flying SAFETY

Another Safe Year for Strat Airlift

New Lessons for the C-130

KC-10: The Best Safety Record

A Somber Year for Helicopters

DECEMBER 1992

Mishap Summaries

THERE I WAS

■ I lied last year when I said, "The rest of the ride was pretty quiet." You remember. Everyone else on the B-52 had gone to sleep. There I was, a young copilot extraordinaire, Maple Flag bound, way, way up north in Canada.

Now, it was true I did drop down to plus or minus 100 feet, mostly minus, and skim the marshy tundra. And it was also true we all eventually woke up and went on with our mission. However, I can't say things remained quiet.

An undercast formed. We were in the clear and on top at about 2,000 AGL. We began to see less and less of the ground, until finally, we were above a featureless, vast blanket of white ... in a huge, dark green air machine.

Don't get me wrong — I love white puffies and ecological stuff just as much as anyone else. The problem for me was this nice undercast was in the wrong place. Why couldn't it be just 200 feet higher? I wanted to be in the clouds, or under them, or many miles above them, but not just barely above them.

The unfairness of it all! The BUFF can't run! Its huge, square sides make it hard to hide, and it can't pull Gs. Besides, we have to fly into this postage-stamp-sized intercept area to practice getting shot down. To top it all off, we've highlighted ourselves over this white sheet of clouds.

And then, for the second (but last) time that day, I executed a brainstorm. Why not just drop down a measly few hundred feet and duck into the clouds?

I asked the nav team how much terrain clearance we would still have if we dropped down 300 feet.

(I didn't want the 40-foot fin sticking up out of the cloud — no Jaws© music for me.) Were there any high towers along the route? Knolls, hills, ridges? Did the terrain slope up into us? Could I go down 300 feet and stay there through the target area?

Their answers were all what I and the pilot wanted to hear ... so we did it. In fact, at the time, the other five folks on the jet thought I had a wonderful idea. (They were no happier at the prospect of this next "fighter exercise" turning out the way every previous one had ended for us: 16 successful intercepts — no misses.)

Yup, we did it. Ducked into the weather below a hard IFR altitude, on a training mission in peacetime. Yes, I know. Dumb, dumb, dumb. Short-sighted. Risky. Ineffective.

The radar never painted a shadow, so we were never below any ridges or other high terrain. If there were towers, we missed them.

But, the exercise monitors didn't miss us. Neither did the ATC radar. We were "clever" enough to turn our IFF/SIF to "standby," but that only had the effect of making ATC and the monitors twice as mad.

No one was waiting for us when we taxied in to parking at homeplate. However, current ops did have a message and phone number for my aircraft commander to call. It was a pretty one-sided conversation on our end. Lots of "No excuse, sir" — that sort of thing.

I did a lot of growing that day. We all did. When I saw people pushing too hard after that, I wasn't afraid to speak up: "Is this worth the risk?" You can, too. Please do. ■

UNITED STATES AIR FORCE

Flying SAFETY

DECEMBER 1992

AIR FORCE SPECIAL PUBLICATION 127-2

VOLUME 48, NUMBER 12

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SPECIAL FEATURES

REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE CHIEF OF SAFETY, USAF

PURPOSE —*Flying Safety* (ISSN 0279-9308) is published monthly by the USAF, Norton AFB CA 92409-7001, to promote aircraft mishap prevention. Use of funds for printing the publication has been approved by Headquarters, United States Air Force, Department of Defense, Washington, D.C. Facts, testimony, and conclusions of aircraft mishaps printed herein may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in mishap stories are fictitious. The contents of this magazine are non-directive and should not be construed as regulations, technical orders, or directives unless so stated. **SUBSCRIPTIONS** — For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Changes in subscription mailings should be sent to the above address. No back copies of the magazine can be furnished. **REPRINTS** — Air Force organizations may reprint articles from *Flying Safety* without further authorization. Non-Air Force organizations must advise the Editor of the intended use of the material prior to reprinting. Such action will ensure complete accuracy of material amended in light of most recent developments. **DISTRIBUTION** — One copy for each six aircrew members. One copy for each 12 aircrew support and maintenance personnel. Air Force units must contact their base PDO to establish or change requirements. AFSP 127-2 is entered as a publication at the Second-Class rate at San Bernardino Postal Service, 1900 W. Redlands Boulevard, Redlands, CA 92373 and additional entries. **POSTMASTER:** Send address changes to *Flying Safety*, AFSA/SEDP, Norton AFB CA 92409-7001.

B-1

MAJOR KELLY M. HAGGAR
Action Officer, AFSA

■ The B-1 had three Class A flight mishaps in fiscal 1992, for an annual rate of 10.64, bringing its lifetime rate to 6.63. However, all three of these aircraft are repairable. In fact, of the nine Class A's in the B-1B's history, only the first three mishaps resulted in a destroyed aircraft. Each of the last six mishaps was an "A" only because of the dollar amount of damage.

The first mishap occurred during a timing exercise when a B-1B and a KC-135R collided after completion of air refueling. The upper portion of the bomber's vertical tail and its left horizontal stabilizer contacted the lower forward fuselage of the KC-135. Each aircraft landed; no one was injured.

The next mishap involved a landing gear door separating from the aircraft during the high-speed, low-level portion of a functional check flight following some major modifications. The door penetrated the side of the inlet duct and was ingested by the no. 3 engine as it departed the aircraft, severely damaging the engine. Again the crew recovered the aircraft safely without injury. The final mishap of the year was an uncontained engine fire and disc burst in the low pressure turbine. Once again, the crew landed the aircraft without injury.

Of the nine Class A mishaps in the history of the B-1B program, three were engine events penetrating the case, and two involved fires in the overwing fairing area. Foreign object damage, an equipment bay fire, a landing mishap, and the midair round out the total at one each. The most remarkable thing about these first 8 years of B-1B operations is how few mishaps there have been. (At this point in their service lives, 155 B-47s, 25 B-52s, and 15 B-58s had been destroyed in flight mishaps, albeit, with larger fleet sizes.)

Four B-1B safety modifications address actual and potential problems on the aircraft. The first concerns the

first-stage fan blades. A stronger retaining ring for these blades has been installed on all aircraft. The permanent fix for an earlier blade retainer problem is a set of small damper weights to change the vibration profile of the first-stage fan blades. Once these are installed, the 25-hour eddy current inspection of the blades will be deleted.

The second and third safety projects for the B-1B involve a related pair of modifications in the overwing fairing. "Fire protection" adds two more fire detection loops in each fairing and gives the crew cockpit control over the isolation valves in the 2-inch cooling loop and 4-inch main flex fuel lines. This will be completed around Oct 93. "Fire prevention" better insulates the precooler and associated bleed air ducting, adds dams and drains to keep any fuel away from ignition sources, and installs an additional pair of Halon firefighting bottles in each overwing fairing. We're on track to complete this by Jan 96.

The fourth project is a "basket" effort which solves several related problems with an integrated package of small modifications — the "aft DC power safety upgrade." The mod:

- Disables the stability enhancement function (SEF) when the stall inhibit system is off so the aft battery will not run down prematurely,
- Replaces the forward and aft Ni-Cad batteries and chargers with larger capacity sealed lead acid equipment,
- Provides separate power sources for the primary and backup oxygen systems and for the pilot and copilot HSIs,
- Moves the forward and aft battery chargers to bus 1 (the essential bus remains powered by bus 2), and
- Rewires wing pumps to the essential bus.

These changes increase both the redundancy and capacity of the DC power system, as well as eliminate several single-point failure modes.

There are a few other programs in work on the B-1B to reduce mishap potential, even though they were not installed on the aircraft specifically for safety purposes. The "sparkling" problem with the EMUX multi-plex digital discrete and control boxes was resolved with some timing and wiring changes. These were done concurrently with SEF activation. Less than a dozen aircraft are still waiting to receive SEF/sparkling work at press time.

However, the largest modification programs on the B-1B are operational enhancements to the Defensive Avionics System and the aircraft's conventional weapons capabilities. The USAF recently reached a settlement agreement with the major contractor completing the current ALQ-161 program. The 10 B-1Bs without this hardware will have mod zero equipment installed as it becomes available. A "sources sought" announcement has also been released concerning defensive avionics systems and conventional weapons integration work on the B-1B. The goal is to award a contract in midfiscal 1993 to a single contractor to integrate many different mods to the aircraft.

The new defensive avionics systems suite could be either an upgrade to the existing ALQ-161 system or a replacement of all or part of the current ALQ-161. The B-1B's expanding role in conventional operations will require enhanced situational awareness, improved jamming capabilities, and improved reliability and maintainability. The target date is 1999. Improved turnaround times are also needed to increase the aircraft's sortie rates for sustained conventional operations.

Full exploitation of the B-1B's high-speed, low-level penetration capabilities can best be achieved with a broader mix of improved conventional weapons. The plan calls for a limited operational capability with six current conventional weapons (CBU 87, 89, 97; MK 62, 56, 65) by 1996. Future weapons will

continued

follow as they are developed. (Details are in the B-52 article, as both aircraft — and the B-2 — will have precision weapon capability.)

Carriage of these weapons is to be accomplished by the dates indicated: Joint Direct Attack Munition (JDAM) I, 1999; JDAM III, 2001; Joint Standoff Weapon, 2003. (The Tri-Service Standoff Attack Missile's certification date has not yet been determined.)

Several other upgrades are also being planned: A secure anti-jam VHF/UHF voice and data system (1996), Global Positioning System (1999), and replacement of the onboard computers with a faster speed, increased memory, and more reliable system (2001).

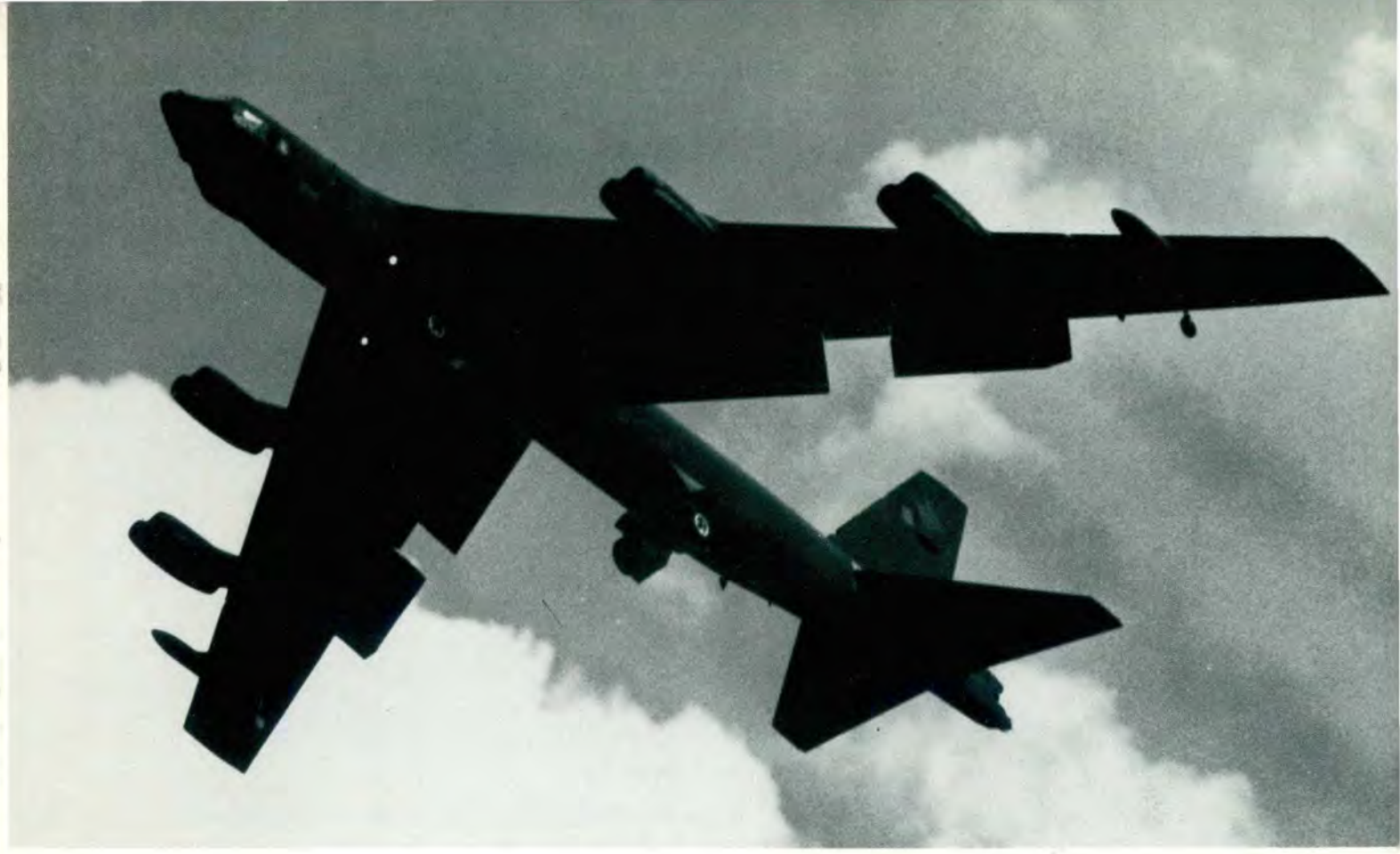
As with most other USAF aircraft, an increasingly younger crew force will have to learn to excel with this formidable weapon system in fewer flight hours. What can they be expected to absorb from recent USAF mishap history? Some of the basics cut across almost every mishap, regardless of the era or the aircraft type. Losing sight of lead has led to many a midair. Not speaking up when unsure of the plan is found deficient by many boards in mishap investigations. Assuming a procedure has been approved has bit many fliers before. It's amazing how often *someone* had a vital piece of data without realizing its importance. "Not speaking up" applies just as strongly within the cockpit as it does during a briefing the day before the mission.

Communication, while vital, may still not prevent problems from occurring. There have been cases on record where many folks did crosstalk a plan, sincerely thought they had a handle on the situation, and proceeded to generate a mishap anyway.

This can happen if a crewmember does not really understand a switch function, whether from poor training or lack of study. The infrequent, but scary, pitchdowns during terrain following fly-ups in the B-1B are a case in point. Selecting and then releasing the stick's second detent trigger will reactivate the fly-up command ... while enabling manual trim.

If manual nose down trim and forward stick are applied to oppose the fly-up, what will happen if second detent is once again selected? Answer: a prompt, possibly severe pitchdown, to as much as 30 degrees of dive, depending on how much nose down trim was previously commanded. (Changes to the flight manual are in progress to provide better information to the crews, as are revisions to fly-up training.)

Thus, the real mishap reduction challenges are not in selecting hardware, or in getting lots of different boxes to meld into a system. Getting the right people onto the team, and then training them to operate in concert, are the keys. Maintainers, staff, and crew alike face new challenges in a changing world. Their bomber is rapidly becoming the mainstay of the Nation's bomber fleet as it shifts to a largely conventional role. Only by continuing to sustain traditions of professional and disciplined performance can we successfully meet these challenges. ■



B-52

MAJOR KELLY M. HAGGAR
Action Officer, AFSA

■ The B-52 had another banner year of safe operations in fiscal year 1992. This marks the seventh year of 37 years without a Class A flight mishap, giving the B-52 a lifetime mishap rate of 1.29 per 100,000 flight hours.

The B-52 weapon system is in the midst of adjusting to post cold war operations, which involves retirement of the B-52G and a shift toward conventional operations as the major mission for the B-52H. The inevitable stress associated with these mission changes, coupled with the larger reorganizations and new policies throughout the USAF, only serve to highlight the super year turned in by the B-52 community.

The ongoing changes in the USAF should not divert our eyes from some key points:

■ Whatever your future plans, you still have to get that next sortie launched, flown, and recovered. Takeoffs must not total up to more than landings. Be concerned about what lies ahead, but don't let it get in the way of studying a target or turning a wrench in the phase dock. First things first, and the first thing you must do to have a second career is live to finish the first one!

■ The B-52H will remain as an aircraft with great range, a large payload, superb ECM, and a fine safety record. (Of the 102 H models built, only 6 have been lost in flight mishaps, yielding a rate near .7 for each 100,000 flying hours.)

■ The B-52G will still be with us for 2 more years. During that time, it will continue to be a formidable conventional asset, as the Iraqis can attest.

■ Both of these aircraft models have high mission-capable rates now and will be maintained to support those rates as long as they are in the inventory. Similarly, training will continue at a realistic pace. US national interests may again require the use of our B-52 force. It will be ready if needed.

■ Both the B-52G and H have economic service lives past the year 2030. Times change. Policies change. The B-52 has seen a lot of history,

continued

B-52 continued

has been modified many times over the years, and has many enhancements planned. Aircraft modifications include the Global Positioning System and better secure radios. Weapons upgrades are further discussed in "Bomber Roadmap" (page 7).

What does the foreseeable future hold for B-52s which could impact safety? There are two safety modifications currently open on the fleet, as well as one safety-related modification. The two safety mods are:

- TCTO B-52H-744 equips the aircraft with the Common Strategic Rotary Launcher. As part of this mod, Section 47 tiedowns are being installed to permit self-deployment cargo to be securely carried in the aft section of the aircraft, just forward of the horizontal stabilizer. The H model is almost 90 percent complete. No more than seven B-52G aircraft will have the mod installed under TCTO B-52G-840 — most likely locally from a kit.
- TCTO -2479 replaces all body and external tank fuel pumps with a new pump. (TCTO -2487 previously replaced the caps of all older pumps with a new design that did not need a flame damper.) The new pump installation is about 80 percent complete now and should be complete well before the 1 Mar 93 expiration date.

The safety-related modification replaces all 12 fuel filler caps with a new cap that has a whistling "pressure relief" popup valve. Should an aircraft be overpressurized during refueling, the valve will open and release excess air pressure prior to wing tank and skin rupture. The mod is slightly past halfway, with completion due before Mar 93.

Several safety mods have been recently completed in the B-52. They are TCTO -2495 (new brake pedals), TCTO -2496 (anti-skid failure indicator lights), and TCTO -2478 (alternate hatch jettison handle for EW and AG seat positions.)

Despite the yeoman service the B-52 has provided to the Nation over the last 37 years, we're still seeing new things show up in its operations from time to time. In the last year, one B-52 refused to lift off at unstick airspeed. A successful high speed abort was made from 3 knots above unstick (150 KIAS). Due to the cold temperature, and a 25-knot headwind, the aircraft reached unstick speed with over 6,000 feet remaining. The headwind, aided by a good drag chute, easily got the aircraft down to taxi speed within the last 1,000 feet of the runway.

This high accident potential mishap produced a full local investigation board. However, nothing was found wrong with the aircraft or in the crew's actions. Anecdotal evidence indicates two more cases of failure to unstick (takeoff) may have occurred in the last 10 years, but nothing is confirmable in the flight or materiel safety data bases. For an unknown reason, the aircraft simply would not take off at the planned speed.

Another puzzle is recurring cracks in the 694 bulkhead. (This forms the forward bomb bay wall and joins the rear spar of the wing.) We do not fully understand what is driving these fatigue cracks. The continuing inspections of the aircraft, such as TCTO -2510, will ensure the aircraft remains safe to fly. (We are confident tactical maneuvers are not causing these cracks. The aircraft removed from service last year for a crack in the wing pin bolt hole portion of the 694 bulkhead had an unrelated stress corrosion problem not linked to cracks in the bulkhead fastener holes.)

On the plus side, the "flex mount" fuel tube (TCTO -973 on the B-52G) is about 85 percent complete. It has

not only cut down on the number of engine fires in recent years, but also led to the discovery of a clamping problem with burner cans. The J-57 engines will get the air-cooled type of clamp the TF-33 has used with good results.

As we have seen, even a mature weapon system will have its problems. Maintaining a keen operational edge in the B-52 will take a concerted effort on the part of an increasingly less experienced crew force. In fact, crew actions (or inactions) are far and away the main area leading to Class A mishaps. The airplane that suddenly sheds a wing or blows up is a minor part of the 94 Class A's in the B-52's 37-year history. Most of the time, there is either nothing wrong with the aircraft at impact, or nothing the crew should not have been able to handle.

Loss of pitot heat, even when you aren't in a cell formation, should not be reasonably expected to lead to loss of the jet. One fuel gauge inop should not be enough to start a chain of events resulting in loss of the jet. Just plain flying into the ground (low level or traffic pattern) should not happen. Attitudes of "They were new" or "What a bunch of dummies" may protect crews from thoughts of their own mortality. However, those attitudes will not avert the next mishap.

There is real potential for greatly lowering mishap rates in how we choose crews and what we teach them. In a mature aircraft, such as the B-52, there just isn't that much "new" material to be learned — it's more a question of absorbing and retaining what we have already paid a high price to learn over nearly four decades.

In sum, the B-52 is a safe, capable, effective weapon system. With study, hangar flying, and presence of mind, its crew can bring it back to fight another day. ■

BOMBER ROADMAP

This excerpt from the 18 Jun 92 *Bomber Roadmap: Enhancing the Nation's Conventional Bomber Force*, describes the new precision weapons the B-52 and B-1 will be able to carry:

"The Joint Direct Attack Munition (JDAM) program grew out of Air Force and Navy requirements and will provide direct attack capability based on an inertially guided, Global Positioning System (GPS) assisted munition. The JDAM is a 2000-pound weapon that will be accurate to within less than 45 feet. (JDAM II centers on a 500-pound class Navy weapon.) JDAM III, a more advanced 2000-pound class weapon, will combine the INS/GPS technology of JDAM I with a precision seeker for precise strike within less than 10 feet of a target, day or night, in adverse weather. Even in regions like the Middle East, cloud cover can obstruct targets up to 30 percent of the time and for Northeast Asia the figure rises to as high as 60 percent in the worst weather seasons. JDAM's ability to overcome poor weather conditions is a big step forward for combat readiness.

"The Joint Standoff Weapon (JSOW) will provide accurate stand-off anti-armor capability, enabling bomber aircraft to launch outside the range of ground unit antiaircraft defenses, and achieve multiple kills per JSOW using sensor-fuzed submunitions. The Tri-Service Standoff Attack Missile (TSSAM) will combine extended range (100nm+) with an autonomous precision warhead and a combined effects submunition in a highly stealthy cruise missile to yield tremendous flexibility and the ability to destroy small, high-value targets from outside the high-threat environment."

Moreover, a total of 47 B-52Hs will be modified to carry conventional cruise missiles (AGM-86C), TSSAM, and JDAM I between 1996 and 2002. Of these 47 aircraft, 19 will take over the Harpoon anti-ship mission from the B-52G, while 10 will inherit the Have Nap precision missile, also from the B-52G.

C-5/C-141

MAJOR DON LARSON
Action Officer, AFSA

While the heavy airlifters achieved a second zero Class A year in a row, flight control problems and ops errors are major safety concerns.

■ Air Mobility Command's (AMC) C-141 and C-5 aircraft from the active duty, National Guard, and Reserve components continued to lead the Air Force in a nearly flawless safety record for FY92. While the Air Force saw its overall Class A mishap rate increase from a record low in FY91 of 1.11 mishaps per 100,000 hours of flying to 1.66 this past year, **the strategic airlift fleet chalked up its second consecutive year of zero Class A's and only one Class B mishap.**

We can take individual and collective pride in our remarkable accomplishments over the past year. It didn't happen by accident (pun intended). Our safety record was achieved as a direct result of the superior performance of aircraft and systems engineers, maintenance personnel, and aircraft operators.

However, as we face the future with our past accomplishments, we cannot become complacent. Our next seemingly "routine" flight could turn into disaster. Until February of this year, the C-130 fleet had gone 2 1/2 years without a major mishap. Then, **WHAM**, back-to-back human factor mishaps which killed 25 people, including 14 friends and fellow crewmembers, 11 civilians, and destroyed 2 valuable aircraft.

In the following paragraphs, I want to briefly discuss some of the incidents we had, some of our close calls, and end with an idea of where we are headed in the future.

Logistics-Related Mishaps

The only Class B mishap in FY92 was a C-5 uncontrollable engine fire which occurred during a local training flight. After receiving various engine malfunction indications and performing appropriate checklist items, the crew wisely decided to land at the nearest available runway when a fire on the engine would not extinguish.

Another potential Class B mishap occurred when a C-141 crew encountered a landing gear malfunc-

tion as they were landing at home station following the completion of a 12-day overseas mission. On landing, the nose gear collapsed, causing $180,000 in damage. Although there were some crew deficiencies in landing gear systems knowledge, checklist discipline, and crew coordination, the crew ultimately made the right decision when they terminated troubleshooting without solving the problem. They proceeded to land upon reaching a predetermined landing fuel weight.

A disturbing trend in the C-141 fleet was an increase in flight control-related incidents. The most serious incident occurred with an aircraft at FL260 and 300 KIAS. The aircraft encountered extreme vibration, sudden pitch oscillations, and uncontrollable left roll. Control was regained after 30 seconds and 500 feet altitude loss as the aircraft was slowed below 250 KIAS.

No structural problems or flight control malfunctions could be found, and there have been no recurrences. The incident was most likely caused by (1) clear air turbulence, (2) wake turbulence from another aircraft, or (3) a one-time flight control malfunction which could not be duplicated.

During a routine preflight, an IP thought the elevator control was stiff. The engineer thought it could be cold hydraulic fluid, and since it was not severe, the IP decided to fly the low level airdrop mission. He ended up doing a controllability check and landed using elevator trim only. Maintenance found insulation had fallen down and wrapped around the elevator control cable.

In another incident, a pilot doing a preflight stated the controls "did not feel right." A visual inspection revealed the tab on the right aileron was unlocked. Maintenance later discovered a large, jagged crack on the actuator attachment plate.

Two other incidents occurred where the artificial feel spring broke, causing abnormal stick forces in-flight. **The bottom line:** Don't treat your pre-takeoff flight control check lightly. If it "doesn't feel right," there's probably something "wrong." Remember, just about any flight control malfunction requires a safety report in addition to a writeup in the aircraft forms (AMCR 55-XX, Chapter 8).

We have had two more cases of total loss of reliable ADI indications in the C-141 (eight cases since Dec 90). An exact cause still has not been determined on how to correct the malfunction in flight. A standby attitude indicator is in the works with installation as early as January 1993.

Ops-Related Mishaps

There were several ops-related incidents which need to be mentioned. A C-5 crew taxied into a maintenance stand while pulling into their parking spot at home station. The primary causes were (1) the wingtip marshaler failed to recognize the imminent wingtip collision and (2) even though the parking spot illumination was not bright enough to illu-

continued

minate taxi obstacles, the crew elected to turn off all taxi lights when they turned into parking (for the comfort of the marshalers) which prevented the crew from seeing the maintenance stand. **Maybe we should examine our own night taxi techniques.**

We had two potentially catastrophic wing scrapes. A C-5 scraped a wingtip when the copilot failed to adequately control a landing in high (within limits) crosswinds, and the IP did not immediately assume control of the aircraft.

A C-141 crew was flying a second visual approach after overshooting the runway on the first attempt and elected to go around. The aircraft commander (instructor qualified) overshot the runway a second time flying cross-cockpit from the left seat. At the suggestion of the copilot (a former flight examiner), the AC transferred aircraft control to the copilot at approximately 100-150 ft AGL. The copilot corrected back to the runway, landed about 2,000 feet down, and ended up scraping the right wingtip.

Finally, there were at least three recorded C-141 tail scrapes in the past year. All three scrapes were unknown to the aircrew and discovered at a later date by maintenance or a subsequent aircrew prior to flight.

Future Emphasis

Historically, over 75 percent of flight mishap causes have been attributed to human error or deficiency. As a result, along with hardware modifications and weapon system upgrades, much of the future efforts in the safety world will be dedicated to reducing these human factor causes.

HQ AMC has already taken several proactive steps in this area. They recently commissioned an indepth review of the cockpit resource management (CRM) training given to AMC aircrews and compared it to current airline, NASA, and other DOD agency CRM programs. This report should be published soon and may provide specific suggestions for improvement.

AMC also surveyed downline units and compiled a list of 12 areas for future consideration and emphasis. Some action has already been taken in some of these areas. I've highlighted three below:

■ *Increased commander involvement* The emphasis is on directly confronting the seemingly overwhelming issues of current USAF turmoil, changes in career path opportunities, personnel or mission reductions, philosophical challenges such as quality management, and new aircrew, operations, command and control concepts and policies. Current losses in cockpit experience levels along with unit manning totals due to early outs and feet-on-the-ramp programs require commanders and supervisors to more carefully scrutinize the backgrounds of aircrew personnel recommended for flight upgrade and command roles. Commanders must resist the temptation to upgrade a less experienced or less capable flier just because a unit position is not filled.

■ *Quality Management* Commanders, supervisors, and safety staffs should continuously challenge and examine mishap prevention processes. Make them quality programs. Every unit member must be convinced whatever function they control is critically essential to the successful, safe execution of the unit's mission. Give people the tools, authority, and empowerment to do their jobs.

■ *Training Programs* A top-to-bottom review of all training programs should be conducted. Use a stairstep approach to training or a walk-before-run concept. Also, we should increase human factors training for commanders and supervisors to help them identify personal problems before they escalate. Monthly instructor meetings should be conducted. We might establish an instructor intervention program to provide guidelines on how far to let a student go in the aircraft. Rehearsal of mission profiles in the simulator will give inexperienced aircrews the feel of the actual mission they are scheduled to fly.

Summary

Although every individual plays an important role in preventing flight mishaps, in most cases, whether or not a mishap occurs ultimately depends on the collective capabilities of a given aircrew. Last year, crewmembers faced an unprecedented level of change within the Air Force. These changes increased our stress level and significantly affected how we perform our jobs. We met the challenge head on and came away with a zero Class A mishap year.

For us to repeat last year's performance and to improve in other areas of the mishap prevention process, we have to maintain our focus on the task at hand. As we prepare to fly, our single-minded focus has to be safe, effective mission accomplishment. All other distractions and worries not related to the mission have to be consciously set aside until they can be dealt with after the mission.

Although the C-5/C-141 world did not have a major mishap this year, other weapons systems did — with important lessons to learn from each. I encourage you to read every article in this issue and use the experiences of others to make you a better, safer aircrew member. I look forward to another banner year in '93. ■

C-130

LT COL PETER H. MAGARGEE
Action Officer, AFSA

■ Considering its widely diversified mission, FY92 was another good year for the C-130. The aircraft flew over 298,572 hours, with a mishap rate of 0.67. Unfortunately, we suffered 2 Class A mishaps and 24 fatalities.

Even with the "Herk" in service for over 38 years, we had to rewrite the Dash-1 at the expense of two aircrews last year. Yaw instability, VMCA, and power-off stall speed will be permanently etched in our collective memory.

The most important outcomes of a Class A investigation are the lessons learned and the recommendations. Let's look at both mishaps from a viewpoint of how we can do business better.

The first mishap involved the C-130's previously unknown ability to rapidly exceed its critical sideslip angle. Despite an excellent understanding of the aircraft's capabilities and, to a lesser extent, its full flight envelope, we were lulled into a false sense of security. The C-130 has been around for almost 40 years, so we must know everything there is to know about it, right?

Wrong! Aircrews must be prepared for the unknown. Instructors must be vigilant for extraordinary control inputs and expect the unexpected. And all aircrews must effectively communicate when things get tense in the cockpit. Think about it.

The next mishap again involved a three-engine situation where the crew's attempt to recover resulted in loss of control and a fatal crash. While performing a simulated threat avoidance maneuver at low level, one engine was retarded to idle, and the aircraft was placed in a very nose-high climb. As airspeed rapidly decreased and recovery was initiated, the aircraft stalled, and altitude was too low for recovery. Significantly, the engine which had been retarded to idle remained there throughout the recovery attempt.

A third incident occurred this year which would have been a Class A mishap except there was sufficient altitude to recover the aircraft. The aircrew was practicing evasive ma-

continued

neuvering. The pilot was using his own personal technique, not one which had been tested or approved. With power back on the inside of a descending turn, he induced a large amount of pro rudder after directing the copilot to raise the flaps. On the last turn, the copilot failed to raise the flaps, and as the pilot induced rudder, the aircraft rapidly exceeded the critical sideslip angle. The crew found themselves inverted, and it took two revolutions, 3,000 feet, and 3.5 Gs to recover the aircraft.

What did we learn from this incident? First, the crew made several crew-coordination errors in the cockpit. Second, personal techniques were being used to fly high risk maneuvers which had not been properly tested and approved.

In summary, both C-130 Class A mishaps (and the incident described above) involved at least one outboard engine in or near flight idle. All were in high rudder boost. All three aircraft departed controlled flight. One premise of mishap prevention is to learn from the past. We must do better for the future.

Safety Concerns Update

Let's update some of the important safety issues for the C-130 community.

Three/four engine power loss continues to be a problem. Over the past year, we had at least three of these incidents where the cause could not be identified. All had the solid state synchrophaser and constant volt transmitter. None of the aircrews were transmitting on the HF radio. The folks at WR-ALC are working this hard. The real fix may come when the electrical system is upgraded. Until then, be ready for the rare electrical surge which may cause this to happen.

The C-130 community has seen a large increase in turbine failures in the last year. Seven involved case penetrations. Aggressive investigation revealed fourth-stage turbine wheel fatigue was being induced by the installation of nonconforming fourth-stage turbine blades at overhaul. SA-ALC has issued safety TCTO 671 to alleviate the situation. This points to the fact the safety process, when aggressively worked, can be very effective.

After 38 years of service, two Class A mishaps this year required changes to the C-130 Dash-1.

As I mentioned last year, upgrade of the bleed air duct system is a critical safety mod for the C-130 fleet. We continue to see bleed air duct failures (two so far this year). The safety mod has been approved, with installation beginning soon.

An important safety issue for the A-model drivers has been fatigue failure of pre-1043 Ronson aileron boost assembly cylinders. This is of critical importance on the 3,000 psi systems where you can lose all hydraulics in a matter of seconds. Through extensive work with WR-ALC, these actuators are being removed from the aircraft and the supply system.

Another critical mod for our special ops C-130s will be the center wing replacement. It is in the initial trial installation stage. We expect full production installation at PDM beginning in FY93.

Human factors continues to be my biggest safety concern for the C-130 community. We continue to engineer systems into the aircraft to make it one of the safest in the inventory to fly. It has been over 3 years since we had a log-related mishap.

But engineering makes up a smaller portion of the human factors equation. The equipment is only as good as the people flying it. Supervision and training are key elements of a sound mishap prevention program. Each must be effective to have a healthy flying operation. Is your organization up to speed?

Future

There are many new innovations on the horizon for the "Herk." The newly formed Cockpit Architecture Integration Team at WR-ALC is responsible for coordinating future avionics needs and developing the cockpit architecture to ensure proper interfaces. This is a widely diversified group including operators, maintainers, and providers.

The team has a large agenda which includes the Traffic Collision Avoidance System, Data Transfer System that will interface with worldwide navigation data bases, Digital Flight Data Recorder, Microwave Landing System, and the Global Positioning System, to name a few.

In addition to this, the team will monitor how all of this ties in with our self-contained navigation system (SCNS), including expanding its capabilities. Another very important responsibility will be to create proper ergonomics in the cockpit. This includes current architecture and the glass cockpit of the future.

Three/four engine power losses and human factors dominated C-130 mishaps during FY92.

After 38 years of service, WR-ALC is still working on new innovations for the Herk.

Other future improvements include a new digital autopilot and ground collision avoidance system (GCAS). I had the pleasure of flying a demo aircraft with the GCAS system installed. It will be a definite improvement.

And for the copilots there is something we have needed for years — a new automatic communications processor to be installed on the ARC-190 HF radio. The system will automatically scan multiple frequencies, select the best, then automatically repeat calling until contact is made. Life will become a lot easier over water.

As I wrote last year, the electrical system will go through significant redesign. The main purpose is to provide smooth, clean, transient-free uninterrupted power to the aircraft. The C-130 has had a lot of problems resulting from its dated electrical system, most notably three/four engine power loss.

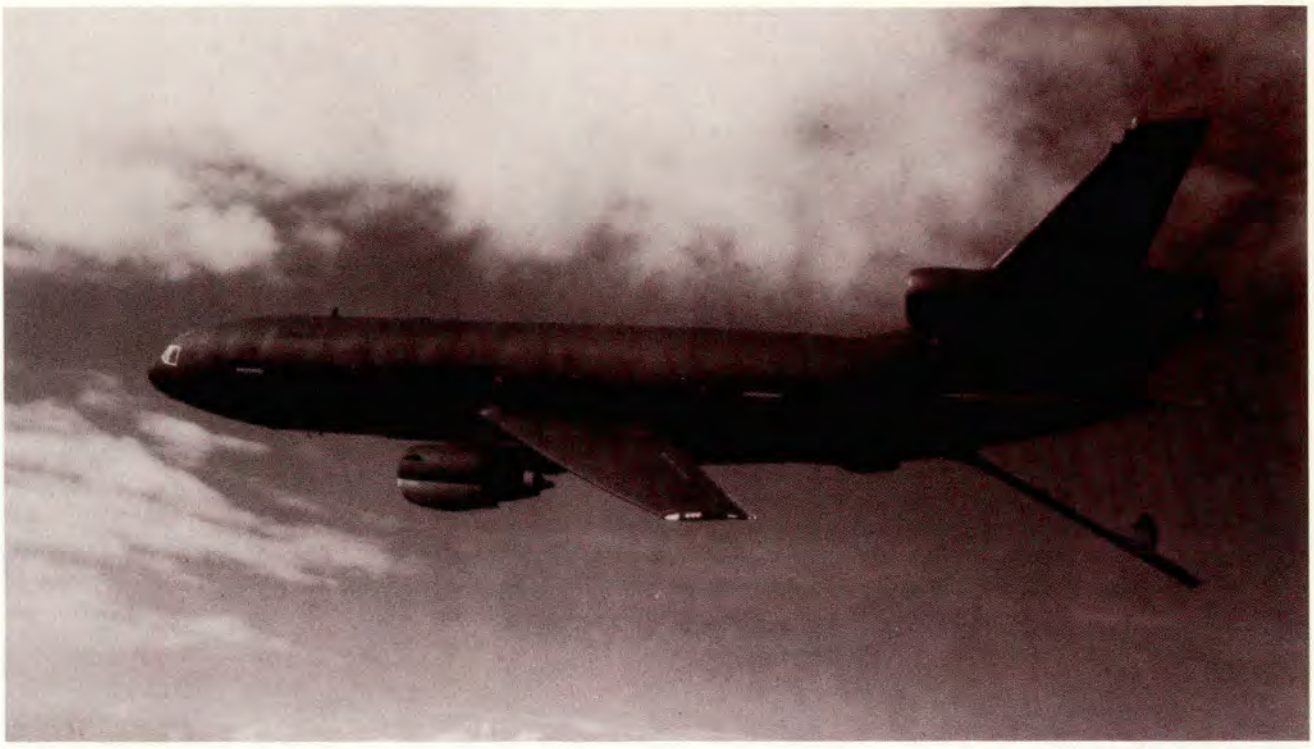
I see a very bright future for the C-130 community. As the newer models come off the assembly line, we know we fly a weapon system critical to the national defense.

Finally, let me make a pitch for the safety business. All of us should take an aggressive active role in the safety process. Let your safety shop know when you see things which are not right. Every one of us is the safety officer's eyes and ears.

Have a good '93 — FLY SAFE! ■

When Will I Get All That Stuff in my Aircraft?

Item	Projected Completion Date
"Have Quick"	Dec 92
CARA	Mar 93
Enhanced SKE	Jan 94
SCNS	Feb 93
Replacement Foam	Nov 94
Dual Power ADIs	Jan 93
Flight Data Recorder	Feb 93
Secure Voice	Sep 93
Strobe Lights	Feb 93



KC-10

MAJOR C. TERRY ANDERSON
Action Officer, AFSA

■ The KC-10 has the best safety record of any large USAF transport. Professionalism, high standards, and adherence to sound operations and maintenance procedures will help maintain this enviable record. This year, we'll review three areas of operation: no. 2 engine FOD, drogue air refueling, and situation awareness. Now, let's review specific incidents of interest in each.

Of the nine total lifetime Class A and B KC-10 mishaps, six have resulted in damage to no. 2 engine, five of these from FOD. Last year, Class A damage occurred when an upper beacon was ingested. The crew did an excellent job in the recovery. Earlier, the crew chief had done a conscientious job using all the information available. Unfortunately, we still had $3.8 million in damage because tech order guidance was not adequate.

This spring, an initially qualifying copilot was doing extremely well in receiver A/R. Unfortunately, the tanker made a turn, and before the instructor or boom operator could intervene and obtain a controlled disconnect, a brute force disconnect occurred.

After the breakaway, the two aircraft returned to the precontact position for a visual inspection. No damage was detected in the darkness. Unknown to both crews, however, the tanker's boom nozzle was in the receiver's receptacle, and some of the sheared bolts had passed through the no. 2 engine. The aircraft separated and continued their missions.

The KC-10 crew flew approaches until tower informed them sparks were coming from their no. 2 engine. Of course, the crew had no way of knowing those sparks were super heated metal from the hot section of their engine! The crew did an excellent job recovering the aircraft. In the future, both ends of those bolts in the boom nozzle will be safety wired on to other boom parts so they cannot be ingested by the no. 2 engine.

Is there a moral to this saga? I have stopped and picked up FOD when I was on crew — don't we all do this? I guess this message is more to the maintainers of all types of KCs the world over: If anything can fall off your aircraft, Murphy's Law says it will find its way into the no. 2 engine. Be diligent during panel and fastener inspections. FOD costs us all. Last year, it cost the USAF over

$10 million.

As of this writing, there have been 26 drogue losses in FY90, 91, and 92. With 21,671 contacts, the good news is the drogue has a 99.8+ percent reliability rate. The bad news is approximately 67 percent of the problem appears to be KC-10 equipment related. The rest of the bad news is the malfunction frequency appears to be increasing.

KC-10 Ongoing and Approved Modifications

ARC-190 Liaison Radio and the Automatic Communication Processor (also to be installed on the C-5, -141, -130, and E-4) replaces the existing 618T2 HF radio. Installation to begin in Apr 93.

NAVSTAR (GPS installation) is still in conceptual design stage and has high priority for funding.

Thirty Onboard Loaders will be produced by Sep 93. This one-pallet portable loader can be assembled in 5 hours, disassembled in 3 hours, can load and unload itself, and runs on APU or aircraft power.

Wing Mounted Drogue Pods — half the current buy of 16 pods (8 pairs) has been completed. One of the 11 aircraft already funded has been modified — the last is to be modified in FY97.

In September, several actions were taken to determine where the problem really lies. AFMC reduced the time between visual inspections and ground reel response checks from 26 weeks to 12. AMC directed a 55-knot airspeed reduction check be done before each use of the drogue. After every five contacts, an internal system check is accomplished. Any abnormal indications result in termination of drogue A/R for that day. AMC also directed maximum drogue deployed speed for contacts be reduced to 300 KIAS.

In October, special reporting of any abnormal drogue refueling began to capture more data on "abnormal" incidents. This is in addition to those incidents which are hazardous and those causing reportable damage. Also, in October, instrumentation of the drogue was completed on three aircraft. Shortly, the data from this instrumentation will be available. We can begin to quantify the forces working on the drogue and reel system. Please record all data so the engineers can fix the problem.

The Navy and Marine Corps have distributed a video to their pilots showing how different approaches to the drogue are perceived in the KC-10 and the effects on the drogue and hose. Training methods and currency were also reviewed. Hopefully, by the time you read this, problem areas will be identified and fixes will be "in the works" for both hardware and receiver training.

This year's final areas of concern are situational awareness, crew coordination, and watching out for the rest of the crew, as well as watching out for yourself.

Last year, a miss of 20-40 feet nearly resulted in the loss of two aircraft and 90 people. The KC-10 crew arrived at the FOL 1 hour before scheduled briefing time and 14.5 hours prior to show time for the next mission. Congested parking, blocked taxiways, and maintenance problems caused several changes in cell makeup.

After takeoff, no. 2 passed lead in the weather, at night, without either aircraft being aware of the other's position. After level-off, cell formation was re-established, and the fighters completed their boom checks on no. 2. Then they went to lead and began the first of several refuelings.

While lead was refueling, the no. 2 aircraft was conducting cockpit orientations for some of the 80 passengers on board. About 20 minutes before dawn, the fighters completed A/R on lead and dropped back to join on no. 2. Several minutes before the mishap, no. 2 had gradually accelerated 20 KIAS. One minute and 45 seconds before the near miss, no. 2 began a series of small turns into lead, resulting in 15 degrees of heading convergence that eliminated the almost 2-mile separation of the aircraft. Thirty seconds prior to the mishap, lead received clearance to climb from below to above no. 2.

Within seconds of the mishap, after prompting by a flight engineer, no. 2 directed lead to turn left. Lead made a 2-G climbing left turn of 30-45 degrees of bank. The wingtips missed each other by less than 40 feet. Lead damaged his left wing as well as a fighter in the evasive maneuver. After lead began evasive action, no. 2 disengaged the autopilot in a roll away from lead, then rolled back to the left, while looking for the damaged fighter. Fortunately, no

continued

KC-10 continued

lives were lost.

How did this happen? For no. 2, this was a slow portion of the mission. The fighters were on lead. All he had to do was maintain position and work some position reporting and clearances. The passengers had some questions, but it was before dawn, and many were sleeping.

Somehow, one of the two following things occurred: complete loss of crew situational awareness, or, the crew was unable to communicate their concerns to the aircraft commander. Why didn't someone ask why turns were made into lead?

How can *you* promote the necessary communication in the cockpit? How can you help your crewmembers do their job better? Do you know the mission crunch points for other positions? Can you lessen their workload by assisting at those crunch points? Can you ask for help or give others some of your duties when you are stressed? Can you tell when you are overloaded? Can you tell the boss? Aircraft commanders, can you recognize a task-saturated crewmember?

More importantly, can you tell when you and the crew are at capacity? Do you stop and redirect tasks or just stop and make sure the most important items are done? — things like altitude, attitude, airspeed, and clearance from other aircraft. You have to be the gatekeeper for the rest of the crew and know when to call "time out." While this is the aircraft commander's responsibility, any other crewmember can help and suggest a "timeout" be taken.

The KC-10 has an outstanding safety record. To continue this record, operators and maintainers must focus attention on the job at hand. There are many things happening to each of us, both individually and collectively, which are vying for our attention. Cutbacks, restructuring of wings and commands, PCSs, and the promotion system all require some of our attention. Just remember, to attend to these tasks, you must successfully complete the task at hand. Make sure you focus on the mission while planning and performing it. Flying each sortie, accomplishing each task, and communicating effectively can make everyone's job much easier. You can make FY93 a mishap-free year. ■

KC-10 Safety Statistics FY 92

The KC-10 flew an estimated 42,000 hours in FY92, down from an FY91 high in Desert Shield/Storm/Sentry of 68,668. As of this writing, the KC-10 had no Class A mishaps, giving it a 0.26 lifetime rate — the best of any large heavy USAF transport/tanker. One Class B gives a FY92 rate of 2.43 and lifetime rate of 1.32. The FY92 Class Cs and HAPs are broken down by category and are shown in the table below:

Air Refueling (drogue)	10
FOD/Lavatory Ice	2
Autothrottle	1
Slats/Fillet	1

KC/C-135

MAJOR C. TERRY ANDERSON
Action Officer, AFSA

■ Change, change, and more change. That sums up the world of the KC/C-135 in the last 18 months. I think the KC-135 community has seen more change than any other weapons system. Over 50 C-135s have been retired. Soon, over 50 percent of USAF refueling assets will be provided by other than active duty units. Reserve and ANG fighter units are converting to the KC-135, some to the "R." Since there is no alert requirement, the ratio of crews to aircraft can be reduced. With the possible exception of Kadena, the traditional tanker task force staffs no longer exist. Command lines are different, wing structures are different, and the mission is changing. The C-135 is carrying more freight than ever before. Studies are being done on life cycle costs and effects of flying the C-135 fleet at three times the historic rate, primarily in a cargo role.

For the most part, you handled it — and handled it well. You flew 287,000 hours, just 12,000 less than last year with desert operations. You did it with fewer aircraft, fewer crews, and two-thirds fewer tanker task force staffs. You did it while your MAJCOM changed and your tasking and managing agency changed locations, people, and capabilities — your wing changed structure, and so did many of your parent wings .

There's plenty happening to hold our attention, but what does all this mean to us individually? To what do we give priority? To successfully recover today's mission, **we must maintain our focus on the task at hand.** Inattention in the phase dock, in the shop, on the flight line, during preflight, the mission, or postflight, may likely be the cause of the next mishap. Distraction or interruption during any operation can result in someone not coming back. Total focus on the job at hand and a firm grasp on the immediate environment is imperative (see the KC-10 article, situation awareness section).

continued

C-135 Inventory 1 Oct 92

CMD	# of Acft
Active:	
ACC	82
AMC	371
ANG	148
AFRES	30
AFMC	14
NASA	1
PACAF	16
USAFE	10
U.S. NAVY	2
Total Active:	674
Inactive:	
DPRMO	45
DISPLAY	10
ATC	4
DESTROYED	75
TOTAL PRODUCED	808

C-135 continued

MODIFICATION: There is presently one designated safety (Class IV A/P (S)) modification. When you read this, teams will be in the field modifying aircraft.

The changes you will see will be a low pressure warning light on top of the glare shield and an additional panel at the jump seat. If the system override switch on this panel is used, the 3,000-pound restriction for the body tanks will again be in effect. If the system is not overridden, the restriction is removed.

HUMAN FACTORS

One place we can all improve is making the job easier for other crewmembers. CRM classes and systems have been developed that are a definite help. These give you tools to help you work as a team. But remember, the goal of the process is to complete the mission BETTER. Is there value added? Don't simply employ these tools for the tool's sake. You don't have to log "CRM technique #4" once each quarter. Critique how you could have helped other crewmembers accomplish their task better. Offer help to others where you can and let them know when you are task saturated. If you get down and you know things went badly, admit it (among yourselves) and talk about how to improve the situation next time. You probably will not see immediate results, but if you continue the process, significant improvement will occur over time. Try it. It's worth it.

Class A's

Last year, the C-135 was charged with two Class A mishaps, giving it a 0.70 per 100,000 hours Class A rate. Fortunately, we had no Class B mishaps and no lost lives, for the second year in a row! In the first Class A, a KC-135 struck a fighter, over water, just before dawn in a successful attempt to avoid a midair with a KC-10. The fighter was lost, but the pilot was recovered.

In the second Class A, a heavy C-135 landed long on a short wet runway. The pilot requested to circle to land — the request was denied, and he landed with an 8-knot tailwind. Another crewmember failed to inform the aircraft commander the landing roll nearly equaled runway available without the tailwind. Reversion to previous training in operating the aircraft's braking system contributed to the overrun of the runway. The spine of the aircraft broke when it crossed a road, but all crewmembers egressed successfully.

Future Challenges

What challenges can you expect to see in the future? Soft crews, more cargo missions, and more interservice missions will certainly occur. In the midst of USAF-wide changes, fewer regulations will give aircraft commanders the opportunity to really command! The staff agencies that used to look over your shoulder and the written guidance you could fall back on to get you through uncomfortable and unfamiliar situations may not be there.

That means aircraft commanders will have to take a larger role in decision making. Staffs will provide flight plans, but you will have to be sure your crew knows what they will face. If you are uncomfortable with your knowledge of how a mission will be run, clarify it before you go to the jet. If you don't know, those on your crew probably don't either. Your cell mates may also have questions. You may be the only person to say "wait a minute" on the ground and keep the crew from being overwhelmed in the air. Swallow your pride, and ask someone. Talk about it. That goes for every member of the crew.

Brief the important things: A/R route, rendezvous altitude (yours and the receivers), direction of turn

and altitude at cell and A/R breakup, alternate weather, divert bases, approaches, and who does what in an emergency. You may have to hangar fly more of the mission or modify simulator sessions.

Speaking of simulator sessions, it's time to make the most of them. Simulated engine failure work is currently prohibited for copilots in the aircraft, so ANY three engine work WILL be in the simulator. Do the best job you can because if you have to fly one in the air, it will be for real.

Aerial Demonstrations

With the shrinking force, we may be asked to be more visible to help reduce funding cuts. If you are asked to participate in an aerial demonstration (flyby, airshow, retreat, published low approach, etc.), read AFR 60-18, *Air Force Participation in Aerial Events*, and governing command directives. AFR 60-18 explains what is allowed, how to plan, and other information required to succeed in the event. Remember these basic rules: Weather must be 2,500 and 5 miles visibility, your altitude must be at least 1,000 AGL, and your speed must be 30 percent above stall speed (you must account for the bank angle). Any time you are asked to do something that has not been done before, or, if you have not done it yourself, closely examine how it is planned. First, ask "Is there a need to do this?" Next, determine "Can this be done?" Finally, "How can I maximize effect while minimizing risk." In other words, plan it, research it, practice it by gradually working up to the final goal, then DO IT the way you practiced it. Focus, adhere to existing regulations, and use common sense (which is not always that common).

Finally, let's talk about reporting hazards and mishaps. Congratulations! Class C mishaps are down 35 percent of the average reported during FY88, 89, and 90. HAPs are down 61 percent. The combined count is down 46 percent during the same period. We had more reports during the desert operations than now. If mishaps and hazards occur and are not reported, the problems don't get fixed. It is just like the aircraft — if it doesn't get written up, it doesn't get fixed. ■

SOME INTERESTING INFORMATION

The KC-135 and the B-707 are a derivative of the Boeing "Dash 80." Boeing referred to it as the "367-80" (a C-97 variation) to reduce the opportunity for industrial espionage. Boeing tested various configurations of the aircraft in their own wind tunnel for over 21,000 hours. The company invested fully half their net worth in research and development of this aircraft.

There were major obstacles to overcome: (1) Where to locate the jet engines so the rest of the aircraft would not catch fire when the engine failed and fire penetrated the engine case (British Comet mishaps in the 1950s). The existing configuration gave the most efficient operation and a high level of safety. (2) Where to place the landing gear. Wind tunnel tests showed the wing could be made thick enough to house an inward retracting gear truck (the existing configuration) with a very small loss in performance. The military version was really developed first, even though internally it was referred to as the missing "B-717" of the Boeing B-7X7 series.

By 1960, Boeing attempted to convince the USAF to install fan engines. To maintain fleet standardization, the USAF stayed with the J-57.

In the 1970s, when a tanker with greater capability was being considered, Boeing offered the existing B-707 fuselage, the B-707-300 wing, and the CMF-56 (R-model) engines. The proposed aircraft would have been capable of 425,000 pounds gross weight, over 100,000 more than the R-model, with little increase in operating weight. This aircraft is no longer available.

Helicopters

LT COL RONALD C. CUNNINGHAM
Action Officer, AFSA

Like all novices, we began with the helicopter (in childhood), but soon saw that it had no future and dropped it. The helicopter does, with great labor, only what the balloon does without labor and is no more fitted than the balloon for rapid horizontal flight. If its engine stops, it must fall with deathly violence for it can neither float like the balloon, nor glide like the aeroplane. The helicopter is much easier to design than the aeroplane, but it is worthless when done.

■ These words were penned by Wilbur Wright on 13 January 1909. Some 62 years later, during the last months of the Vietnam conflict, the late CBS correspondent, Harry Reasoner, may have had Mr Wright's words in mind when he wrote, "Being a helicopter pilot is so different from being an airplane pilot and why, in generality, airplane pilots are open, clear-eyed, buoyant extroverts and helicopter pilots are brooders, introspective anticipators of trouble. They know if something bad has not happened, it is about to."

The past year was a somber one in the Air Force rotary wing community causing us to be even more introspective than usual. All the Class A mishaps occurred during the first month of the fiscal year, in just a 20-day span, and caused eight fatalities.

Class A Mishaps

For FY92, three Class A mishaps produced an annual rate of 4.67 (based on estimated total flying hours). This rate is an increase over last year's two Class A's but below CY82 and 84 when there were five and four Class A mishaps, respectively. In the past 10 years, there have been a total of 26 Class A helicopter mishaps.

The first mishap involved a UH-1N scheduled for a multiple-lift paradrop sortie. Following an uneventful high-altitude, low-opening (HALO) drop, the pilot landed at the drop zone, reloaded the three jumpers, and took off for the second HALO deployment. Five minutes into the climb, the aircraft broke up in flight. The pilot, aerial photographer, and jumpmaster received fatal injuries. Two parachutists were able to deploy their chutes and landed safely.

The second mishap involved an HH-1H performing transition training when the aircrew was notified for a medical evacuation mission. After picking up two medical technicians, the aircraft proceeded toward a missile launch control facility to transport an injured airman to the base hospital. En route to the facility, the aircraft impacted the ground and was destroyed. The two pilots and two med techs died. These two Class A's are the sixth and seventh H-1s lost in the preceding 10 years.

The final Class A of FY92 was the loss of an HH-60G on a search-and-rescue mission over the North Atlantic. On the return leg from the unsuccessful attempt to rescue an individual from his boat, the helicopter was unable to refuel from the HC-130 tanker due to darkness, poor visibility, and moderate to severe turbulence. The aircraft was forced to ditch. All five crewmembers egressed into 40-foot seas.

Four crewmembers were rescued by a Coast Guard vessel. A para-rescueman was lost at sea. This is the third H-60 lost in the last 6 years.

Class B Mishaps

For the first time since FY90, there were no Class B mishaps. In the past 10 years, there have been nine Class B mishaps.

Class Cs and HAPs

Last year, a remarkably low 29 Class Cs and HAPs were reported. This year, the number increased to 53, somewhat closer to the average. The totals were evenly distributed between H-1s, H-53s, and H-60s. The exception was the shrinking H-3 fleet, reporting only five Cs or HAPs.

The majority of the reports, across all helicopter types, dealt with engine failures due to FOD, compressor stalls, and intentional shutdowns for various problems.

The H-60 community identified some comm/nav problems and fuel migration into the dry bays. Late in the reporting period, two separate incidents of total electric failure were cited on MH-53s. An Air Rescue single engine H-model performed a near perfect autorotation following an engine failure. Other than the engine problems, there were no remarkable trends to mention.

Summary

If we look at the 40 Class A helicopter mishaps occurring in the last 17 years, what percentage of these mishaps would fall under operational causes versus logistical causes? How do helicopter percentages compare to the Air Force averages where 70 percent are human error (operational) causes versus 30 percent logistical causes? Actually, the helicopter mishap percentages fall very close to the Air Force averages — 67 percent ops causes versus 33 percent log causes.

Causes of helicopter mishap rates, 67 percent ops and 33 logistic, closely match the overall Air Force rate.

What do these percentages mean to those of you who are flying the line? They tell us maintenance is doing their job. There is always room for improvement, but for the most part, the technology is in place, and the TOs are being followed. They also show we need to do a better job understanding the human factors which cause the majority of our mishaps.

Every flying command in the Air Force has some type of aircrew coordination training effort in place. In some commands, the program is in its infancy. In others, the importance of aircrew coordination training needs to be reemphasized through training, standardization, and supervision. Past efforts in the programs demonstrated they do reduce mishaps. The next year can be safer if we have disciplined operators, involved supervision, smart training programs, survivable tactics, and sound maintenance. ■

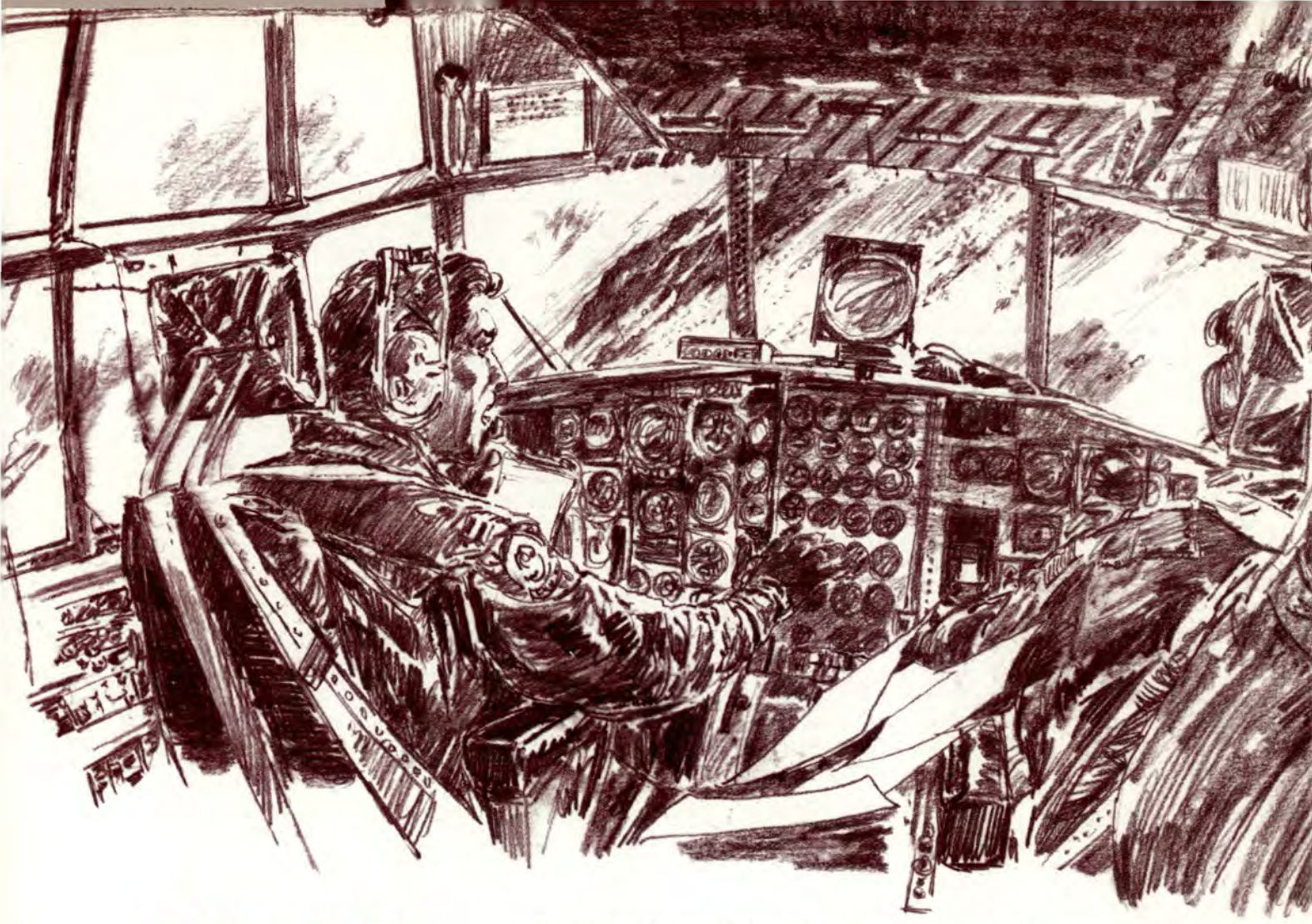
The Air Force mishap rate for rotary wing aircraft rose one-third over last year.

Air Rescue to ACC

On 1 Jan 93, Air Combat Command's rotary wing assets will grow from 3 to 79 helicopters. This will occur as a result of the Chief of Staff's directive to more closely align combat missions and simplify command lines. Air Rescue's CONUS helicopter squadrons, as well as Air National Guard and Air Reserve forces, realign under ACC. Currently, ACC has three N-models based at Langley. After realignment, 21 H-models and 24 N-models will be gained from the eight detachments under the 37th Air Rescue Squadron.

Twenty-six HH-60Gs will be acquired from two AFRES, two ANG, and one active duty Air Rescue unit. Five H-3s from one east coast rescue squadron complete the total. Additionally, the HC-130 tanker assets co-located with some of these helicopter squadrons fall under ACC.

Theater Air Force MAJCOMs will acquire the remaining worldwide rescue assets from Alaska to Iceland. These total 22 HH-60G and 4 H-3s. With this realignment, ACC will possess 50 percent of the Air Force helicopter inventory.



What Do You Know About ASYMMETRICS

MAJOR TERRY ANDERSON
AFSA/SEFB

■ "We've flown a 7-hour, by-the-book mission, and are about to complete an ILS in VMC conditions. We'll land just after sunrise, and I'll be glad to put this one to bed. The duty day started over 16 hours ago.

"Nice approach, a little low on glide slope at 4 miles, half a dot below, nice correction. Now passing over the threshold, throttles idle, flare, good smooth touchdown on centerline. The nav calls lights on all four reversers, I advance power for reverse thrust, not too much, I'll take it to the end. The aircraft wants to go right a little (one of the engines must have accelerated faster than the others). A gentle left rudder correction brings it back to center. The right seat calls out 'approaching 80 knots.' I bring the engines to reverse idle, then forward thrust ...

"Suddenly, the aircraft veers hard left. I counter the movement with full rudder, then add nosewheel steering. It's still heading off into the weeds! I recheck all the throttles at idle, add right brake and full lateral controls right. Finally, full right nosewheel steering and it *still* departs the runway. I ride it out, holding the controls, commanding a right turn until it stops in the dirt. Everyone evacuates. What happened?" I gasp!!

Next

"It's a 2230 takeoff for a 9-hour Desert Shield support sortie.

My crew and I are rested, predeparture and preflight have been normal. Takeoff weather is okay. We'll enter the overcast within 1,000 feet. The takeoff roll is normal. Rotate. Call for the gear up. Suddenly, I'm rolling right, feels like no. 4 has quit and the jet's really yawing and rolling faster than I can believe. The engine instruments look good, so I push up on the no. 4 to reduce the asymmetrics, but it rolls faster than ever! What can I do? We're passing 50 degrees of bank and 200 feet! What can I do?"

And Then ...

"The other pilot is practicing engine-out approaches. The aircraft is halfway down the glide slope, on the proper speed for flap setting and gross weight. Tower directs an immediate go-around. Immediately, the throttles are advanced to maximum thrust available. In spite of full opposite rudder, the aircraft yaws and rolls into the dead engine. This continues to a full departure from controlled flight. What next?"

Or,

"I'm back in the pattern, giving a student a requal as an instructor because he has been out of the aircraft for 3 years. We have completed airwork and are ready to pound the pattern for a while. On the next one, we'll simulate engine failure on the runway during the touch-and-go. We brief. He flies a good, smooth approach and landing. I hold back no. 1 as he advances the other three, and he applies full **LEFT** rudder! What now?"

Each of these unpleasant situations have something in common. Asymmetrics! What happened in each? Airplanes were damaged or destroyed, and people were killed! How ready are you for an outboard engine to fail to full thrust during landing? How about a thrust reverser deploying just after rotation? How about the other pilot applying the wrong rudder in response to a failed engine just above approach speed? These are the things nightmares are made of — and these examples have all occurred. Let's talk about it.

It's Not Normal

In the first place, all asymmetric flight is an abnormal situation — it is either a real emergency or one we are simulating. We practice so often, and become so proficient, it might be easy to lose respect for the seriousness of such a situation. So let's go over the basics to see why we get into the books and calculate ground minimum control speeds (V_{mcg}) and in-flight minimum control speed (V_{mca}).

All of an aircraft's control capability is dependent upon two factors: thrust and lift. Asymmetric thrust produces force in one direction — yaw. Available control surface authority produces force in the opposite direction — force to counteract yaw. In aircraft, this force is aerodynamic force or thrust being produced. Aerodynamic force (lift) is determined by the velocity of the air passing over the surface and the size of the surface, as seen in the lift formula, $L = 1/2\alpha\rho\mu\ V^2S$. Since most of our aircraft cannot change the total control surface area (in nearly all aircraft, V_{mca} is defined with the rudder fully deflected), the only variable is the velocity of the air passing over the control surface.

The more smash you have, the more "G" (and roll and yaw) you can get for a given amount of control deflection. Notice the "V^2" in the lift formula above. You have a great deal more control authority with higher airspeed. (Viper drivers, ignore this statement. Your controls are atypical. Besides, you have only one centerline engine.)

So, at a given indicated airspeed, a constant amount of force is available from the aircraft control surfaces. Since asymmetric thrust is countered primarily by rudder, I'll concentrate on it (them) and the vertical stabilizer(s). For a given indicated airspeed, the force applied by the rudder depends on the degree the rudder is deflected. But at full deflection, it is exerting maximum force. If full rudder is applied, the only way to increase the force applied to the airframe is to increase airspeed.

Since the thrust is not applied to the center of mass of the aircraft, each engine acting by itself attempts to rotate the aircraft about its center of mass. Fortunately, in normal operation, the thrust of an engine is countered by equal thrust an equal distance on the other side of the center of mass, and we fly straight (when we want to) and not in a constant arc. When one engine quits, if we were able to cut one off on the other side, we would never have an asymmetry problem.

Unfortunately, most of the time our altitude or airspeed begins to decrease, and the aircraft eventually contacts something (like dirt) which will hurt it and you. This is especially true in thrust-limited aircraft (KC-135A, light civil twins). If you are at a high gross weight and low airspeed (takeoff), you may not wish to retard the throttle creating your control difficulty (this is obvious in a twin-engined aircraft). The remaining (operating) engine(s) can remedy the situation but may also create control problems.

How Did We Get Here?

Several things can happen to cause an asymmetric situation. The most common, and what we practice, is loss of an outboard engine. This situation creates our worst control problem. Right? With most aircraft, it does. However, for those who fly thrust reverser-equipped aircraft, the condition could be far worse. You can have more than 50 percent REVERSE thrust, which is like losing at least 1 3/4 engines on the same side, if it is an outboard

continued

What do you know about ASYMMETRICS? continued

Asymmetric conditions can occur for many reasons. This KC-135 landed safely after literally losing two engines.

reverser. (In fact, it has the longest lever arm from the aircraft's center of mass, which makes it worse than the total negative thrust produced.) Undetected **reverse thrust** has happened only **twice**, and two aircraft were lost. It does not happen frequently, but so far, it's been deadly.

What can put us into an uncontrollable situation? The most common is outboard engine loss below in-flight minimum control speed. More powerful engines have the capability of producing more thrust than the aircraft has control surfaces to counteract, which is why the E-3 and KC-135R have thrust limits on the outboard engines for go-arounds. If flight control authority is lost or if an engine is overboosted or oversped at minimum control speed, we must increase the airflow over the control surface to get back the necessary force to counter an asymmetric condition. To regain control, increase airspeed or reduce the asymmetric thrust (pull back the opposite outboard). Otherwise, departure from controlled flight will result (if below V_{mca}).

Obviously, these are **EXTREMELY DANGEROUS** situations and a good reason why we do not practice them in the aircraft. The simulator is the place for such practice. Make sure you get enough of it.

Nothing's Inevitable

So, how do we minimize risk of asymmetric flight situations? First, KNOW the capability of the aircraft. What are the conditions for minimum control speed? Is the asymmetric engine at full thrust or maximum charted outboard (KC-135R) thrust? Is yoke deflection included? If so, how much? If on the ground, is nosewheel steering, full forward column, or bank required to achieve the V_{mcg}? In flight, what effect does a change in rudder hydraulic pressure have on V_{mca}? Do you have to maintain bank into the good engine? Some USAF aircraft (C-130, C-135, etc.) require 5 degrees of bank **into the good engine**, and V_{mca} increases between 9 and 20 knots at no bank.

Banking away from the good engine increases V_{mca} by a like amount. If another engine fails on the same side, how much is V_{mca} changed? How fast does the aircraft depart controlled flight? How much time do you have to react? If the other pilot applies the wrong rudder, how long do you have?

Second, be prepared. Takeoff, approach, landing, and low level give you the least altitude to recover. If an engine fails or goes into reverse, what will you do FIRST? How will you determine if uncommanded thrust reverser deployment has occurred? (For C-130s, how do you recognize a prop about to go into reverse?) How will you **PREVENT** the other pilot from applying the wrong rudder? (Applying full rudder in the wrong direction, for all practical purposes, is NOT recoverable.) Think about critical phases of flight NOW.

Have a plan. If simulating an engine-out approach, return to symmetrical thrust by bringing up the simulated failed engine. If actually engine out, try to eliminate the asymmetric condition, altitude and airspeed permitting, by reducing power on the asymmetric good engine. If you are already below V_{mca}, unless you reduce asymmetric thrust or increase speed, you will be unable to maintain controlled flight. If V_{mca} is 130 KIAS, an increase of 10 KIAS increases control authority 16 percent; 15 KIAS, by 25 percent. Dropping below V_{mca} decreases control authority just as dramatically (remember V^2?). NOTE: You CAN fly below V_{mca} IF you are using LESS than full or maximum allowable charted thrust. If thrust is increased to these values while below V_{mca}, the aircraft will not maintain controlled flight.

Few people realize how deadly an engine-out situation in a multiengined aircraft can become. Asymmetrics can cause departure from controlled flight faster than any other event. Although the aircraft are designed to be operated in these conditions, they are at the edge of the envelope — which is why the conditions are so finely defined. Know your aircraft's flight characteristics, anticipate high risk situations, and practice them in the simulator. If you know the flight characteristics of your aircraft and operate inside its envelope, you can tell war stories about your skill and the reliability of the aircraft. Operate outside the envelope, and you'll tell of neither. Fly smart, fly safe. They are the same. ■

Cockpit Resource Management for a Flight Instructor

GENE HUDSON, APC
SoCAL Aviation Review, Oct 92

■ Increasingly, it is becoming evident the crews who succeed in tight situations tend to be those in which a high level of positive and open verbal communication occurs. The captain learns from the crew as much as the crew learns from the captain. The group works together in an environment of mutual trust, confidence, and respect. The captain is still the final decision-maker, but the group works as a cohesive team.

But what does this have to do with flight instruction? The cockpit of a 152 on a pre-solo training flight is light years away, psychologically, from a cohesive team of blue-suited professionals coolly bringing a crippled 200-ton Airbus™ back to a feather-light touchdown.

There are several reasons why CRM might fail in an airline cockpit, and these give us clues as to how we might be at risk in an instructional situation.

One of the most insidious obstacles to effective resource management occurs when the captain or aircraft commander does not have confidence in the technical skills of one of the other crewmembers.

A pilot who does not trust the skills of the crewmembers will tend to take on all tasks and underutilize the crew. The overloaded captains are so busy flying the airplane that they "lose the big picture," and an accident ensues.

This principle makes it difficult to apply some of the lessons of CRM to the instructor-student relationship. Given the instructor does not have confidence in the pre-solo student's piloting skills, the instructor cannot afford to delegate tasks without constant and direct supervision. In the same way that a captain may tend to "take the airplane" away from a subordinate in whom there is no confidence, the flight instructor often feels forced to "take over" as soon as things get a little hectic.

As most of us know, the workload on the flight instructor is often much higher when teaching a maneuver than if the maneuver was simply demonstrated. We have to watch the student's performance, offer comments, respond to ATC calls, monitor the aircraft, and watch for traffic. If anything goes wrong, the problem is magnified tenfold. The flight instructor is under the same kind of excessive-workload situation as is the mistrusting airline captain.

Communication between instructor and student is repressed in these situations in the same way as it fails in the poorly managed airline cockpit. The student is reluctant to express doubts about what the instructor is doing. After all, the instructor is the all-knowing expert aviator upon whom life depends.

Take the case of the CFI and pre-solo student during a real engine failure over the practice area. The sudden, unexpected silence from the business end of the airplane will prompt most CFIs to immediately command "I've got it." Soon the instructor is completely consumed in the task of dealing with the emergency, and the student is reduced to the role of terrified spectator.

The spectator-student, having but 5 hours, believes without question

continued

Cockpit Resource Management for a Flight Instructor continued

The "me-great-instructor, you-just-bum-student" syndrome has caused many embarrassing and some fatal incidents. Encouraging students to ask questions is simply good cockpit resource management.

that Chuck Yeager's alter ego in the other seat must surely know about the dirt strip they just turned away from. There must be some compelling reason why the instructor rejected that option. The spectator-student considers asking about the decision, but decides to remain mute in order not to disturb the concentration of the instructor who is now very busy and fully absorbed in saving both their posteriors.

The 152 comes to rest in the plowed field, not 2 miles from the dirt strip. There are no serious injuries, but the aircraft is substantially damaged. (Cut to scene two, the inevitable postcrash discussion.)

"Wow! That was one great approach!"

"Yeah, looks like the airplane's totaled, though. Too bad there wasn't a better place to put it."

"I wondered about that. Why did you pick this field? I would have gone for the dirt strip."

"What dirt strip?"

"Uh, it was right below us out my window when the engine quit."

"You mean there was a strip right below us and you didn't tell me?"

Our instructor is understandably upset but does not realize it is the CFI, not the student, who bears most of the responsibility for a failure to communicate. Although light plane accidents historically are not analyzed this way, this scenario represents a classic CRM failure.

The aircraft commander failed to adequately manage (identify, prioritize, and use) a valuable cockpit resource. This accident actually began a full month prior to impact.

A month ago, the instructor fell victim to the "me-great-instructor, you-just-dumb-student" trap. In the zeal to impress the student with great expertise and confidence, the instructor unwittingly established a pattern of "I talk, you listen" in the cockpit. In air carrier operations, this is called an excessively steep authority gradient. Nobody challenges the pilot in charge, because the pilot is always right.

How can I better manage my cockpit resources while instructing? The following are a few suggestions, derived directly from airline-type CRM courses, which I believe might help all of us achieve safe and efficient flight instruction.

Establish an "open cockpit" policy. Set your student down prior to the first flight, and make it clear you desire and expect input, and you want the students to communicate their status, feelings, ideas, and doubts. If they see a low airspeed, they are to call it out. If they see traffic, you want to know. If they are uncomfortable with a maneuver, speak up. The only dumb question is the one which doesn't get asked.

Give yourself permission to be wrong. All too often we instructors are embarrassed when we are caught with our pants down. After all, we are supposed to be teaching them, and we are not supposed to do anything less than perfect. It is too easy to get defensive and explain our error away, invalidating our students' insights! Realize you cannot be perfect. Make sure they know you are not going to be perfect. When they catch you fair and square, 'fess up! They're right, and you need to make sure they get full credit for it!

Delegate. As the students' skills come up, transfer as much of the workload to them as is consistent with their abilities and current level of stress. Free up as much of your time as possible to understand "the big picture."

Use an intercom and headsets. Most CRM accidents result from some sort of failure to communicate. The light trainer is a lousy place to be clearly understood. A good inter-

com reduces misunderstood speech, reduces workload, and reduces noise fatigue and stress.

Resolve all conflicts by outside verification. If the student thought the controller said 3,000 and you are absolutely sure it was 4,000, get the clearance verified. As a matter of principle, never ever rely on one person's confidence or authority (especially your own) to resolve the slightest doubt. The 50 times you were right won't save you on the day you are wrong. No matter how inexperienced the other pilots are, in any given situation, they may be the sole possessors of the information which will save your certificate — and your life.

Get away from the airport as quickly as possible. The vast majority of midair collisions occur below 3,000 AGL and within 5 miles of an airport. Especially in the early stages of training, you cannot maintain a maximum effort traffic watch and teach at the same time.

Implement a sterile cockpit policy. Air carriers typically require flightcrews to refrain from nonflight-critical conversation during any operation below 10,000 MSL. This is, of course, an overly restrictive requirement to place on a 152 driver. Why not implement a sterile cockpit within 15 miles of the airport, or while in any TCA or ARSA? The top priorities while transiting this airspace need to be flying the airplane and keeping up the traffic watch, in that order. Save the conversation for later.

Teach precise radio communication procedures. The more effective the student is on the radios, the more time you have to manage other resources. Don't presume your instructor, the controller, or even the airline pilots are good models of communications. Go back to the AIM glossary, and look up those bold face phrases. You may run into some surprises. Go to the classroom with your students, and simulate exchanges with ATC until they have it down.

Conduct a positive critique after every flight. The captain should critique the crew, and the crew should critique the captain. We can, and should, do the same thing. Make it a stated policy there will be a postflight critique after every lesson, and the student will critique your performance as well. Don't just expect it — require it.

Implement constructive criticism techniques. If the student tried to destroy the 152 landing, critique the maneuver as an "it," not the student as a person. "That one didn't work out. Let's try again" works a lot better than "Boy, you just can't get that right, can you?" The student is humiliated enough, so don't make it any worse by letting your critique come across as a negative judgment of an individual.

Apply active listening. Don't let your zeal to achieve perfection overshadow your concern for the student as a person. Ask questions. Draw out the personality. Look at the student. You may be surprised at how much easier your job will be.

An outstanding instructor is also a good friend. The old-school method of motivation by fear and intimidation went out years ago. Learn to share authority with your student. Contrary to our fears of seeming "ineffectual," this will actually increase the bond of respect and trust which marks the best student-instructor relationships.

Get into the habit of letting the other person talk. If you don't, one day you may end up standing in front of a bent 152 only to hear yourself saying, "Why didn't you tell me?!!" ■

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Constructive criticism helps build student confidence. Good instructors learn to share authority with their students.

AERO CLUB SAFETY

LT COL JOE BROWN
Air Force Military Personnel

■ The Air Force Aero Club Program experienced humble beginnings in the early 1950s when Gen Curtis LeMay authorized some NCOs to operate a tube-and-fabric Taylorcraft *BC-12-D* from Offutt AFB. Now comprising 41 locations worldwide, 10,000 members, and over 440 aircraft, aero club popularity is reaching an all-time high. Flying hours are at a 10-year peak with over 190,000 flying hours per year and are expected to increase.

However, it has been an evolutionary period with growing pains. The loss of appropriated fund support, increased insurance premium rates, price increases for fuel and parts, and more operational oversight have been major factors. While a few viewed the clubs as candidates for extinction, commanders have always recognized there is a place for general aviation flying in today's Air Force.

The benefits derived from aero club flying are many. Aero clubs support official TDY travel for qualified members and their passengers at a great savings to the government. Aero club aircraft and pilots survey low-level tactical routes at a cost far below operational aircraft. Parts and maintenance personnel are transported to breakdown sites quickly and economically. These are only a few of the operational functions performed.

But these are secondary to the aero club's primary mission of providing low-cost recreational flying to Air Force personnel and their families. Aero clubs do this extremely well and, in the process, train hundreds of new pilots every year. The clubs are helping people to reach goals which might not be possible without them.

If aero clubs have an Achilles' heel, it is the perception they are a dangerous activity. For years, commanders have had a certain amount of trepidation about their flying clubs. It is easy to understand their concerns. In an operational flying

★ U.S. GOVERNMENT PRINTING OFFICE 1992-679-016/60004

unit, everyone graduates from a highly standardized training program, and each pilot is checked regularly to ensure performance meets standards. Each flight is carefully orchestrated as to exactly what will occur.

Not so with aero club flying. Experience levels vary widely from test pilots to 70-plus-year-old grandmothers. While training is standardized to the maximum extent possible, the attitudes and approaches to flying are also widely divergent. And, of course, pleasure flying is much less strictly controlled.

The history of aero club flying safety has indeed been a rocky one. In the early 1960s, the accident rate was as high as 34.7 accidents per 100,000 flying hours with a 6.2 fatality rate. These rates were completely unacceptable.

Several actions took place, including the complete restructuring of aero club operations as directed by the aero club regulation. Supervision increased with the addition of wing advisors at base level. A rated officer was assigned to oversee the program at the Air Force level. Checkouts became mandatory in each make and model aircraft as well as yearly checkrides.

These are only a few examples of the dramatic steps taken to improve the aero club safety record. Their effectiveness is shown by the 1991 aero club accident rate of 3.3 per 100,000 hours and the zero fatality rate compared to a 6.9 accident rate for general aviation.

Admittedly, 1992 got off to a rocky start with a 7.7 accident rate and one fatality. While the higher rate is not unusual for this time of year, aero clubs must strive to be better.

Weak areas continue to be landing proficiency, fuel management, and pilot judgment. The best advice that can be offered to each aero club pilot is, "Know and follow the applicable Air Force and FAA rules and regulations." Additionally, pilots must know their own limits and stay well within them. The likelihood of a serious mishap can be greatly diminished, and with that, the aero clubs *will* attain a safety record second to none. ■

The Cessna 172, such as this one from the Eglin AFB, Florida, Aero Club, is the world's most popular general aviation aircraft.

Many U.S. Air Force aero clubs offer a wide range of training from basic private pilot to multiengine instrument ratings.

Whether flying an F-15 or a small single-engine aero club aircraft, in the Air Force, safety comes first.

Do you know how to take a jet engine apart with a pocket knife?

DO YOU KNOW HOW *NOT* TO?