-130 are the reason the aircraft has a great reputation for accomplishing the mission. You, the supervisors and aircrews, are the final focal point in mission accomplishment. When you encounter a situation that endangers your crew, aircraft, or cargo, which, under less favorable circumstances, could result in more damage or injury, *report it*.

Unless the problem is properly identified and reported, those who can do something about preventing it from happening again will not learn about it until after a more serious mishap occurs. ■

CT-39

SQDN LDR PHILIP R. ARMITAGE RAAF

■ The Air Force operates 137 CT-39 aircraft. Military Airlift Command is the major user with 113 aircraft. The remainder are spread around PACAF, AFSC, AFCC, and ANG. During 1981, the CT-39s flew a total of about 78,000 hours with no reported Class A or B mishaps. In fact, over 230,000 hours have been flown since the last Class A.

Last year, 82 Class C mishaps were reported. Figure 1 is a summary of mishaps by type.

Figure 1
CT-39 Class C Mishap

Mishap Cause	1980	1981
Birdstrike	1	4
Electrical	4	6
Engine	28	33
Engine FOD	4	1
Flight controls	2	5
Instruments	3	1
Landing gear	9	20
Pressurization	6	6
Weather	10	2
Miscellaneous	3	4
Total	70	82

There are three areas with potential to cause serious mishaps. These are the engines, the landing gear, and the electrical system.

Only a casual look is required to realize over 40 percent of reported mishaps have been engine related. These were either engine components or an airframe system component that caused a flameout or required an engine shutdown. Six mishaps were caused by defective fuel units and a further 11 were caused by various oil

system components. The remaining material failures were virtually one-time occurrences. In all, on 27 separate occasions, a CT-39 landed with one engine shutdown. Some of these problems may be a symptom of the advancing age of the aircraft. Certainly increased vigilance by pilots, technicians, inspectors, and supervisors is indicated.

If you didn't notice the engine statistics, you probably saw the 20 mishaps associated with the landing gear. A number of structural failures have been detected in separate components of the main landing gear. Many of those have been rectified by changes to tech orders, while a few are still under investigation to determine the underlying causes. Loss of aircraft control during landing rollout (included in landing gear statistics) continues to cause concern. There were eight such mishaps. In four cases, the antiskid system was inoperable. In two cases, failures of aircraft components or wiring caused a failure of the antiskid system. The cause of one mishap remains undetermined while the last was a direct result of the failure of a component in the antiskid system. This system has had some problems in the past but is now 100 percent supportable with spares, and, in fact, the Air Force has complete overhaul capability.

Although the number of electrical mishaps is relatively small, the potential for serious mishap is great. Three mishaps resulted in aircraft recovering with no electrics. Fortunately, the recoveries could be made in VMC although one aircraft was in only marginal VMC. An engineering investigation of the aircraft electrical system is still under way, so rectification proposals are still under consideration. There is, however, a modification being processed (not yet approved) to provide a standby power source for an attitude indicator.

At the moment, there are three approved Class IVA (safety) modifications in various states of completion. The current details on these are:

- The installation of strobe lights has been delayed due to design problems on the prototype. Installation is scheduled to start in April 1983.
- The aft fuselage overheat detection system will be modified to provide a sensor near the hydraulic pump. This is designed to give earlier warning of an overheat or fire in the pump. January 1983 is the date when installation should commence.
- Installation will soon begin on a modification to provide access to the vertical stabilizer rear sparcap. As the aircraft approaches its airframe life, this structural component becomes critical. This modification provides easy access for regular inspection.

As time goes on, the aircraft approaches the current approved life of 22,500 hours. At the moment, the high flier has 20,970 hours, and the fleet average is around 17,150 hours. At current flying rates, the first aircraft will reach the limit in mid-1984. For quite some time, Sacramento ALC has been studying the requirements for life extension. When those studies are completed, decisions from higher headquarters will follow.

This article has intended to give you, the operator in the field, a brief insight into the "big picture." The objective is to "fly safe" in 1982. Awareness of past problems and current trends should help you anticipa[illegible] problems to come. Kno[illegible] what to do in advance and stay safe. ■

C-135

MAJ ARTHUR P. MEIKEL

■ The 747 aircraft C-135 fleet experienced three Class A flight mishaps in 1981. The three mishaps equaled the highest annual mishap total and rate since 1969 and resulted in two destroyed aircraft and loss of 27 lives. Three Class A mishaps also occurred in the years 1972, 73, and 79. Fortunately, 1981's adverse trend stopped early, preventing a disastrous year. We would like to think that the "good fortune" in the last half of the year was the direct result of efforts by aircrews, supervisors, maintenance, and the logistics community.

The importance of correctly executing the abort checklist at any speed was again painfully evident. A 1979 Class A mishap was similar to the recent one and shows a need for copilots to closely follow pilot actions. In two cases in 1981 direct action by alert copilots averted or lessened the severity of mishaps.

Awareness of crew limitations, by both supervisors and aircrew members, is critical. Maintaining currency/qualification for pilots flying both fan and nonfan engines should become easier as JT-3D-3B engined aircraft become available. Eighteen aircraft will be reengined with these fan type engines by June 82. The first -135E aircraft was delivered in Jan 82. The military designation of the JT-3D is the TF-33P-102. While the increased availability of fan engine aircraft will provide trainers for fan equipped units, the reengining of 251 other KC-135s with CFM-56 engines could cause the same type of currency/qualification problems in a mixed engine fleet. The more fuel efficient, reengined tanker, KC-135R (9 kits are contracted for installation), appears to be on the way to reality.

TCTO 1C-135-1139 resulted in the replacement of 63 special use aircraft's trim switches with a new, recessed, two-pole stab trim switch. A special order has been placed for enough trim switches to install on the entire -135 fleet. Installation will begin when the new switch[illegible] are received.

Due to an increasing trend in C-135 autopilot malfunctions, including four uncommanded pitch inputs while refueling, OC-ALC is looking at the feasibility of updating the aging autopilot system.

An Air Force-wide special autopilot report is being conducted to determine the extent of the system deterioration and exactly which parts are causing the majority of the problem.

There were three Class B flight mishaps involving C-135s in 1981. Two were multiple birdstrikes damaging two engines. The third was a nose gear up landing due to a missing bolt. The crew did a good job in preventing further damage.

Other C-135 items of interest are:

- After making its way to the top, the ground proximity warning system for the C-135 was cut from the budget.
- Air refueling mishap experience was equal to last year's (better than previous five years). Improvements in many areas were obscured by three problem areas. They are KC-10 nozzle fuse failures, refueling damage to F-16 UHF antennas, and an overall increase in inadvertent contacts between the boom and various parts of receiver aircraft.
- Birdstrikes have shown an increasing trend. It appears that safety offices will have to take more positive actions to reverse the trend.

The C-135 fleet has room for improvement in its safety record. The last year that there were zero mishaps in the C-135 was 1978. There is no good reason not to have a "0" year in 1982. Aircrew performance, supervision, and a sound machine are the cornerstones of a perfect year. ■

KC-10

MAJ ARTHUR P. MEIKEL

■ The KC-10 is a DC-10-30CF modified for Air Force use. The first KC-10A was delivered to Barksdale AFB, Louisiana, on 17 March 1981. By the end of 1981, the 32 AREFS had six operational KC-10s.

Besides the normal safety interest in the growing pains of a new aircraft and crews in a new environment, safety concerns have focused on three main hardware areas. These areas are the refueling boom, the hose and drogue, and aircraft exterior lighting.

The newly designed KC-10 refueling boom incorporates many improvements to the KC-135 boom. The majority of the changes have been successful; however, problems have developed with the "breakaway" nozzle. To preclude the loss of an entire, expensive boom, a structural "weak point" was designed so that only a nozzle would be lost in the event a receiver exerted excessive forces. The weak point is achieved by structural fuses which work similar to the shearpin in an outboard motor. The problem to date is that more force than expected is being generated during normal refueling, and the structural fuses are failing prematurely. To correct the problem, TO 1C-10(K)A-610 directed the installation of a new fuse ring assembly on 8 December 1981.

The air refueling hose/drogue system was initially bothered by hose oscillations during receiver contacts. Hose takeup reel and drogue adjustments have been made to correct the problem.

In order to improve KC-10A aircraft night visibility, three external lighting packages are being installed. A tanker-mounted receiver floodlight will illuminate the air refueling envelope similar to bright moonlight. Forward underbody floodlights illuminate the

KC-10 continued

underside of the KC-10 lower nose. Vertical fin upper surface floodlights illuminate the upper surface areas of the KC-10A. These modifications will assist both boom operators and receivers during air refueling.

The KC-10's cargo-carrying capability and long-range capabilities present many new challenges for SAC crews and staff. Initially, mishap experience has been low, but long-term results of SAC and AFRES programs will become more evident in 1982. ■

C-141

MAJ KURT P. SMITH

■ Safety-wise, 1981 was a good year for the C-141. The Starlifter experienced one Class A flight mishap in 1981, which equates to a rate of 0.3 mishaps for every 100,000 flying hours. Unfortunately, this Class A could have been avoided. The same mishap almost occurred in 1979. The mishap involved the separation of the MLG piston and bogie from the cylinder. Although it remained attached by the torque arms, it separated from the cylinder upon landing, and the aircraft sustained over $200,000 worth of damage.

The single Class B mishap involved the failure of a petal door during an airdrop mission. The failure of the door was the result of unit maintenance failing to properly inspect for delamination. The number of Class C and high accident potential (HAP) mishaps was down significantly with 75 Class C and 63 HAP mishaps reported in 1981. Overall, we can be proud of the C-141 safety record in 1981.

Logistics Mishaps

Flight control and landing gear problems accounted for the largest numbers of logistic related mishaps. The C-141 experienced 37 flight control related mishaps and 24 landing gear related mishaps in 1981. Although 10 mishaps involved the TF33 engine, only three involved actual engine problems. The other seven mishaps were FOD-related.

C-141 flight controls continue to account for the largest number of logistic mishaps. Basically, the problems have been traced to three areas. The first problem area is the rudder power control unit (PCU). The excessive yaw problem is caused by differential contraction between the bearings and input cranks when subjected to low temperature. An improved rudder PCU is currently being installed on the aircraft, however, poor quality control of these PCUs has resulted in additional problems. Quality control has been increased to eliminate these problems.

C-141 FLIGHT MISHAPS, HATRs and CAT I MDRs 1979-81

	Class A	Class B	Class C	HAP	HATR	CAT I MDR
1979	3	4	90	103	55	209
1980	1	0	109	123	25	88
1981	1	1	75	63	30	109

The second problem area is the aileron PCU which exhibits two failure modes. The first mode is a structural failure of the hinge plate caused by fatigue. This results in mechanical binding of the servo valve and a jammed aileron. If this occurs, roll control becomes marginal. The other mode is sluggishness and uncommanded aileron inputs. This is caused by problems within the PCU and can be controlled by shutting down the PCU and using tab operable.

The third problem area is a weak aileron structure. This failure results in a free-floating aileron.

All three of these areas are being addressed. The aileron PCU is going to be modified, the hinge plate strengthened, and the aileron structure beefed up. The modification to the PCU and hinge plate should start toward the end of 1982. The aileron structure beef-up will start in mid-1982.

Landing gear related failures — struts, wheels, tires, brakes — were the second largest cause of logistic factor mishaps in 1981.

Seven out of the 24 landing gear mishaps involved

MLG wheels. Two wheels were improperly installed. Five wheels failed as a result of heat damage during the life of the wheel. The wheel has a service life of 10 years and is overhauled every two years during its life. The last purchase of new wheels occurred around 1970; however, procurement for the next cycle — 1980 — somehow fell through the crack. Although new wheels have been ordered, they are just starting to show up in the field. Inspections have been increased to handle the problem in the interim.

The number of tire failures — four — in 1981 was down significantly. This is a result of the installation of improved tires on the in-board positions. Although a number of old tires are still installed on the outboard positions, failure rates have not warranted their immediate replacement with the new tires.

In addition to the Class

A mishap previously discussed, some old gear problems are still with us. They include one MLG actuator failure and two MLG support structure failures. New actuators are being procured, however, long lead times have delayed their installation. The support structure is the subject of increased inspections for fatigue.

Operations Mishaps

Operations factor mishaps included five taxi mishaps, four air refueling mishaps, and three tail dragging mishaps. The main target of the taxi mishaps appeared to be taxi/runway edge lights and an occasional runway distance remaining marker. While the aircraft damage was usually limited to the tires, we proved runway/taxiway edge lights were no match for a Starlifter. The number of air refueling mishaps — four — doesn't appear to be excessive considering the amount of AR training. There has been no satisfactory explanation for the three tail dragging mishaps early in 1981. Since we haven't experienced any since early 1981, it doesn't appear to be an airplane problem. However, we will continue to monitor the problem.

Twenty mishaps involving cargo problems were reported in 1981. The majority involved the old airlifter's nemesis: cargo improperly prepared and documented for shipment. Unfortunately, we have not found a long-lasting solution to this problem. Load defensively!

The C-141 experienced 15 birdstrikes in 1981. Although birdstrikes have occurred all over the world, Travis leads the "flock" in total number. Two-thirds of the birdstrikes also occur from October through March.

What's New In 1982?

1982 should be a good year for the C-141. The number of flight control mishaps should decrease. With the installation of new rudder PCUs on all aircraft, the chances of experiencing a serious excessive yaw/dutch roll mishap should be greatly reduced. The start of the aileron PCU modification and aileron beef-up should begin to reduce the number of roll problems. The arrival of new wheels in early 1982 should reduce the number of wheel failures. These actions should have a positive effect on the C-141 mishap rate in 1982.

Cargo spills will continue to be a problem. The problem is related to the constant changeover of people within the transportation system and the requirement to continually train these people. The problem becomes particularly acute during exercises and contingencies. Be on the lookout for improperly prepared cargo!

The Stretch Mod should be completed in July 1982, but airframe availability will still be affected by FS 958 outer strap repairs and WS 77 spar cap repairs. The repairs will continue thru FY84. Installation of the new weather radar and emergency locator transmitter (ELT) will be com-

C-141 continued

pleted in Dec 82. Kitproofing of the strobe light installation will occur in Sep 82 and installation should run from Mar 83 to May 84. A new digital flight data recorder (DFDR) and cockpit voice recorder (CVR) should be kitproofed in Aug 82, and installation should run from Jan 83-Feb 84. A new engine fire and overheat detection system should be kitproofed in Jul 82 and installation should run from Jun 83 to Dec 84.

In short, the C-141 is a sound airplane with an impressive safety record. Problems with the flight controls and landing gear systems are being addressed. However, the landing gear problems are forecast to be with us in 1982. Although hardware problems dominate the 1982 mishap forecast, the potential for aircrew type mishaps is always present. The odds of a human error multiply if preflight is less than critically complete, the press for an on-time takeoff override sound judgment of procedures, crew rest or supervision are sacrificed for the last minute high priority mission, etc., etc.

Be on your guard for these problems and don't get set up! Although this is easier said than done, know your limitations! Report potential problem areas! ■

C-5

MAJ KURT P. SMITH

■ 1981 was a great year for the C-5 Galaxy. It did not experience a Class A flight mishap in 1981. This compares favorably to the one Class A that occurred in January 1980. Only one Class B was reported in 1981, which compares favorably to the three Class Bs in 1980. 1981's Class B involved a material failure in the main landing gear (MLG). An electrical interruption in the gear-up circuitry resulted in a shaft failure. The investigators were unable to determine the cause of the interruption. The aircraft sustained approximately $107,000 worth of damage. The number of Class Cs and high accident potential (HAP) mishaps was also down significantly with 20 Class C and 15 HAPs.

Logistics Mishaps

Equipment or material problems accounted for almost half of the reported mishaps. The major logistics problem areas were the TF-39 (8 mishaps), landing gear (4 mishaps), windshield heat transformers (2 mishaps) and leading edge slats (2).

The most significant engine-related problem was a mishap that involved the shutdown of two engines in flight. One engine was shut down for loss of hydraulic quantity/failure of the pumps to depress due to a bad depress valve. The other engine was shut down for a faulty overheat indication. Although other problems complicated this "simulator" flight, the crew was able to overcome them and get the aircraft on the ground safely. Four other mishaps involved familiar engine problems. Two involved engine case penetration/burnthroughs and two involved bleed duct failure on takeoff. Current efforts (1C Update) to improve the TF-39 should continue to reduce the risk of serious engine problems.

Problems with the landing gear resulted in four mishaps, one of which was the Class B previous-

C-5 FLIGHT MISHAPS, HATRs AND CAT I MDRs, 1979-81

	Class A	Class B	Class C	HAPs	HATRs	CAT I
1979	0	2	26	21	6	98
1980	1	3	26	23	7	45
1981	0	1	20	15	2	54

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ly discussed. One of the remaining mishaps involved failure of the gear door actuator, a problem that has been with us since 1976. The actuators fail because defective seals allow water to mix with grease, forming an acid. The acid corrodes the bevel gear and eventually the actuator fails. The problem has been corrected on about half the aircraft and efforts will continue in 1982.

Other gear mishaps involved the "first reported case" of a failure of the MLG slot door and the loss of a MLG wheel due to improper installation.

Windshield heat transformer failures accounted for two potentially serious mishaps in 1981. A TCTO has been issued to replace the aging transformer. This should resolve the problem for another 10 years (useful life for the transformer).

Failure of leading edge slat actuators resulted in two more mishaps. Excessive wear of the actuators during the service life of the C-5 is the cause. Actuators are being swapped out.

Operational Mishaps

Operational mishaps included two jet blast mishaps, one taxi mishap, one air refueling mishap and one mishap involving a stall. The most significant mishap was the stall during an approach. A number of factors were involved in this mishap. They included short-notice SAAM mission, limited info on the destination airfield, one approach plate for the approach flown, fatigue, inoperative stallimeters, poor judgment, and a weak crewmember. All of these factors contributed to confusion in the cockpit. As a result, the pilot failed to monitor his airspeed and eventually stalled the aircraft. The copilot also failed to assist the pilot. Although there are no excuses for not maintaining aircraft control, these factors did set this pilot up for the mishap. As the C-5 project officer, I appreciate the forthright efforts of the mishap pilot to fully disclose all the facts surrounding this mishap. These efforts will surely help prevent a similar mishap.

Cargo spills accounted for five mishaps in 1981. The cause of these mishaps was improper preparation and documentation for shipment. This is a continuing problem, but particularly acute during exercises and contingencies.

What's New In 1982?

1982 should see a slight improvement over last year's mishap experience. Efforts to improve the safety of TF-39 engines and the swap out of gear door and slat actuators will continue to reduce the number of mishaps attributed to these systems. Replacement of windshield heat transformers should eliminate them as a source of our recent cockpit fire problem. The changeover to a less flammable hydraulic fluid (MIL-H-83282) should also reduce the risk of serious hydraulic fires. All these actions should have a positive effect on the C-5 mishap rate. However, we will continue to experience some mishaps with the TF-39 engine, landing gear, and slats until all corrective action has been completed.

The number of cargo spills will continue to be about the same. The problem is related to the changeover of people in the transportation system and the requirement to continually train new people on how to properly prepare shipments. We do not see this changing, so be on the lookout for these types of problems.

A new concern will be what effect the start of the Wing MOD (Feb 82) will have on airframe availability and the status of the aircraft left to fly the mission.

Based on recent history, mishaps involving landing gear and engines are statistically probable. As always, the mission-related pressures and problems will continue to pose problems for the aircrews. The subtle influences of accepting less than mission-ready aircraft, pushing for on-time departures, circadian rhythm induced fatigue, short notice or exercise missions, lapses of supervision, etc., etc., can start or sustain the series of events which occasionally overwhelm the aircrew's capabilities. The point is: don't get set up! This is easier said than done, but know your limitations and report potential problems! And just remember, you have to be tough to fly the heavies. ■

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AIR NATIONAL GUARD

The ANG achieved the lowest aircraft accident rate, the fewest accidents, the fewest aircraft destroyed, and the second lowest number of fatalities in its history. The command flew more than 410,000 hours in a variety of 17 weapon systems while performing critical and diverse operational tasks involving tactical fighter and attack operations, air defense, air refueling, tactical airlift, reconnaissance, and tactical air support activities. Safe mission accomplishment while operating in a demanding flight environment testifies to an effective flight safety program and to the professionalism of aircrews and support personnel.

SECRETARY OF THE AIR FORCE SAFETY AWARD

Major Command That Flies More than 2% of The Total USAF Flying Time

TACTICAL AIR COMMAND

TAC's Class A aircraft mishap rate was the lowest in the past 7 years, sustaining the near record low of the previous year. This achievement was attained while flying nearly 650,000 hours in high-performance aircraft accomplishing a demanding tactical operational mission. Ground safety accomplishments were equally impressive. Not a single military or civilian on-duty operational fatality was experienced, and off-duty fatalities were the third lowest in the history of the command.

SECRETARY OF THE AIR FORCE SAFETY AWARD

Major Command Without a Primary Flying Mission

AIR FORCE LOGISTICS COMMAND

An outstanding reduction in ground accident mishaps was achieved while performing a worldwide logistics mission with nearly 90,000 people involved in complex industrial operations. Not a single military or civilian on-duty operational fatality was experienced, and total military and civilian injuries were nearly 20 percent lower than the previous year. Weapons safety accomplishments were equally impressive. For the third consecutive year, the command did not experience a single Class A or Class B explosives mishap, and the nuclear surety program was excellent.