flying

SAFETY

APRIL 1986

SPECIAL ISSUE

Mishap Review and Forecast

THE HEAVIES

Special Issue

Last year was the best year in Air Force history in terms of aircraft mishaps. It is important we reflect on what the numbers really mean.

In this issue, we take a look at how we did in 1985 in our heavy aircraft. This issue also contains the 1985 USAF Ejection Summary.

B-52

MAJOR JAMES M. NICOL
Directorate of Aerospace Safety

■ Congratulations! The B-52 had its best year ever in 1985. There were no Class A or Class B mishaps. The only other years that approached this record were 1955 and 1976. The aircraft became operational in 1955. In that year, there were no Class As or Class Bs — the same as the 1985 record. However, in 1955, the total flying time was only 4,979 hours compared to 105,191 hours in 1985. In 1976, the B-52 had another exceptional year with no Class As but five Class Bs.

Seven hundred and forty-two B-52s have been built since 1955. In the past 30 years, the B-52 fleet has experienced 90 Class A flight mishaps (through the end of 1985). These mishaps have resulted in 71 aircraft destroyed and the loss of 307 lives. The B-52 has amassed 6,655,816 flying hours, resulting in an overall Class A rate of 1.35. This article will address the B-52's recent mishap experience, trends, current actions, and modifications, as well as the 1986 forecast.

Figure 1
B-52 Class A Flight Mishaps
(1975-85)

Phase of Flight	Ops	Mx
Engine Start		1*
Takeoff		2
Climb	1	
Cruise		2*
Low Level	3	
Landing	1	2
Total	5	7

*Ops Involvement

Mishap Experience

The B-52 force did better than AFISC's 1985 mishap forecast. We had predicted one Class A and two Class Bs.

Since 1975, there have been five operations and seven maintenance-related Class A flight mishaps. Figure 1 shows the phase of flight and whether it was an operations or maintenance-related mishap. The asterisked mishaps under the maintenance column indicate operations involvement (i.e., although the mishap was caused by maintenance or logistics factors, timely corrective action by the pilot(s) could have either prevented the mishap or mitigated the damage).

continued on page 2

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SPECIAL ISSUE

The USAF flight safety success story continues. The bomber community had a 0 Class A rate, and the tanker/transport community had a 0.5 rate. The tanker/transport operations rate was 0.4. In this issue, we take a close look at how we did in our bomber and tanker/transport aircraft.

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DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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For 1985, the B-52 fleet experienced 90 Class Cs and 35 HAPs. Twenty-one of the thirty-five HAPs were loss-of-water injection. Class C and HAPs are important because of the total dollar cost and the trends they may indicate. The Class Cs are broken out in Figure 2.

In 1985, the majority of bird strikes we experienced occurred during the low-level portion of the mission. Pilots and safety observers: Keep at least one visor down. Crews: Have a plan for bird encounters. If you perceive the bird hazard is getting too high, climb out of the hazard area or even abort the route if necessary. Report/relay bird concentrations so those following you are warned.

The physiological/pressurization mishaps varied. Seven involved failure to pressurize or loss of pressurization for various reasons. One was smoke and fumes in the cockpit, and two crewmembers flew with illnesses. The others were isolated.

The water injection problems continued in 1985. Boeing was tasked to obtain a 200-millisecond relay to replace the existing inhibit relay previously installed. The System Manager also instituted tech data changes that will result in 100-percent swap-out of the water system boost pumps, shutoff valves, boost pump check valves, and also will require wet and dry engine trims during PDM. We are looking forward to an early resolution to the water injection problems. The rest of the engine mishaps do not reflect any major trends.

The six weather-related mishaps were the result of static electrical discharges. Flying in light precipitation and within 10 degrees of the freezing level is conducive to static discharges. If the mission will allow, avoid this area by climbing, descending, or altering the route of flight.

Foreign object damage in 1985 did not provide any trends.

Figure 2
B-52 Class C Flight Mishaps 1985

Bird Strikes	43	Dropped Objects	3
Engine Failures	11	Flight Controls	2
Pressurization	7	Takeoff/Landing	2
Weather	6	Aircraft Structure	1
Landing Gear Failures	5	Heating/Cooling	1
Physiological	4	Collision w/Object on Gnd	1
Engine FOD	3	FOD	1

Current Safety Mods

Safety modifications in progress are:

- TCTO 1B-52G-785 changes the engine water injection system electrical circuitry. This modification deactivates water to both engines in a pod if one of the throttles to that pod is reduced. Additionally, it prevents water reinitiation on that pod. This modification is 100-percent complete.
- TCTO 1B-52G-805 installs a diode across the relays in the water injection system to provide a time delay function to these relays. This will help prevent inadvertent loss-of-water injection to engine pods caused by vibrations during takeoff. This modification is 100-percent complete.

Water injection continues to plague the B-52G model. The first two safety mods mentioned above did not totally cure the water injection problems. A third mod is now in progress.

- TCTO 1B-52G-810 replaces the inhibit relay with a 200-millisecond delay relay. The purpose of this relay is to prevent water injection loss to the engines by maintaining a continuous electrical input to the water injection system during minor electrical interruptions. At the present time, the technical experts believe that electrical interruptions are causing premature shutdown of the water injection system to one or more of the engine pods.

■ TCTO 1B-52-2372 will replace the fuel hose between the forward body and center wing tanks. The new hose will be fire resistant and less susceptible to the chimney effect of a forward wheel well fire.

■ TCTO 1B-522-2378 will upgrade the autopilot thus improving the safety, reliability, and maintainability of the autopilot system. This is accomplished by replacing the altitude control, parameter control, main amplifier relay box, coordination control, servo control, and steering coupler with a solid-state line replaceable unit. Roll and pitch information will be taken from the Attitude Heading and Reference System. Maintenance methods and maintainability of the equipment will be improved. Estimated completion date is December 1989.

Other Ongoing Modifications

■ TCTO 1B-52-2255 replaces the centering and squat switches on the right forward, right aft, and left forward main landing gear. Thirty-three aircraft are all that remain to be modified. The estimated completion date is October 1986.

■ TCTO 1B-52-2309 and 2310 will replace the existing air conditioner pack with a unit of larger capacity. Programmed depot maintenance is in progress for this fleet modification. Twenty-five aircraft have been modified, and the program is continuing on track. The estimated completion date is October 1989.

To provide new or improved operational capability is part of the definition of a Class V modification. Two will be addressed.

■ TCTO 1B-52-2252 provides for external cruise missile launch capability. This modification applies to two-thirds of the G and all of the H models.

■ TCTO 1B-52-2253 incorporates the offensive avionics system through replacement of most of the bomb-nav system with state-of-the-art digital equipment.

The Future

Reviewing the B-52's mishap history, one Class A and one Class B flight mishap are predicted for 1986. The Class A will be a collision with the ground. The Class B will be a pilot-induced landing mishap.

The forecast reflects the way we support, maintain, and operate our aircraft. It is based on three assumptions: (1) That we have accurately defined the type 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, or operate our aircraft in terms of policy, procedures, tactics, etc. The forecast also presumes the B-52s will fly 104,520 hours in 1986. Unfortunately, all too frequently, AFISC mishap forecasts are accurate.

You can prove our forecasts wrong. You did it last year; you can do it again. The Air Force's goal is to reduce mishaps this year. Let's continue to keep the B-52 Class A rate and Class B rate at zero. ■

C-5

MAJOR JAMES C. PARRY
Directorate of Aerospace Safety

■ On 28 December 1985, the first C-5B was accepted into the Air Force inventory adding to the 77 C-5A aircraft presently in service. Fifty of the C-5As have the new wing, and all have the improved TF39-1C engines. As the fleet continues to fly more and more hours each year with the new wings, we know the outstanding record of safe mission accomplishment will continue to improve.

This was another banner year for the fleet (for the second year in a row). There were no Class A mishaps and only one Class B mishap. This is the first time since 1972/73 that we have had 2 years in a row without a Class A. As the aircraft's flying time continues to build up and we continue this string of mishap-free years, the C-5's record will continue to approach the milestones achieved by the C-141.

The only Class B mishap of 1985 was a carbon copy of one of 1984's Class B mishaps. During a local training flight away from home station and while on down-wind, a hydraulic line on the No. 3 engine failed, and the subsequent explosion blew off the cowl doors. The aircraft made an uneventful landing. A newly designed and fabricated hydraulic line will be replacing these lines as soon as possible.

This outstanding record of mishap-free flying lowers the C-5 overall Class A mishap rate to 1.61 from last year's level of 1.75. The Class B rate for 1985 was 1.68 (down from 3.48 for 1984), with an overall rate of 2.81. Of the 21 Class B mishaps in the C-5 history, only one has been operator error, 8 were bird strikes, and the others were related to logistics problems.

Figure 1
C-5 Flight Mishaps (1979-1985)

	Class As	Class Bs	Class Cs	HAPs	Total
1979	0	2	26	21	49
1980	1	3	26	23	53
1981	0	1	20	15	36
1982	1	2	31	14	48
1983	2	2	28	18	50
1984	0	2	24	14	40
1985	0	1	27	19	47

Logistics Mishaps

The number of logistics-related mishaps increased last year, and the majority of the problems seem to appear in the landing gear and miscellaneous categories. What appears more telling is that many of these mishaps were caused by maintenance errors. Let's take a look at logistics mishaps by category.

One of the two engine-related

mishaps was a fan blade failure that shook up the aircraft and crew when it departed the aircraft. A better fan blade previously identified for use on these engines continues to be installed on an attrition basis replacing these older blades. The other mishap occurred when a series of oil leaks led to the wear and failure of the No. 5 engine bearing. This failure caused an engine fire on the ground after a mission.

Landing gear problems are still causing their share of mishaps in the C-5. While we did have one mishap with an 82-degree gearbox early in the year, the gearbox problems of previous years are not recurring as frequently. A design problem with the main landing gear torque tubes caused the majority (four) of the problems in 1985. A new tube has been designed and ordered for replacement to correct this problem area. Retraction/rotation problems caused two mishaps, and two bogie pin failures also provided some interesting landings. Of the 15 mishaps in the landing gear systems, at least 6 involved maintenance personnel not complying with directions. This subject will be discussed later. Some that fell in this category included wheels that came off after maintenance was performed, wheel bearing/ axle spacers missing, loose connectors allowing water to enter a box and cause corrosion problems, and improper maintenance resulting in deflated tires. Several nose landing gear problems were also included in this category.

The three slat/flap-related mishaps all involved flap problems. In two cases, the trolley failed jamming the flap and breaking the jackscrew. In the other case, the swing arm failed, also jamming the flap and causing damage.

In the miscellaneous category, there were 14 mishaps. These included an oven fire, three crash data position indicator recorder deployments, two cases where jet blast caused improperly designed refueling panographs to hit C-141 aircraft, two cases where parts of the aircraft (an oil servicing door and a wing panel) departed in flight, a thrust reverser open in flight, a yaw augmentation problem during aerial refueling, two autopilot problems on one aircraft causing hazardous pitch changes in flight, an engine anti-ice duct separation in flight, and a two-engine shutdown for a broken pylon bracket that caused false overheat/fire warnings. In at least six of these mishaps, maintenance factors were involved in the mishap.

In at least a third (12 of 35) of these logistics mishaps, maintenance was the cause. This is much higher than last year.

Operations Mishaps

There were two mishaps in this category. In one of these mishaps, the crew with a gear problem did not complete the emergency checklists and, thus, did not have full nose gear extension on landing. The only other operations-related mishap was jet blast damage. The crew was "ops checking" a repair to a previous hydraulic problem. Unfortunately, the spot they selected to make their high power run was not clear enough, and a fence and some civilian property was blown over by the engine blast. It is always wise to remember the wind the C-5 generates during a high power run.

Other Mishaps

While bird strikes decreased from last year's four to only one in 1985, cargo leaks continue to be an ever-present concern. In 1985, cargo leaks occurred from two helicopters; an MA-3 air conditioning unit, and sealant containers that weren't properly prepared for air shipment Crewmembers need to be on the lookout for suspicious items because once there is a leak, all that is needed to start a fire is an ignition source.

Several passengers had problems with their eardrums when the cabin pressurization was lost due to a bad pressurization controller. Twice this year, C-5 engines had foreign object damage, once when a mechanic left a tool in the engine after performing maintenance and another when a titanium bolt somehow was left where the engine could swallow it.

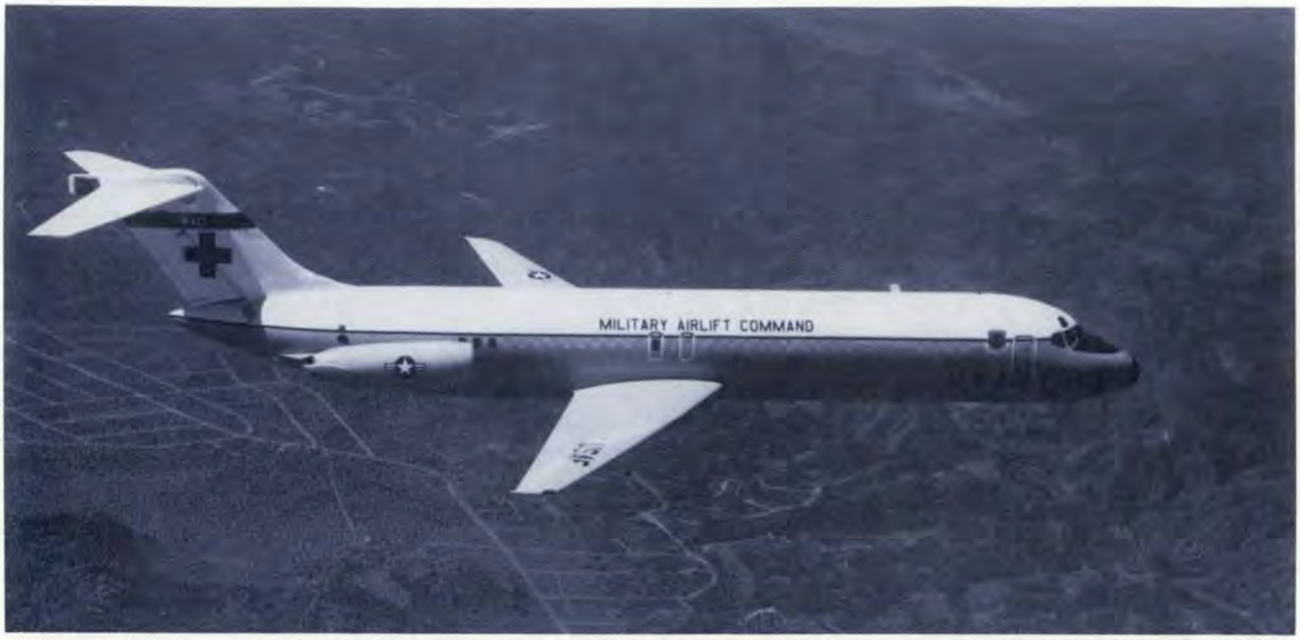
Lastly, a lightning strike while flying IMC near the freezing level resulted in significant damage to the radome requiring replacement of the radome. This mishap was very similar to another mishap earlier in the year, and Lockheed is studying these two radomes to see if there are design changes needed for the radome.

1986 Expectations

The continued outstanding success achieved with no Class A mishaps for the last 2 years and only one Class B is impressive. The outlook for the future is bright. New wings for almost all the remaining C-5A aircraft and the continued delivery of new C-5B aircraft show great promise for a safer and better future. ■

Figure 2
Types of Mishaps (1982-1985)

	1982	1983	1984	1985
LOGISTICS	31½	29	27½	35
Engines	13	2	4	2
Landing Gear	13½	13	9	15
Slats	2	4	0	3
Miscellaneous	3	10	14½	15
OPERATIONS	2½	5	½	2
Taxi	1	2	0	0
Miscellaneous	1½	3	½	2
OTHER	14	16	12	11
Bird Strikes	10	5	5	1
Cargo Spills	2	6	2	4
Physiological	2	2	2	1
FOD	0	0	3	2
Miscellaneous	0	3	0	3



C-9

MAJOR DOUGLAS J. MILLER
Directorate of Aerospace Safety

■ The USAF C-9 fleet sustained another Class A and B mishap-free year in 1985. In over 400,000 hours and 17 years of operation with the Air Force, the C-9 fleet has only experienced 2 Class As and one Class B mishap. Crewmembers, supervisors, and maintenance personnel can be justifiably proud of your professional efforts in achieving this record.

In 1985, the three C-9C special air mission aircraft had one High Accident Potential (HAP) mishap — a main landing gear position sequence control cable was binding. The C-9A aeromedical evacuation aircraft experienced four Class C flight mishaps, two Class C nonflight mishaps, and one HAP mishap. These incidents included a lightning strike, an engine flameout, a turbine failure during climbout, an engine FOD mishap, a broken support bracket, a physiological mishap, and an in-flight loss of all gyro stabilized attitude indications.

The lightning strike incident provides us with some valuable lessons. Even though the pilots had received thorough weather briefings, their plan to fly through a gap in a line of thunderstorms did not work because the storms grew at a faster rate than anticipated. This fact, compounded by misinterpretation of displays on the weather radar, led to inadvertent penetration of a thunderstorm. There were also some misunderstandings as to the capabilities of the weather radar. Frequent weather updates and knowledge of the capabilities and limitations of weather sensing equipment are essential to safe flight near areas of severe weather.

The Class C mishap involving inflight loss of all gyro stabilized attitude indications highlights the importance of thorough troubleshooting and repair of flight instrument malfunctions. Had the crew not correctly interpreted the faulty indications of both of their attitude indicators while in instrument meteorological conditions, a catastrophic mishap could have occurred.

The two cases of engine failures were dealt with effectively and, therefore, serious incidents were avoided. However, we are reminded of how serious an engine failure can become from the crash of a civilian DC-9 in 1985. Engine problems were encountered shortly after takeoff, and the aircraft crashed killing all crew and passengers. Though the results of the NTSB investigation have not yet been published, news reports on the investigation point towards engine problems and pilot error as contributing causes.

In other areas of flight safety, C-9s were involved in eight Hazardous Air Traffic Report (HATR) incidents in 1985, up from seven in 1984. Considering the multiple sortie missions and operations into high density air traffic airfields, these HATR mishaps identify the need for a high state of awareness in clearing and close monitoring of aircraft radios.

The C-9A air evacuation and the C-9C special airlift missions are both challenging. Although the nature of the missions is sometimes urgent, any tendency to "press" weather, directives, or mechanical problems must be avoided to accomplish the mission safely.

C-9 maintainers and operators should be proud. With the same high level of commitment made in 1985, you can continue to keep the C-9 safety record outstanding in 1986. ■

C-12 and C-21

SQN LDR ALASTAIR G. BRIDGES, RAAF
Directorate of Aerospace Safety

■ All 40 C-12F and 80 C-21A aircraft are up and running, and a short review of operations aspects is in order. Both aircraft are used in the operational support role from bases located worldwide, and both are leased systems using contractor logistic support.

Although the C-12F and C-21A have not been with us long, the C-12A has been used in the operational support aircraft (OSA) role for a number of years, and both the Army and Navy use other models of the C-12. The history of these older models throws light on the future for the newest model. The lessons from old C-12 mishaps can be applied to both the C-12F and C-21A to help us avoid the mistakes of history and brighten the light even more in the future.

C-12A Class A/B

C-12A aircraft have been involved in two Class A and three Class B mishaps. The first Class A killed both pilots, as well as three of the five passengers when the aircraft hit rising ground while maneuvering over a crater. The long hours the aircrew were working at that time may have contributed to the mishap by reducing the crew's situational awareness. Today's OSA unit is not overworked. However, crew duty days often start very early and are stretched to the limit. On such missions, the crew should be aware of their own deteriorating performance and treat with utmost caution any suggestion — even if only in the mind — to deviate from the norm.

The second Class A occurred when a C-12A was hit above the cockpit and on the tail by a helicopter when both were turning final. The C-12A landed safely, but the helicopter pilot was killed. C-12 visibility is not good above the cockpit; C-21A visibility is not much better. Both types operate in high traffic density areas with poor visibility and many civilian light aircraft operating under VFR. Many areas have periods of high traffic density and poor visibility combined, but an alert, visual look-out must be exercised at *all* times; this particular Class A occurred on a nice, clear day with only the two aircraft in the pattern.

All the C-12A Class B mishaps occurred on landing. One was apparently a heavy landing. The second was probably a gear-up touch and go; the type of approach probably not allowing the gear warning horn to sound until too late. Both of these mishaps resulted in Class B damage; and if they can occur on a C-12A, then the same mishap can occur on the C-12F or the C-21A.

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C-12 and C-21

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The third Class B was caused by a deer which ran onto the runway while the aircraft was completing its landing roll. The deer struck the nose gear, which collapsed, resulting in bending of all propeller blades. In the past 4 years, 10 deer or coyotes have been hit, 7 on landing and 3 on takeoff, by USAF aircraft. Most of these mishaps occurred in the colder months, with a scattering in the warmer months. In a smaller aircraft, like the C-12 or C-21, the potential for a major mishap is higher than in a bigger aircraft.

Smoke and Fumes

The C-21A has had 5 reports of smoke and fumes in the cabin, one taking 10 minutes to clear. So far no similar incidents have occurred in the C-12F fleet; however, smoke and fumes have occurred in the earlier model C-12 aircraft. MAC intends to test both the C-12F and C-21A aircraft to prove the best method of eliminating smoke and fumes. Aircrews must be so familiar with Dash One procedures they can get on oxygen and quickly accomplish the rest of the procedures in a cabin filled with smoke so thick you can't see the yoke in front of you. Know the procedures. You won't be able to read the checklist.

Lightning

Lightning strikes are an age-old hazard. In 1985, six lightning strikes were reported: Two on Army C-12Cs, one on a C-12F, and three on C-21A aircraft. Most resulted in substantial damage. The Army mishaps resulted in propeller and windshield changes. The C-12F incident also required a propeller change as well as causing damage to an elevator and a flap which had a piece missing. The C-21A incidents resulted in radome, avionics, and static wick damage.

All these lightning mishaps had the potential for disaster, all occurred in clouds, and most included rain and moderate turbulence. However, they also occurred at heights between 18,000 feet and 43,000 feet, with and without thunderstorms on the radar and with or without visible lightning. The only viable conclusion from these mishaps is that lightning may strike at any time without warning, and a combination of clouds, rain, and turbulence may indicate an increased lightning potential.

Specific Problems/Fixes

The C-12F has a history of false fire warning indications and engine shutdowns due to false engine oil pressure indications. In December, one aircraft was fitted with the Systron-Donner Fire Warning System and new oil pressure transducers. These fixes should alleviate false warnings. Modification of the remainder of the fleet is programmed for completion in June 1986.

The C-21A engine rollback phenomenon is proving more difficult to solve. The spurious nature of this problem together with the engine design have presented Garrett (the engine manufacturer), Lear, and ASD with a difficult situation on which they are concentrating much effort while maintaining close contact with the operating units. Aircrew can help solve this problem by following the Dash One procedures when it does occur and by fully reporting all parameters and actions taken.

Conclusions

The C-12F and the C-21A aircraft are new systems for the Air Force. The lessons from past experiences and the growing number of lessons from these two weapon systems must be applied to the future. Learning from others' mistakes is the most appropriate in OSA operations where crews are usually young, and the average experience level is below other transport squadrons. To improve your experience level, learn from past mistakes — don't practice them. ■

C-130

MAJOR DOUGLAS J. MILLER
Directorate of Aerospace Safety

■ Air Force C-130 operators and maintainers sustained a good safety record in 1985 while accomplishing many difficult missions. Over 381,000 flying hours were logged in 1985 which brought the total for the Air Force C-130 fleet to more than 10,600,000 flying hours.

This article will present some of the lessons learned from the C-130 mishaps which occurred in 1985. We'll also look at some trends and other safety issues which those of us in the C-130 business face.

C-130 Mishap Summary

	1984	1985
CLASS As	3	3
Rate/100,000 flight hours	*.8*	*.8*
Destroyed	2	2
Fatalities	18	27
CLASS Bs	1	2
Rate/100,000 flight hours	*.3*	*.5*
CLASS Cs and HAPs	248	238
Rate/100,000 flight hours	*66*	*62*
Bird Strikes	31	41
FOD	25	25
Physiological	19	25
Lightning Strikes	20	17
Foam Fires	10	15
Two Engine Shutdowns	9	12
Flight Control Malfunctions	19	9
Dropped Objects	6	9
Cargo Leaks	3	4
Other	106	157

Class A Mishaps

There were three Class A mishaps in 1985. The first occurred when a C-130 impacted the water on a routine channel mission. All 21 on board perished in this tragedy. In the second Class A, a C-130 was severely damaged when it slid off the runway while landing at a remote site. Finally, the third mishap took place when a C-130 stalled and crashed during a formation airdrop training mission. Six crewmen died, two sustained major injuries, and the aircraft was destroyed. All of these mishaps were ops related.

Class B Mishaps

There were two Class B mishaps in 1985. The first occurred when a maintenance technician's toes were crushed under an extending ramp during an engine running off-load. The second was a gear-up landing. Again, both caused by operations factors.

Class C and HAP Mishaps

C-130 Class C and High Accident Potential (HAP) flight mishaps decreased from 248 in 1984 to 238 in 1985.

For the second year in a row, reportable bird strikes have increased by 32 percent. Increased low altitude operations are a likely factor in these more frequent encounters with our feathered friends. Many

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bases now report locations of high bird concentrations in their operating areas. Noting them and avoiding areas and time of day of high bird activity can help us reduce these expensive mishaps.

There was also an increase in physiological mishaps in 1985. Though they resulted from a variety of factors, a common message from these incidents is that we operate in a hazardous environment. Thorough knowledge of emergency equipment and procedures is essential to be prepared for those occasional occurrences of environmental systems malfunctions.

Fuel tank foam fires were on the increase in 1985. With a larger percentage of the fleet now modified, this is not surprising. Yellow foam with impingement cages and reduced refueling pressures have decreased the number of refueling related fires, but fires started by inflight sloshing continues to be a problem. With 52 foam fires which have occurred in the C-130 since the installation of blue foam began (and none of those catastrophic), it is fairly safe to say that an initial foam fire is not too serious. However, it is very important to check for and track foam fires (i.e., soot in the fuel tank vents or a malfunctioning fuel quantity gauge is a potential indicator that a fire has occurred) in that if multiple fires were allowed to take place in a fuel tank, enough airspace for a catastrophic fire could be created.

One very positive trend in our Class C mishaps was a reduction in the number of flight control mishaps from 19 in 1984 to 9 in 1985. Continued vigilance by our maintainers and operators can keep these problems detected and corrected before they can become a flight hazard.

One Class C mishap which is worth mentioning occurred when several C-130 crewmembers were injured when they encountered severe turbulence. It is easy to become complacent when we routinely operate near areas of severe weather, but it is essential that we do not.

Lessons Learned

There are some valuable lessons to be learned from the Class A mishaps which took place in 1985 which can lessen the possibility of future tragedies. We'll never know exactly what happened in the mishap C-130 that hit the water. But we do know the crew was attempting to fly VFR in marginal weather. "Pressing the limits" can and does kill! Our first two Class As of 1985 occurred in poor weather conditions and unfamiliar locations where the crew was attempting to land at a remote site. In both cases, a decision to try it another day in better conditions could have averted disaster.

From our stall mishap, we learned many of us had some serious misconceptions of finstall characteristics and the time required for one to develop. Also, we were reminded that in critical phases of flight, our margin for error becomes small, and any deviation from our normal flight parameters must be corrected immediately.

Safety Modifications

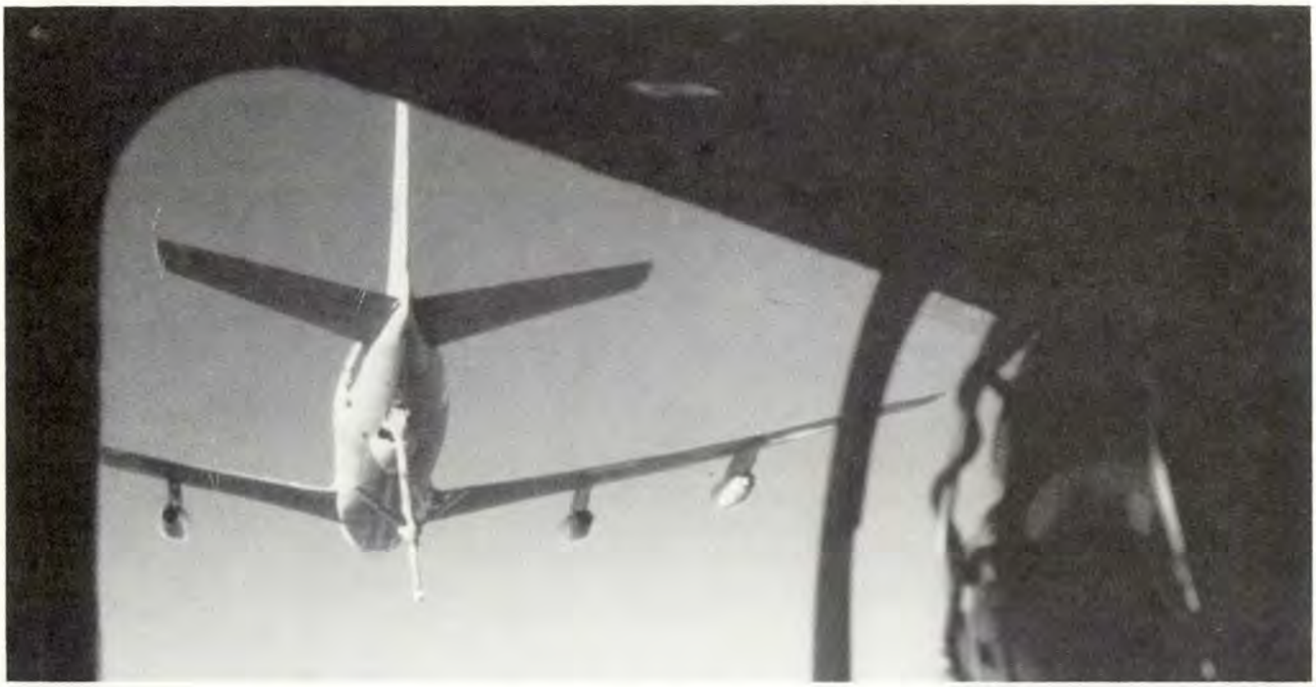
Turning to safety mods and the "health" of the C-130 airframe, the situation continues to improve. The new outer wing modification for C-130B and E models is approximately two-thirds complete. Also, Warner Robins ALC now tracks all C-130 aircraft individually so that the ones which receive the most severe treatment (i.e., assault landings, etc.) will be inspected first.

There are other safety modifications which are progressing. More than one-third of the fleet has been modified with cockpit voice recorders, and a crash survivable solid state flight data recorder is presently in the trial installation phase. With this equipment installed, mishaps which would otherwise be concluded as "cause undetermined," crew actions as well as crash parameters will be known, and faulty components can be identified to expedite corrective measures. Strobe lights will eventually be installed on the C-130 fleet. Technical problems halted an effort for a wing tip strobe light modification. Trial installation of fuselage strobe lights is projected for 1987 with a mod completion estimate of 1991. Strobe lights will decrease the midair collision hazard and, therefore, improve the safety of C-130 flight operations.

The visualator for C-130 flight simulators is also a very positive safety enhancement for the Air Force's C-130 fleet. There are now three visualators in operation (two at Little Rock AFB, Arkansas, and one at Pope AFB, North Carolina). Kirtland AFB, New Mexico, and Dyess AFB, Texas, are scheduled to receive visualators in 1986, and funding has been approved for three more (Clark AFB, Philippines, McChord AFB, Washington, and Pope AFB, North Carolina). These visualators, along with more realistic simulator training scenarios, are allowing us to better prepare for emergency situations.

A lot has been done toward enhancing safety in the operations side of the C-130 fleet, too. MAC conducted an executive review of C-130 Class A mishaps, and many positive actions resulted. CINCMAC's "Primacy of Flight" video sent out a clear message that the primary responsibility of all aircrews is to maintain maximum proficiency in flight operations, and flight safety is never a secondary consideration even in wartime operations. Other review-generated changes which should enhance safety include reinstitution of approach to stall training, more emphasis on basic proficiency flying, crew coordination seminars for all crew positions, etc.

The overall picture for the C-130 fleet is bright, equipment is improving, and procedures and training are getting better. The remaining variable in the equation is you. If you, the C-130 maintainer and operator, sustain a high level of safety consciousness, 1986 can be a great year. Can you do it? Will you do it? Only *you* can do it! ■



C/KC-135

MAJOR RAY GORDON
Directorate of Aerospace Safety

■ In June of 1986, the C/KC-135 will enter its third decade of distinguished service to the Air Force; over 8.4 million hours have been flown. Of the 808 aircraft produced for the US, 742 are still in active service. Unfortunately, 1985 ended nearly a 3-year period without a Class A mishap.

Class A Mishaps

■ An RC-135T flew into a mountain ridge while trying to fly an MLS approach. The crew apparently tried to fly the approach without course guidance while in weather conditions.

■ A KC-135A contacted the runway with an engine during a touch and go. The engine caught fire, and while turning downwind, the instructor pilot allowed the aircraft to stall. All crewmembers on both aircraft were fatalities.

■ Another KC-135A had a nonflight Class A mishap when an auxiliary power unit caused a fire during ground refueling, and the aircraft was destroyed.

For 1986, AFISC is predicting one Class A destroyed aircraft due to a controlled flight-into-terrain (CFIT) landing mishap.

Class B Mishaps

There were no Class B mishaps reported in 1985.

Class C and HAP Mishaps

A look at 1985's Class C and High Accident Potential (HAP) mishap information reveals many similarities and some interesting differences from the previous year. In 1984, there were 111 reports; in 1985, there were 121. Categories with the greatest number of mishaps follow.

Air refueling again accounts for the greatest number of mishaps. Ten occurred while refueling "heavy" aircraft, nine occurred while refueling fighters, and eight occurred while "probe and drogue" refueling with Navy and Marine receivers. In addition, three air refueling "systems" failure mishaps were reported.

Figure 1
C/KC-135 Most Common HAP and Class C Mishaps

	1984	1985
Air Refueling	29	30
Bird Strike	23	18
Pressurization	3	12
Engines	10*	11
FOD	3	8

*There were also 2 Class B mishaps in 1984

Pressurization mishaps jumped significantly in 1985. Causes included failures of hatch seals, outflow valves, automatic pressure controllers, and air conditioning valves. Five of these mishaps were complicated with physiological incidents, including two separate incidents of "bends." Two of these mishaps with physiological problems were particularly significant in that the crew continued the climb to FL 230 in spite of known pressurization problems.

Engine-related mishaps included six J57, three TF33, and two F108 problems. One of the J57 problems included an engine fire caused by a cracked fuel manifold. The crew dumped fuel, landed safely, and egressed as the fire department fought the fire. However, because of the fuel dump sequence, an aft fuel imbalance occurred during firefighting operations, and the aircraft settled on its tail. The J57 fuel manifolds have a known fatigue problem, and a TCTO to increase the life expectancy of the manifold is being accomplished.

Another known problem with the

continued

J57 engine is third-stage compressor blade fatigue. One of these occurred in 1985, and we predict more failures before changeout of all the blades is completed.

Another J57 mishap was a runaway fuel control on takeoff. The crew aborted the takeoff, but the asymmetric thrust caused the aircraft's left gear to depart the runway before the crew could regain control.

Other mishap categories that have been problems in the past follow.

Figure 2
C/KC-135 Other HAP and Class C Mishaps

	1984	1985
Physiological	8	6
Gear/Brakes/Tires	7*	6
Flight Controls	0	6
Crew Error	7	4
Lightning/Static Discharge	2	4

*Plus an additional Class B mishap

The six physiological mishaps noted above were in addition to the five pressurization/physiological problems already discussed.

A nose gear-up landing mishap occurred because an incorrect dust seal was installed, and rubber pieces were lodged in gear actuating mechanisms.

Flight control mishaps include three aileron restrictions and two uncommanded autopilot pitch malfunctions.

Crew errors directly accounted for four mishaps (not including air refueling). These included damaging a wingtip by taxiing into a hanger, blowing a guard shack over during an engine run, and striking an engine pod during landing due to improper crosswind controls.

The fourth mishap occurred when the crew did not ensure a sliding window was properly closed. When the window opened during takeoff, the pilot had to make a heavyweight, high speed abort.

Not to be outdone, maintenance directly accounted for seven mishaps.

Failure to follow checklists, tech orders, work cards, and operating instructions are still major causes of mishaps. Inadequate supervision in both operations and maintenance is cited in many mishaps. Supervisors at all levels must take positive actions to ensure checklists and procedures are followed.

Other Class C mishaps had the potential for even more serious consequences. An electrical system failure resulted in 57 popped circuit breakers, and power was lost to the pilot's instruments, stab trim, navigation aids, and UHF radios, among many others. The crew was able to divert their aircraft to a base with VMC conditions. The cause for the electrical failure was never discovered.

Another mishap occurred when severe turbulence was encountered during descent. The aircraft lost 1,000 feet in 8 seconds, and the crew had to use full aileron to limit the bank to 45 degrees left and right. The aircraft landed safely, but stress cracks were discovered in all forward engine mounts.

In another mishap, the tanker landed on a wet runway with a disengaged antiskid which resulted in blowout of all eight main tires.

Class A Mishap History

The C/KC-135 Class A flight mishap history is rich with stories of failure. A review of almost 30 years of mishap history is vital to remind us of where we have failed in the past. It can also serve to guide the direction of future safety improvements. An analysis and mishap list from all C/KC-135 Class A reports are outlined below. Knowing this list will also make it easier for the field to locate and make specific safety data requests. If you're interested in obtaining this list for safety purposes, AFISC can make it available, subject to AFR 127-4 restrictions. If only one mishap can be averted by learning about others' mistakes, we'll have earned our pay. "Read and heed."

The C/KC-135 has been involved as the primary aircraft in 69 Class A flight mishaps since the aircraft first flew in 1956, for an overall Class A rate of 0.82 per 100,000 flying hours. Fifty-three of the 69 mishaps resulted in at least one destroyed 135, with a destroyed rate of 0.63. At current flying levels, that equates to the loss of approximately two aircraft per year. (The 135 was also in-

volved as the secondary aircraft in 14 other mishaps, primarily during air refueling midair collisions.)

In addition, 6 aircraft have been destroyed in nonflight mishaps, for a total mishap attrition of 62 aircraft. Besides the cost in damaged and destroyed aircraft, 296 crewmembers and 284 passengers lost their lives. Happily, 254 crewmembers and 105 passengers involved in Class A mishaps lived to tell the story.

As expected, takeoff, landing, and air refueling are the primary phases of flight where Class A mishaps have occurred. These account for 67 percent of all mishaps. Let's look at why these are referred to as "critical phases of flight."

Figure 3
Takeoff Mishaps

Engine Failure		12
w/Abort	(3)	
w/Stall	(2)	
CFIT		4
Abort (Other than w/Eng Fail)		3
Stall (Other than w/Eng Fail)		3
w/Flight Controls	(1)	
Crosswind/Turbulence		3
Gear Failure		1
Midair		1
Total		27

As you can see, engine failures account for the majority of takeoff mishaps. Directional control problems, heavyweight takeoffs, premature rotation, takeoff stalls, and disorientation/distraction during IMC account for most mishaps with engine failures. Aborts after S-1 and with low RCR account for other engine failure mishaps.

A CFIT mishap can be defined as one where the pilot "takes a perfectly good airplane and flies it into the ground." Those CFIT mishaps which occurred after takeoff were caused by inadequate crew planning, failure to follow departure instructions, and inattention.

Abort mishaps have occurred after pilots failed to retard all throttles to idle and subsequently departed the runway. One other mishap occurred after two high speed aborts resulted in a brake/wheel well fire.

Takeoff stall mishaps without engine failure have resulted from overrotation and one with a possible rudder malfunction/dutch roll.

Crosswinds, gusts, and turbulence during takeoff have caused stalls due to premature rotation and dutch roll.

Other takeoff mishaps were a nose wheel steering/strut failure and an attempted takeoff and collision with an F-4 on the runway. You will probably recognize some of these mishaps from the legacy of warnings found in the Dash-1. Now let's look at some of the landing problems of the past.

Figure 4
Landing Mishaps

CFIT		6
w/Flight Controls	(1)	
Hard Landing (1 w/Stall)		3
Gear Failure		3
Engine Failure (1 w/X-Wind Control)		2
Stall		1
RCR		1
Animals on Runway		1
Total		17

CFITs again account for a large number of landing problems. And again, they are not new mishaps. Five descended in weather below the PAR glide slope or MDA, and one descended in weather into a mountain on an MLS approach, probably without course guidance.

Hard landings have occurred with out-of-limit forward CG and improperly set stab trim as factors. One also occurred during a steep, idle power approach demonstration which resulted in a stall.

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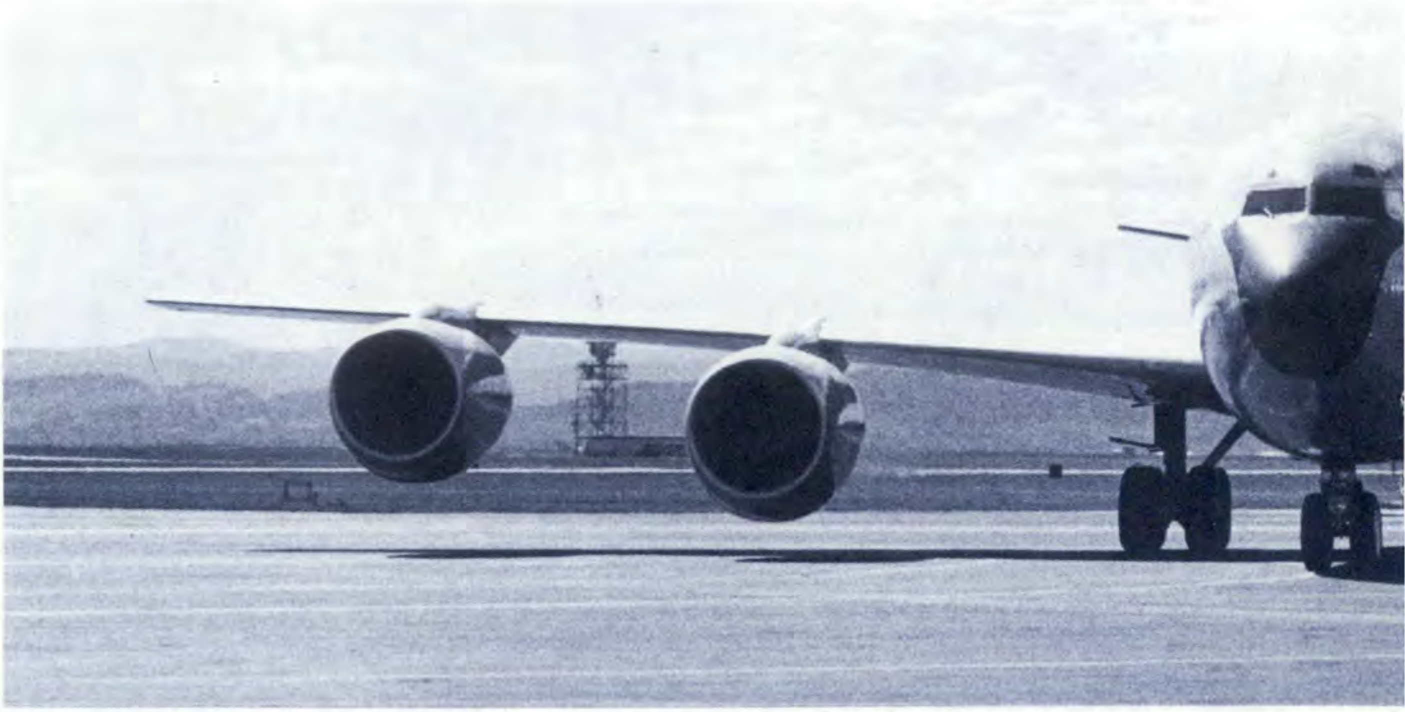


C/KC-135 continued

Defective nose gear struts have accounted for several landing mishaps, and a herd of cattle took the gear out from under another aircraft.

An engine failure partially contributed to one mishap when the aircraft landed short. The crew may also have failed to retract the speed brakes during the approach. Another engine failure mishap resulted from the engine nacelle striking the runway due to poor crosswind directional control.

An overbank and stall in the turn to final occurred during an attempt to avoid overflying hostile territory. Now let's take a look at the last critical phase of flight — air refueling. Here we will also cover other midair collisions.

Figure 5
Air Refueling Mishaps

Boom Receptacle	9
Probe/Drogue	3
Total	12
Midairs (Other than During T/O or A/R)	
Unauthorized Formation	3
Dissimilar Aircraft	2
Total	5

Of the nine boom/receptacle air refueling mishaps, three mishaps resulted when the receiver overran the tanker, two midair collisions occurred during rendezvous, two were the result of the boom striking the receiver, and two more were caused by receiver pilot-induced oscillations. Of these nine mishaps, four KC-135 aircraft were destroyed.

The KC-135's boom drogue adapter has caused three other aircraft losses. An F-100 lost its canopy because of an off-center disconnect; both an F-105 and a Navy A-4 were lost due to ingested fuel from a ruptured hose. All crewmembers ejected successfully.

Several midairs with tankers have occurred during unauthorized formation. One was with a B-52 inspecting a possible engine problem. Another was with a T-39 inspecting a gear problem. One formation of two tankers was lost over the ocean; the cause was undetermined.

The very first C/KC-135 Class A was a head-on midair collision with a T-33. The T-33 was destroyed and its pilot lost. The 135 made it safely back to base. Another KC-135 and crew was not so lucky when a civilian aircraft attempting to fly VFR in IMC conditions struck the tanker during their instrument approach.

Listed below are mishaps in categories other than a "critical phase of flight." Let's take a look at what happened.

Figure 6
"Other" Operations Mishaps

CFIT (Other than After T/O or Before Land)		5
Alert (Other than w/Gear)		3
Weather (Other than T/O)		3
Turbulence/Gusts	(1)	
Thunderstorm	(1)	
Lightning	(1)	
Stall (Other than During T/O or Land)		2
Total		13

The 5 remaining CFIT mishaps make a total of 15 Class A CFIT mishaps. We predict 13 more will occur through the year 2020 unless action is taken to prevent them. Each of these five mishaps occurred when the crew descended below their published approach segment altitude, minimum safe altitude, or last assigned altitude.

Through 1980, alert exercises were

classified as flight mishaps. Three episodes occurred including one during a night alert taxi where two aircraft collided, one where a crew tried to taxi without hydraulic pressure for brakes, and another where the crew taxied their wing into a light tower while returning to park.

Weather plays a role in many mishaps, but deserves the primary blame for the following three: One aircraft tried to climb over a thunderstorm at FL400 but didn't make it; one encountered severe turbulence about 5 minutes after takeoff and lost control; and another lost part of its wing due to a lightning strike.

Stalls other than during takeoff or landing have accounted for two mishaps. One occurred during a flight test of a modified external configuration when the aircraft entered a stall and spin and threw off an engine before it could be recovered. The second stall mishap occurred during an attempted turn at low altitude and low airspeed. Prior to takeoff, the crew experienced a long delay at the end of the runway in very cold weather without heat available. After takeoff, the gear failed to retract which distracted the crew prior to the stall.

The last category that will be covered is mishaps involving aircraft systems.

Figure 7
Aircraft "Systems" Mishaps

Flight Controls (Other than During T/O or Land)		3
Gear (Other than During T/O or Land)		2
During Alert Taxi	(1)	
Fuel System		2
Ground Operations		1
Undetermined		1
Total		9

Flight controls have been blamed for three mishaps in phases of flight other than during takeoff or landing. One was a vertical stab failure which occurred either during a turn series or possible dutch roll demonstration. In the second mishap, the crew radioed a report of vibration from an undetermined source before the aircraft was lost and never recovered. The last mishap was a stab trim or autopilot malfunction which led to an "upset" maneuver and in-flight breakup.

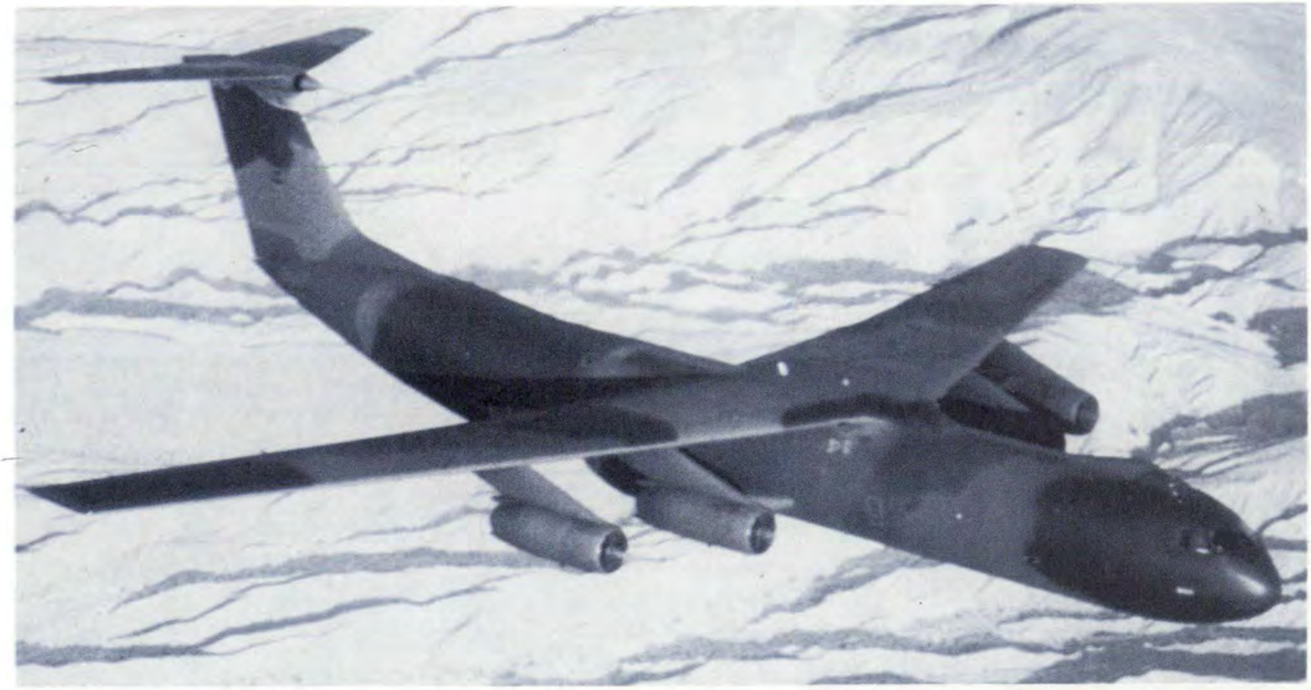
Gear problems don't always happen during takeoff or landing. Two happened during taxi. One was a main landing gear support failure, and the other was a nose strut failure during an alert taxi.

Body tank fuel leaks have led to two in-flight explosions. Another mishap was blamed on a starter that exploded and caught fire during engine start. Finally, one aircraft was lost in the ocean for an undetermined reason and never recovered.

Historical Comparison

It's also interesting to compare the causes of 30 years of Class A mishaps with some of the causes of 1985's Class C mishaps. Except for the magnitude of loss, many of the causes are the same. Usually the only difference is a combination of other factor(s) which add up to a destroyed aircraft and lost crew.

You can see from this article why all of us — commanders, supervisors, safety officers, and crews — must be concerned with determining the causes of all mishaps. All mishaps start with someone. What can you do? What are you doing to prevent the next one? ■



C-141

MAJOR JAMES C. PARRY
Directorate of Aerospace Safety

■ The C-141 is one of the safest aircraft ever to have flown in the United States Air Force. With over 7,400,000 flying hours to its credit, it has only had 28 Class A mishaps for a truly remarkable rate of 0.377 mishaps per 100,000 flying hours. It has carried more goods around the world than any previous military aircraft. The C-141 is performing its role as both a strategic airlifter and a tactical airdropper while using its air refueling capability with unsurpassed success. This airplane for all missions and all seasons continues to lead the MAC fleet.

In 1985, the C-141 had zero Class A or Class B mishaps, a first since 1972. While this is great news, several of the Class C and High Accident Potential (HAP) mishaps in 1985 came close to being costly. Thrust reversers opening in flight; tail or belly scrape mishaps; coffee maker, radar altimeter, windshield heater electrical fires; engine and fan blade disintegrations; steering paddles problems and a lightning strike all caught our attention because of the potential for very serious consequences. With 137 of these Class C and HAP flight mishaps, we should take a look at any trends that are apparent.

Logistics Mishaps

The number of these types of mis-

Figure 1
C-141 Flight Mishaps (1979-1985)

	A	B	C	HAPS	TOTAL
1979	3	4	90	103	200
1980	1	0	109	123	233
1981	1	1	73	66	141
1982	1	0	66	74	141
1983	0	2	77	73	152
1984	1	0	73	49	123
1985	0	0	84	55	139

Figure 2
C-141 Mishap Comparison

	1981	1982	1983	1984	1985
LOGISTICS	76	60	53	60	57
Flight Controls/ Autopilot	37	18	13	14	12
Landing Gear	24	10	18	7	3
Engine Thrust Reversers	0	0	0	4	17
Brakes	0	0	0	5	6
Misc (No Trend)	15	32	22	30	19
OPERATIONS	15	13	23	18	23
Taxi Mishaps	5	1	3	1	4
Air Refueling	4	2	3	2	2
Belly Scrape	3	2	8	1	6
Misc (No Trend)	3	8	9	14	11
OTHER	50	68	76	45	59
Cargo Spills	19	29	31	5	12
Bird Strikes	15	20	25	15	19
Engine Fod	7	8	10	8	9
Physiological	7	6	2	5	15
Misc (No Trend)	2	5	8	12	4

haps remained about the same as previous years; where they occurred and did not occur is significant. The No. 2 escape hatch problems of the last several years seemed to have vanished with the new rigging procedures. The very significant recapped tire failure problems of 1984 did not recur in 1985. The short-term solution of special care, placement, and pressure checks of the recapped tires has helped, but the long-term solution of new improved tires is still under consideration. As stated above, unplanned thrust reverser opening in flight skyrocketed with 11 mishaps in 1985. The rerigging TCTO issued in October seems to have corrected the problem.

Flight control-related malfunctions remained about the same, with the autopilot system seeming to cause most of these hazardous changes in flight. The age of the avionics may be catching up with the aircraft, and the preparedness of our crews to monitor the system remains more than ever a strong requirement.

Landing gear problems decreased from previous years' levels, but the age and health of the components like the bell-cranks require careful monitoring for trends. Several significant engine failures occurred besides the 11 thrust reverser problems. Overseas, a turbine blade failed which could have led to a much more serious mishap. An engine fire occurred when a starter unit sheared, and an engine disintegration also made the day for another aircrew.

Brakes and antiskid problems are still occurring. The aircrews and maintenance people need to check these areas closely as the aircraft gets more and more into a tactical, short field role.

Under miscellaneous, three times during the year, life rafts deployed in flight and departed the aircraft. Unexplained fuel jettisoning on one mission got the crew's attention very quickly. Flipped nose landing gear steering paddles raised a lot of interest, especially when one crew visited the grass on the side of the runway. Flaps and spoilers being asymmetric also can make for some interesting maneuvers.

Operations-Related Mishaps

Operator-error mishaps took a step in the wrong direction in 1985, increasing to 23, or about 17 percent of the mishaps. This is not a favorable trend. Taxi mishaps jumped up to four mishaps this last year occurring at Goose Bay, Rhein Mein, Kwajalein, and McGuire. Only two air refueling mishaps occurred last year.

Unfortunately, tail scrapes increased again. We have a history of 20 tail scrapes in the C-141B and to have 6 in 1985 is definitely an undesirable trend. Two of these were especially noteworthy when the aircrews failed to use the landing data they had in front of them and failed to change their command markers. The resultant low speed almost allowed the aircraft to stall onto the runway resulting in significant damage. All aircrew members need to be aware of what's going on, especially the pilots, to ensure we fly the aircraft and not become complacent or rushed about flying.

The miscellaneous category included several ramp rollers that were dropped out the back of the aircraft, a coffee maker that was turned on without enough water in it, a crew that took off over a barrier causing damage, a food poisoning episode, a large piece of rolling stock that was not properly tied down, some crewmembers who were injured when clear air turbulence was encountered, and some ramp damage that occurred during an engine running offload maneuver.

Operations-related mishaps are the hardest ones to prevent, and it is only through the dedication and professionalism of supervisors and crews that we can turn this trend around.

Other Mishaps

The large increase in mishaps in this category are clearly highlighted in the physiological, cargo spill, and bird strike numbers. Cargo spills increased by 150 percent, and this points to the fact that we are hauling more and more hazardous materials for exercise deployments. We must ensure adequate joint inspections are accomplished on the materials and vehicles we are carrying. Further, loadmasters must be aware of the preparation requirements for the cargo they are accepting for air shipment so they can be prepared to handle it should a problem arise inflight, and A/Cs must be aware of the kinds and extent of hazardous cargo they're carrying. The A/C is ultimately responsible.

Bird strikes are occurring all over the world from Mildenhall to Clark. Four of last year's occurred around Travis, so be on the lookout for our feathered friends.

In the physiological arena, hypoxia, hyperventilation, passengers passing out, inhalation of fumes from cargo, dehydration from the chemical defense warfare ensemble, decompression, and sinus blocks all appeared in our aircrews. If you aren't prepared to fly or aren't prepared for the conditions you may encounter, then you could be the next mishap.

Engine damage due to foreign objects also occurred all over the world, but especially in the Pacific area like Cubi Point and Kadena (both twice); a word to the wise. Finally, in the last category of miscellaneous, three of the four in this area were lightning strikes while flying IMC near the freezing level, just as one might suspect.

C-141 Safety Record and Expectations

The outstanding record of safe mission accomplishment is directly attributable to you, the aircrews and maintainers, who do an outstanding job every day all over the world. Your dedicated efforts and desire for excellence have brought this aircraft to this unparalleled achievement. The challenge continues to keep this proud aircraft flying and flying safely. ■

E-3

MAJOR RAY GORDON
Directorate of Aerospace Safety

■ At the end of 1985, the TAC E-3 fleet had flown 172,916 hours since becoming operational in 1977. Last year the fleet flew 29,594 hours. There have been no Class A mishaps in the aircraft's history.

The only 1985 Class B occurred when an integrated drive generator (IDG) explosion and fire caused extensive damage and loss of an engine cowling. An over-pressure in the IDG split the case and severed fuel lines. Three other similar generator failures without fire have occurred, two of which were also in 1985. Water contamination from oil servicing carts contributed to these failures. Several actions are being considered to improve reliability and minimize failure damage, including installing a pressure relief valve and a new thermal switch.

A comparative look at 1984 and 1985 Class C and High Accident Potential (HAP) flight mishaps follows.

E-3 Class C and HAP Mishaps

	1984	1985
Air Refueling	2	0
FOD	2	0
Bird Strike	1	0
Engines	1	0
Lightning	1	0
Fuel System	1	0
Physiological	1	1
Electrical	0	6
Dropped Objects	0	3
	9	10

Excellent progress has been made to reduce problem areas identified in 1984. The only physiological episode was a case of appendicitis. The point to be made here is "don't try to become your own doctor." Symptoms occurred well before the flight, but the individual decided to fly in spite of pain and nausea.

Two of the six electrical mishaps were generator failures which were discussed above. Three of the other four were HAPs which involved fires from defective switchlights. The switchlights have a known design deficiency, and a TCTO is being implemented to retrofit the fleet with improved switchlights. Until the entire fleet is modified, however, the potential is high for more electrical fires.

Flight crews should continue to be aware of this potential and should know their firefighting and smoke elimination procedures "cold." The remaining electrical mishap occurred when a chafed electrical wire shorted on an equipment cabinet.

Three mishaps were reported when objects were lost in flight. One was an inadvertently deployed crash position indicator, and the other two were engine strut kneecap fairings. When one of these fairings was lost, an oil scavenge line was severed dictating an engine shutdown.

Safety issues for the E-3 seem to gravitate toward electrical problems and the potential for fire. With switchlight problems, electrical cable chafing, generator failures, etc., it is imperative that crews be trained and prepared to immediately implement smoke elimination and firefighting procedures as necessary. The proposed modification for fume detectors in the lower lobes will give needed early warning of smoke, fire, or toxic gases in hard to reach areas.

Recent Air Force safety initiatives have resulted in procurement of improved protective breathing equipment for passenger-carrying aircraft, including the E-3. Other commands are currently validating the effectiveness of in-flight smoke elimination procedures for aircraft similar to the E-3, including the C-18, C-137, and C-135.

Another needed modification is the addition of a ground proximity warning system to help prevent the controlled flight-into-terrain (CFIT) mishap. Based on the mishap history of aircraft with similar-type missions, we forecast one or two CFIT mishaps during the expected life of the E-3. According to current cost estimates, this would save $26 for every $1 spent for this modification. We think this modification makes sense and should be pursued aggressively.

In 1985, the Air Force achieved its best safety record ever — 1.49 mishaps per 100,000 flying hours. Professionalism is synonymous with "safety," and the E-3 community can be justifiably proud of the professional attitudes and safety achievements of its crews in 1985. In addition, the Class A forecast for the E-3 fleet is "zero" for 1986. Congratulations. However, AFISC forecasts a 1.61 Class A rate for the Air Force as a whole, with 39 "ops-related," 15 "log-related," and 3 "other" mishaps. It's clear that supervisory involvement must be directed in the "ops" arena at all levels to prevent the next Class A mishap.

The safety goal for the E-3 community should continue to be zero mishaps, as manifested by your past successes. However, this goal cannot be achieved without hard work and vigilance on everyone's part. Only *you* can meet the challenge to maintain your E-3's superb safety record. ■

KC-10

MAJOR RAY GORDON
Directorate of Aerospace Safety

■ In 1985, the KC-10 fleet continued to grow both in size and in mission support capability. By the year end, 39 of the projected 60 aircraft had been delivered to tanker units at Barksdale AFB, Louisiana, and March AFB, California. A new tanker unit will be activated in 1986 at Seymour-Johnson AFB, North Carolina. The KC-10 continues to exceed all expectations for reliability and effectiveness in its tanker/cargo role. Since the aircraft first flew in 1981, the KC-10 fleet has flown 66,019 hours, 24,582 of which were flown in 1985. The KC-10 has also maintained an excellent operational safety record, with no Class A mishaps and only one Class B mishap in 1984 (FOD).

Class C Mishaps

In 1985, 20 Class C mishaps were reported which involved the KC-10 as either the primary or the secondary aircraft. In comparison, 1984 had one Class B and eight Class C mishaps reported; additionally, one Class A mishap occurred during air refueling with a Marine A-4, but it was not charged to the KC-10.

By far, the largest mishap category involves air refueling. Let's look at what happened:

Figure 1
KC-10 Air Refueling Mishaps

As Tanker	
w/Damage to Receiver	6
w/Damage to KC-10 Boom	2
As Receiver	
w/Damage to KC-135 Boom	2
w/Damage to KC-10 Recep	1
Total	11

Eleven Class C air refueling mishaps were reported in 1985. (In comparison, there were three boom-related and two drogue-related Class C mishaps reported in 1984.) As the "tanker," the KC-10 damaged six receivers: Four F-4 and one F-111 receiver aircraft had their air refueling receptacle damaged; the sixth mishap involved a probe and drogue system malfunction. (The hose reel takeup system apparently failed, and the resulting hose oscillation broke a Marine F/A-18's probe. This type of failure also caused the 1984 Class A mishap to a Marine A-4.)

Conversely, the KC-10's air refueling boom was damaged in two mishaps. The first was a system malfunction where the polarity of the boom roll position transducer was reversed. This caused uncommanded rapid roll oscillations and resulted in damaged boom components. The second mishap was a hard contact with an F-15 which damaged the KC-10 boom chain and sprocket drive.

As a receiver, the KC-10 damaged two KC-135 air refueling booms by exceeding the inner air refueling envelope limit. In addition, one KC-10 receptacle was broken when the pilot fell below the KC-135's lower elevation limit. Before a disconnect could be made, nozzle binding and receptacle damage occurred.

In a comparison with other 1984 Class C mishaps, 1985 also shows increases:

Figure 2
KC-10 Other Class C Mishaps

	1984	1985
Bird Strike	1	2
Tires	0	2
FOD	1*	1
Physiological	0	1
Dropped Object	0	1
Flight Controls	0	1
Depart Taxiway	0	1
Engine	1	0

* Plus one Class B mishap in 1984

Of two bird strikes, one damaged an engine, and the other damaged a flap. The two tire mishaps involved almost identical nose wheel tread delaminations with associated wheel well damage.

An engine core cowling was lost in flight due to a forward latch failure. Because of this mishap, more frequent inspections will be performed on cowling latches. Another mishap was reported when the crew chief discovered an outboard elevator wrinkled and buckled.

Another mishap involved a KC-10 taxiing off the load bearing portion of the taxiway at a deployed location. Guidance was found to be inadequate for the planned taxi operations, and supervisors did not ensure crews were aware of taxi limitations. Also, the mission briefing did not address airfield hazards, the pilot failed to ensure he would not taxi onto the asphalt taxiway shoulder, and the SOF failed to intervene during the mishap.

Future Expectations

With the growth of the KC-10 fleet and the expansion of its operational commitments, more pressure will be placed on the KC-10 operations community. In 1986, training programs will become even more important as the required experience levels of new pilots drop. The learning curve for KC-10 pilots with low previous experience in receiver air refueling is also likely to become evident in mishap statistics. More frequent air refueling commitments with Navy and Marine receivers may increase mishap numbers, and operations from more forward operating locations will further challenge crews and supervisors.

Remember, *you* prevent mishaps. Operators — commit yourselves *now* to ensure you are prepared to handle any emergency. Maintainers — commit yourselves similarly. The hard work and professionalism of all KC-10 operators and maintainers has resulted in an excellent safety record of which you all can be proud. Make 1986 another outstanding year! ■

Helicopters

MAJOR PHILLIP T. SIMPSON
Directorate of Aerospace Safety

■ The 1985 helicopter mishap record showed significant improvement over that of 1984. During the past year, there were two Class A mishaps and one Class B mishap. One of the Class A mishaps resulted in seven lives lost while the other two mishaps resulted in several injuries but no fatalities. The 1985 mishap experience by category is shown in Figure 1.

Figure 1
Class of Mishap

	A	B	C	HAP
H-1	0	0	21	20
H-3	1	1	17	8
H-53	1	0	12	10
H-60	0	0	2	3
Total	2	1	52	41

During an attempt to rescue a crewman off a boat at sea, an HH-53 experienced structural problems while in a hover. The aircraft crashed into the ship it was hovering over resulting in seven fatalities.

An HH-3E was attempting to land on a glacier to rescue a downed civilian pilot. During a go-around attempt, the aircraft inadvertently contacted the ground and rolled over.

The only Class B mishap of the year occurred when an HH-3E was on final for a practice instrument approach. An engine exploded causing not only loss of the engine but also an oil-fed fire in the cargo compartment. The crew landed in an open field sustaining one major injury and two minor ones.

The total number of HAP and Class C mishaps remained the same as 1984. This year, we experienced 41 HAP and 52 Class C mishaps. Figure 2 breaks these mishaps down further.

Figure 2
HAP and Class C Mishaps

	H-1	H-3	H-53	H-60
Rotor System	2	0	1	0
Flt Controls	2	2	3	0
Engines	15	6	8	2
Drive System	8	3	2	0
Fuel System	2	0	2	0
Aircrew	3	1	3	1
FOD	1	4	0	0
Misc	8	9	3	2
Total	41	25	22	5

H-1

Once again, the Huey fleet had the largest share of Class Cs and HAPs. This has been the case over the past several years. Engine problems top the list with 15. There were four flameouts reported — all on the ground. Two engines had to be shut down in flight. Drive system problems were again the second most common mishap with a variety of gear box malfunctions occurring. The aircrew mishaps included two physiological incidents and an engine failure caused by misidentification of a switch.

H-3

Engines remained the number one problem area in the H-3 fleet again in 1985. Four of these missions involved flameouts. The number of FOD incidents doubled to four. There were also three mishaps involving M-60 machine guns. One aux tank was hit, a round was put into the floor, and a barrel fell off during flight. Main transmissions are being totally rebuilt by Sikorsky and should be installed in the remainder of the fleet this year.

H-53

The engines continued to produce the most mishaps in the fleet in 1985. Four of the eight engine mishaps were fuel leaks. One more tail pylon hinge fitting crack was discovered, down from two in 1984. The aircrew mishaps included a tailskid strike during landing and a wire strike.

H-60

The H-60 fleet had a good year with only five mishaps reported. The most serious was an engine failure during flight. Other mishaps included the alternator, the de-ice system distributor harness, and a crewmember ear block.

Summary

In summary, one of the Class As and the Class B were logistics-related mishaps. The vast majority of the Class C and HAP mishaps involved logistics factors. Identified logistics problems are being worked, but the helicopter fleet is aging, and we can expect more mechanical and material problems. We, as operators and maintainers, need to be aware of this and make an extra effort to find logistics problems before they become mishaps. Aircraft inspections, whether done by maintenance or by the aircrew, need to be demanding and thorough. Use checklists and tech orders and avoid shortcuts.

The other Class A mishap was operations related, and this is an area where aircrew members, commanders, and supervisors can have a direct impact. After a mishap, it's easy for the mishap board to identify all the mistakes and deficiencies that resulted in the mishap. The trick is to find and correct the deficiencies before an aircraft is damaged and people are hurt. Everyone involved in operating our helicopter fleet, from commanders to aircrew members, must demand top quality performance every time we fly.

In 1985, we had a good year with the number of Class A and Class B mishaps being half the 1984 numbers. Our goal is to not lose a life or an aircraft in 1986. It can be done if we commit ourselves to do it. ■

Safety Warrior

WARTIME SAFETY

RICHARD W. HULING, Ph.D
AFISC Historian

■ Unquestionably safety has become an integral part of the flying mission — at least in peacetime. But what about war? In the crucible of battle do we really have the luxury of safety programs — and does it really make any difference anyway?

A World War II general gives us an excellent example of how a vigorous safety program actually did work in a combat theater and how safety made the difference in the success of the mission. In his lively memoir, *Over the Hump*, republished by the Office of Air Force History in support of Project Warrior, General William H. Tunner recalls his stint as commander of the crucial India-China airlift during the last year of World War II.

In the 1940s, the very concept of military airlift was in its infancy. In fact, the India-China airlift had only been reluctantly called into existence by a ground-oriented command because a deadly combination of Japanese and geography made the better-known Burma Road somewhat less than efficient.

The purpose of the airlift: To carry enough supplies into Western China to keep the Chinese in the war. A Chinese military presence tied down approximately two million Japanese troops — troops that otherwise could be used against US forces in the Pacific.

When General Tunner arrived in India in the summer of 1944, the airlift had been in operation about 2 years. Its performance was barely adequate in terms of tonnage transported, but the major problem was safety. General Tunner described the situation:

"Here, in a strange land far from home, on the fringes of a mysterious backward civilization, were all the conditions that bring hazardous flight: Fog, heavy rain, thunderstorms, dust storms, high mountains, a necessity for oxygen, heavy loads, sluggish planes, faulty or no radio aids, hostile natives, jungles, and one-way airfields set in mountainous terrain at high altitude."

As tonnage had gradually increased during the airlift's operation, so did the mishap rate. In January 1944, the accident rate was 1.97 — per 1,000 flying hours!! Every 200 trips over the hump cost one airplane; for every 100 tons flown into China, 3 Americans died. As General Tunner put it:

"Not only was the accident rate alarming, but most of the accidents were washouts — total losses, with planes either flying into mountain peaks or going down in the jungle. In many of the cases in which there was reason to believe that some or all crew members had been able to parachute from their planes, the men were never seen again. The jungle had simply swallowed them up. The combination of a high accident rate with the hopelessness of bailing out was not conducive to high morale in the flying crews."

Certainly an understatement.

In WW II China, General Tunner proved safety considerations are essential to efficient operations.

General Tunner soon identified a major problem. All efforts up to that point had concentrated on increasing tonnage, the prime indication of mission success. But all consideration for safety had been ignored. Night flying had been introduced on the Hump, although radio communication and navigational facilities were nonexistent except at the terminals. Weather conditions were virtually ignored; the common saying was "there is no weather on the Hump." Many planes flew in violation of standard Air Corps specifications. As one report indicated: "If Air Corps technical orders were now in force, I doubt that there would be an airplane in the air."

General Tunner's challenge became immediately clear: Increase tonnage *and* lower the accident rate, seemingly contradictory actions in a wartime environment. Yet the record shows the two were not at odds at all. By instituting a safety program that seems obvious to us today, it became possible to change the whole tenor of the airlift.

What was the program? Nothing more than the basics distilled into four main points: (1) Analysis of existing flight and maintenance procedures and practices, (2) statistical investigation and analysis of accidents, (3) recommendations for the correction of faults revealed in the foregoing analysis, (4) prompt action and follow-up on that action.

In particular, General Tunner and his staff carefully investigated the training of the pilots and made up for any gaps before sending them over the Hump. They began to take weather and communications seriously (there *was* weather on the Hump) attacking such conditions as icing and turbulence and becoming more familiar with navigational equipment and how to best deal with its absence.

Another major area was one we hear much about today, particularly in the area of human factors — pilot discipline. General Tunner was very specific about the use and importance of the checklist, an aid which told the pilot "the exact procedure he must follow from the time prior to starting the engine to that following his cutting it off at his destination. We found planes without checklists and pilots who didn't bother." Both situations had to be corrected.

Briefing and debriefing, according to General Tunner, lay at the heart of the program:

"Briefing and debriefing proved to be of the greatest importance. Briefing involved not only a thorough preparation of the pilot for the route he was to take, but a check to make certain that the crew was competent to make the proposed flight safely. Debriefing would show up incompetent flight procedures, indicating the necessity for corrective action and additional training. Debriefing also provided our best weather reports."

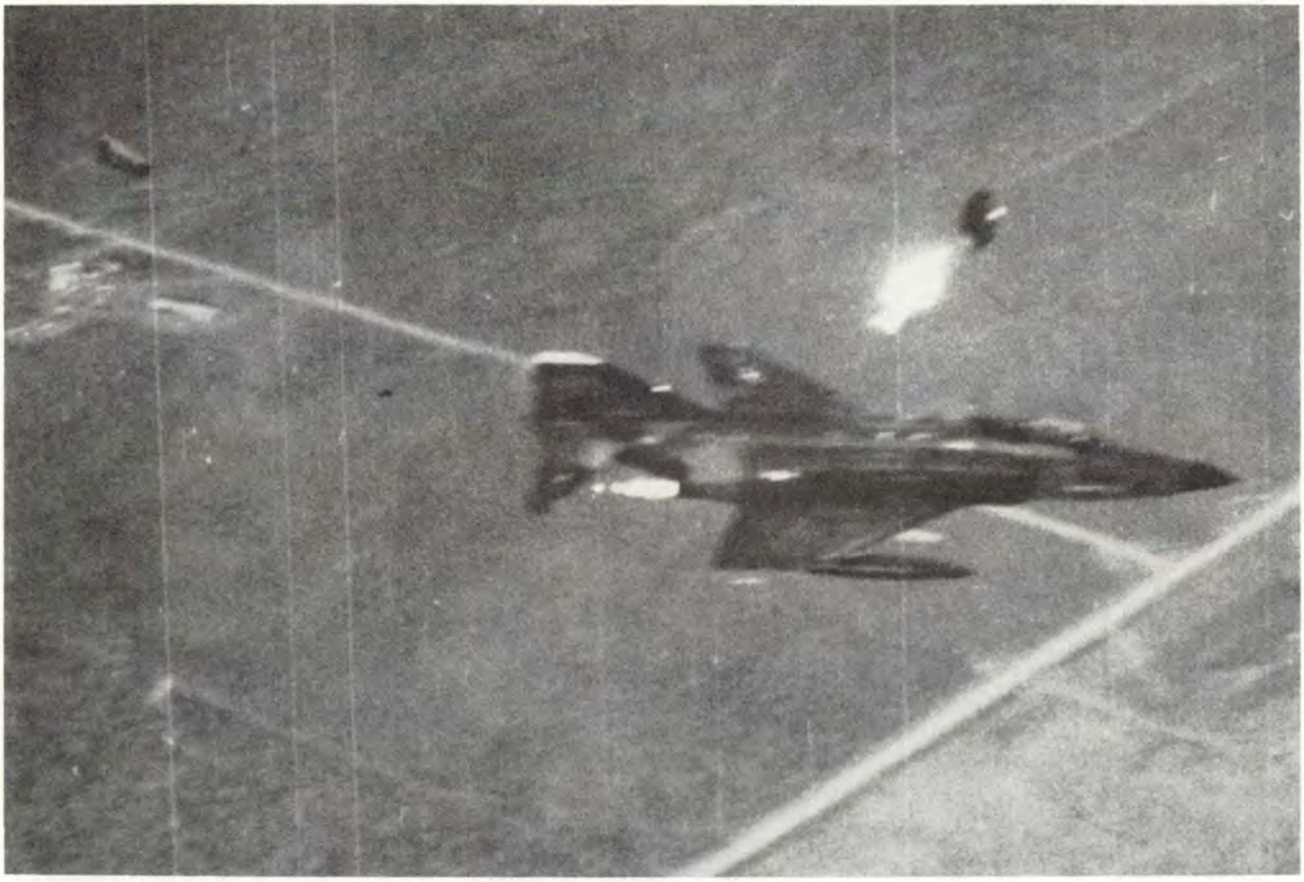
Did all of this work? In August 1944 (just before General Tunner's arrival), they airlifted 23,000 tons to China with an accident rate hovering around 2.0 per 1,000 flying hours. In January 1945 with close to 40,000 tons airlifted, the accident rate dropped to .301. By July 1945, total tonnage jumped to 71,042 with an accident rate of .239. During August, the final big month of the airlift, 20 planes were lost during 136,000 flying hours bringing the accident rate down to .154 per 1,000 flying hours. General Tunner makes the statistics come to life by looking at them another way:

"If the high accident rate of 1943 and early 1944 had continued, along with the great increase in tonnage delivered and hours flown, America would have lost not 20 planes that month, but 292, with a loss of life that would have shocked the world."

Serious military airlift was born in this distant theater on the almost forgotten edge of the twentieth century's greatest war. Along with it, however, came safety. Especially the realization that safety was a necessary part of the success of a wartime mission. ■

The thorough briefings and debriefings established by General Tunner revealed incorrect crew procedures and the necessity for better training and crew discipline.

The accident rate was alarming in both losses of aircraft and crews. The hopelessness of surviving a crash was a very demoralizing aspect of flying the hump.



1985 USAF Ejection Summary

RUDOLPH C. DELGADO
Directorate of Aerospace Safety

■ There were 58 crewmembers involved in escape system-equipped aircraft mishaps during 1985. Of this number, 43 attempted ejection and 35 of them survived. The resultant 81 percent ejection survival rate, while not spectacular, is not too bad when we recall some years when it was below 70 percent. Still, when we consider that six of the eight ejection fatalities were due to our old nemesis, out-of-envelope ejection, we need to keep emphasizing the life or death importance of a timely escape decision. The out-of-envelope ejection fatalities involved three in F-4s, two in a T-38, and one in an F-16.

■ The F-4 mission was planned as a 4-ship surface attack sortie with the mishap aircrew flying in the No. 4 position. During a tactical turn at 4,000 feet MSL, the mishap aircraft performed a nose high rolling maneuver that resulted in a low altitude departure from controlled flight. Prior to impact, the rear cockpit crewmember initiated a dual-sequenced ejection which was subsequently interrupted by ground impact. Both crewmembers were fatalities.

■ The F-4 mishap aircraft was flown as No. 3 of a 4-ship SAT sortie. After release of two practice bombs, the mishap aircraft turned left towards slightly rising terrain. The pilot and WSO initiated dual-sequenced ejection. The WSO completed a successful ejection. The pilot ejected out of the envelope and received fatal injuries.

■ The T-38 mishap aircraft was on a contact training sortie. It entered the overhead traffic pattern, via a closed pullup, immediately following a rolling initial takeoff. Approximately one-third of the way into the final turn, the RSU crew observed the mishap aircraft rapidly increase bank and pitch down. The aircraft impacted the ground seconds later killing both crewmembers.

■ The F-16 mishap aircraft was No. 2 in a planned 2-ship dry CAS mission. It was a 2-hour mission.

The flight departed with No. 2 in 20-second radar trail. The predominant weather at takeoff was 600 scattered, 1,600 broken, 3,000 overcast, and 2NM visibility with thunderstorms in the immediate vicinity. Shortly after becoming airborne, lead entered the weather and began a left turn as cleared by Air Traffic Control. Number 2 did not follow his leader's ground track but continued basically along the runway heading. As he was performing a left turn, he entered a nose low unusual attitude from which he failed to recover. Number 2 initiated an out-of-envelope ejection less than 0.5 seconds prior to ground impact and was fatally injured.

The latter helps to show that even our best ejection seat, the ACES II, needs to be used within its design parameters for it to have time to do its job.

One of the other ejection fatalities was most probably caused by an F-16B canopy striking the aft seat occupant while he was still in the seat. This was after a midair collision had severely damaged the aircraft, and the resultant asymmetrical loads caused the canopy to jettison in an abnormal manner. The pilots in both aircraft ejected safely.

The remaining fatality occurred in another F-16 mishap over water. The cause of death was drowning.

■ The mishap pilot was No. 2 in a flight of 2 F-16s on initial qualification training. The flight departed under an IFR clearance. After receiving clearance, they entered the working area. The third defensive BFM engagement with Aircraft No. 1 attacking Aircraft No. 2 was initiated with the defender approximately 16,000 MSL (16,000 AGL) and 400 KCAS. The mishap pilot executed a nose low, hard left defensive turn that rapidly progressed into an overbanked steep dive. Aircraft No. 1 transmitted a knock it off call and seconds later transmitted two pull up calls. An emergency locator transmitter beacon activated and then went silent. The mishap pilot ejected at low altitude and high speed and received incapacitating injuries. He was unable to inflate his LPU or release his parachute and drowned. The mishap aircraft impacted the water and was destroyed.

The 43 ejections for the year make it the second lowest number since 1950 when we had 19. In 1984, we had 62. The most we've had in one year was 304 in 1957.

In the mishaps where 15 crewmembers did not eject, 13 were fatalities and 2 survived. The two survivors were in an F-4 which collided with another aircraft on the runway while landing. The crew managed to make a successful emergency ground egress before their aircraft was destroyed.

■ The mishap aircraft was returning to home station following a night, low level radar nav mission. After clearing the mishap aircraft for a low approach, the tower controller cleared a civilian aircraft to taxi into position and hold on the same runway. The mishap aircraft then received clearance to land on that same runway.

continued

1985 USAF Ejection Summary

continued

During the approach, neither pilot nor WSO observed an aircraft on the runway. On landing rollout, the pilot observed two dim white lights on the runway centerline. The lights then disappeared, and he observed another white light which appeared brighter than the first two and similar to a flash associated with a strobe.

Up to this time, the pilot had not associated these lights with an aircraft on the runway, briefly thinking they might be centerline lights. Immediately afterwards, he saw the outline of an aircraft sitting in front of him on centerline and attempted to maneuver left to avoid impact. The aircraft collided on the runway destroying the civilian aircraft and fatally injuring the civilian pilot. Both aircraft burst into flames, and the F-4 crewmembers emergency ground-egressed successfully.

The remainder of the year's ejection experience was, for the most part, unremarkable. There was an interesting mishap involving an F-4 which landed short. The pilot tried to go around but couldn't. As the aircraft came onto the overrun, the nose gear broke intruding the cockpit causing both canopies to jettison and raised the front seat up, triggering a command-sequenced ejection. The aft seat occupant ejected manually and survived with major injuries. The front seat was pushed up too high for the sequencing actuator to initiate ejection but high enough to deploy the drogue parachute, which deployed the personnel parachute pulling the pilot out of the aircraft. In this condition, you would expect the pilot to hit the vertical fin, but the aircraft had by now turned partially sideways so he missed it. He survived this ground-level bailout with major injuries.

The rest of the year's mishap experience is shown in Figures 1 and 2. Among other things, it shows the F-16 did not have a good year regarding ejection attempts, with 7 survivors out of 10 attempts. The F-100 ejection was out of a QF-100 drone, but at the time, it was flying with a pilot on board.

■ The mission was briefed as a two-ship mobile control station mission. On initial climbout, a greyish-white swirling puff was observed coming from the tail section of the mishap aircraft. Approximately 9,600 feet from liftoff, as the pilot deselected afterburner, he felt a thump, heard a mild chug, and felt a noticeable loss of thrust. The pilot attempted an airstart, confirmed the flamed-out condition, and began a right turn. When the chase pilot informed the mishap pilot he was on fire and should eject, the mishap pilot increased the turn to avoid a populated area as the flight controls seized due to low hydraulic pressure. The mishap pilot then added full right rudder to further turn the aircraft as he ejected. He ejected barely in the envelope and suffered only minimal injury. The message in all of these is quite clear. If you get into trouble and you have an escape system, use it. If you do use it, keep in mind that depending on what type it is, it needs from 3½ seconds (ACES II) up to 11½ seconds (F-111 crew escape module) to get a full parachute. Don't delay! ■

Figure 1
Escape System-Equipped Aircraft Mishap Results

	Crewmen Number	Crewmen Percent
Ejected/ Survived	35	60
Ejected/Fatal	8	14
Not Ejected/ Survived	2	3
Not Ejected/ Fatal	13	23
Total	58	100

Figure 2
1985 Ejection Results by Aircraft

Aircraft	Fatal	Major	Minor	Minimal	None	Total
A-7		1	1	1	1	4
A-10				1	1	2
A-37		1				1
F-4	3	3	3	3	1	13
F-15		1	1	1		3
F-16	3		3	1	3	10
F-100				1		1
F-106					1	1
T-33		2				2
T-37					2	2
T-38	2		1	1		4
Total	8	8	9	9	9	43

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UNITED STATES AIR FORCE

Well Done Award

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

FIRST LIEUTENANT
Timothy T. Corrigan

MAJOR
William M. George

4th Tactical Fighter Wing
Seymour Johnson Air Force Base, North Carolina

■ On 5 March 1985, Lieutenant Corrigan, Pilot, and Major George, Weapon Systems Officer, were flying an F-4E aircraft as No. 2 in a two-ship deployment. Ten minutes after takeoff from their en route refueling base, the aircraft experienced total utility hydraulic failure. The crew accomplished checklist procedures while holding south of the field. When they attempted to use the emergency pneumatic system to lower the landing gear from the front cockpit, the left main gear remained up and locked. Repeating the attempt from the rear cockpit was also unsuccessful. The crew obtained technical assistance by phone patch from both the home base supervisor of flying and the F-4 systems manager. All attempts to lower the stuck left main gear proved fruitless. Because of the utility hydraulic failure, they were unable to raise the gear already down and were committed to landing with only the nose and right main gear down. The crew burned down fuel and prepared to fly their crippled F-4 to an approach-end barrier engagement. They had to plan for the reduced effectiveness of their flight controls because of the utility failure, as well as an approach to a different runway than the one they took off from. Using a no-flap approach, Lieutenant Corrigan flew the aircraft to a touchdown on centerline, short of the barrier. He gently lowered the left wing and wing tank to the runway. After a perfect barrier engagement, a fire erupted when the external wing tank ruptured upon contact with the runway and residual fuel ignited. Lieutenant Corrigan and Major George shut down the engines and performed an emergency ground egress. Local firefighters quickly put out the fire. Subsequent investigation revealed a pneumatic line in the gear well failed, leaving the gear trapped in the up and locked position. Lieutenant Corrigan's flawless approach and landing limited the damage to the aircraft, allowing it to be repaired and flown back to home station within a week. Through their calm analysis, use of technical assistance, superior crew coordination, and excellent aircraft handling, Lieutenant Corrigan and Major George recovered a valuable aircraft with minimal damage. WELL DONE! ■

SAFETY AWARDS

THE CHIEF OF STAFF

SPECIAL ACHIEVEMENT AWARD

AIR TRAINING COMMAND

The Air Training Command (ATC) had outstanding flight and ground safety accomplishments in 1985. ATC won the General Foulois Memorial Award for the most effective flight safety program of all MAJCOMs during 1984 and again nearly equaled their record-low Class A aircraft mishap rate in 1985. ATC had a rate of 0.46, only two-hundredths of a percent over the record-low 0.44 rate of 1975 and the 0.45 rate of 1984. ATC also experienced only two Class B aircraft mishaps compared to three in 1984. The command flew nearly two-thirds of a million hours during the year and logged more than 454,700 sorties and made 1.5 million landings in the first 10 months of 1985 while performing a student training mission. In ground safety, ATC had the fewest ground mishap fatalities in its history during 1985. They had only 12 fatalities as compared to 23 in 1984 and 18 in the previous record-low year of 1983. Military injuries and civilian injuries were both about 20 percent lower than in 1984, and government motor vehicle mishaps were about 12 percent lower.

MILITARY AIRLIFT COMMAND

The Military Airlift Command (MAC) had outstanding flight and ground safety accomplishments during 1985. MAC experienced 4 Class A aircraft mishaps in 1985 for a rate of 0.5 as compared to 8 Class As in 1984 and a 1.1 rate. The 1985 Class A aircraft mishaps equaled the second lowest number of mishaps in the history of the command. MAC also experienced only three Class B aircraft mishaps in 1985 as compared to four in 1984. The command flew more than 778,100 hours, the most hours flown since 1971, while performing a global airlift mission. In ground safety, MAC experienced 19 ground mishap fatalities in 1985, compared to 38 in 1984, the second lowest number of mishap fatalities in MAC history. Military injuries were about 5 percent lower than the previous year, and government motor vehicle mishaps were more than 15 percent lower than in 1984.

STRATEGIC AIR COMMAND

The Strategic Air Command (SAC) had outstanding flight safety accomplishments during 1985. SAC experienced two Class A aircraft mishaps in 1985, compared to three Class As in 1984. The 0.59 Class A rate attained in 1985 was the fourth consecutive year the Class A mishap rate has been below 0.9, and the 2 Class A mishaps equaled the second lowest number of mishaps in SAC history. For the first time in Air Force history, the command did not experience any bomber aircraft mishaps. SAC had only one Class B aircraft mishap in 1985, compared to five in 1984. The command flew more than 340,300 hours, the most hours flown since 1981, while performing a worldwide strategic bombardment, reconnaissance, and refueling mission. SAC logged more than 60,100 sorties and had more than 179,700 landings in the first 10 months of 1985.

UNITED STATES AIR FORCES IN EUROPE

The United States Air Forces in Europe (USAFE) had excellent flight safety accomplishments during 1985. They experienced 6 Class A aircraft mishaps in 1985 for a rate of 2.66 as compared to 9 Class As and a rate of 3.9 in 1984. The 1985 Class A rate was the lowest in the history of the command and about 8 percent lower than the previous record low of 2.9 in 1975. Aircraft mishap fatalities were also the lowest in the history of the command. Only one aircraft mishap fatality was experienced in the six Class A mishaps, attesting to successful ejection experiences. USAFE had three Class B aircraft mishaps, compared to two in 1984. The command flew more than 225,300 hours, of which 97 percent were flown in high-performance fighter/attack aircraft, and performed a realistic combat training mission in one of the most demanding flying environments in the world. ■