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The Mishap Investigation Process

Photo courtesy U.S.Navy *APPROACH* Magazine

LCDR NEIL MAY*
Courtesy *Approach Mech*, Jul-Aug 96

■ Once upon a cruise, an E-2C Hawkeye launched on a night AEW mission south of the Azores while en route to the Med. The weather was great, with loads of starlight but no moon. We had done the standard Case III departure and were outbound climbing to station. Although I was a new guy, I was also the senior pilot in the squadron because the CO and XO were NFOs (Naval Flight Officer—nonpilot officer crewmember). I was sitting in the right seat, with the plane commander in the left seat at the controls (a more junior pilot but squadron veteran). Passing 12,000 feet, the pilot turned to me and asked, "Do you have the air plan?"

I replied, "Sure do!" and handed it to him. The plane commander said, "Uh, great. I like knowing who's in the recovery with us." I was impressed by his attempt to gain more situational awareness and continued monitoring the climb as he read the air plan. I was also impressed with how well he had trimmed the aircraft since he was flying hands off, scanning the air plan and the instruments.

I took a quick scan outside and noticed the pilot had turned gently (about 20 degrees AOB) toward our station. I came back into the cockpit and noticed the pilot still scanning the air plan and instruments, hands off. The aircraft gently rolled further right to 30 degrees AOB.

"Thirty degrees," I said over the ICS and continued looking at the pilot and attitude reference for a reaction. The turn continued to 45 degrees AOB and I said, "Forty-five degrees AOB." Still no response, so I took the controls, rapidly leveling the wings, and continued the climb through 19,000 feet.

The plane commander looked up as I rolled wings level. The mission commander, in the rear of the aircraft asked what had happened.

After a simultaneous "I thought you had the airplane!" we realized how we had miscommunicated. The plane commander had originally asked if I had the "airplane," not the "air plan."

Several weeks before this flight, I had received aircrew coordination training during my refresher syllabus at the FRS. The course included the "two command" rule for multiplace aircrew. This rule states *"During IMC or night conditions, an AOB exceeding 30 degrees must be challenged. After two challenges without a response, the other pilot is to assume control of the aircraft."*

That night, we made a fundamental error in our command-reply procedure. The initial command should have been, "You have the controls," the reply being, "Roger, I have the controls." Although I watched the situation develop, I am still impressed how easily aircrew coordination can take a "turn" for the worst. ✈

*LCdr May flies with VAW-126.

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SPECIAL FEATURES

REGULAR FEATURES

CONTRIBUTIONS

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MISHAP INVESTIGATION

BOB VAN ELSBERG
Managing Editor
Road & Rec Magazine

Nervously, he worked his way forward to the cockpit. Mr. Hoenig (an aircraft engineer played by Jimmy Stewart) had bad news for the crew. Having investigated potential causes for the crash of an airliner similar to the one he was now aboard, Hoenig had come up with a horrifying realization. After 1,440 flight hours, metal fatigue would cause a catastrophic failure of the rear control surfaces—literally ripping the tail off the aircraft. And more terrifying yet, this airliner was due for its appointment with tragedy before it could land. Only an unanticipated variable—temperature—allowed this flight to pass the 1,440-hour mark and land safely.

If you saw the rest of "No Highway in the Sky," *you saw that Hoenig's conclusions about metal fatigue were right. There was a distinct cause for the "mysterious" crash which had claimed the first airliner. Hoenig eventually proved his theory by testing a good aircraft until the tail fell off. Fortunately, Air Force mishap investigators don't have to rely on such extreme measures. Today, there's a process which allows them to find a mishap's cause without destroying a good aircraft.*

Whenever an Air Force aircraft goes down, particularly if there's loss of life involved, it's a tragedy requiring an immediate response. The nearest active-duty Air Force base provides emergency firefighting, rescue teams, and security at the crash site. At the same time, the base sets up an Interim Safety Investigation Board to gather and preserve evidence for the permanent Safety Investigation Board (SIB). Included in the interim SIB's lengthy list of tasks are photographing the crash site, interviewing witnesses, taking aircraft fluid samples, testing the members of the flight and ground crews for toxic substances, and collecting any witness photos or videos.

The MAJCOM appoints the SIB, which is normally formed and on its way to the mishap site within 2 to 4 days. The members include the board president, investigating officer, an Air Force Safety Center representative, pilot, aircraft maintenance officer, medical officer, and recorder. Representatives from Air Traffic Control, weather, weapons, life support, and the mishap unit may be appointed to the board if these areas are suspected of being mishap factors. Ultimately, it is the SIB which must look at the facts and determine why an aircraft went down.

Finding out the "why"—discovering the root cause of a mishap—is hard work and involves four distinct phases, according to Lt Col Dan Dougherty, former Chief of the Aviation Safety Operations Branch.

Phase One—Fact Gathering

"The first 7 to 10 days are normally spent establishing *what* happened," he said. During this "fact-gathering phase," wreckage is identified, and factors such as the impact angles are looked at. Top priority goes to recovering the crash-survivable flight data and cockpit voice recorders, if the aircraft had them. The flight data recorder can measure more than 30 instruments, giving some idea of how the aircraft and its major systems were functioning when the crash occurred. On aircraft without flight data recorders, looking at the remains of the aircraft systems can also provide valuable clues, according to Maj Tim Towne, an Air Force Safety Center maintenance officer.

"It's possible to look at the engines and determine if they were at full power, idle, had seized, or had been FOD'd," he said. Also, looking at the cockpit instruments can provide valuable clues. He explained that on some instruments, marks on their drive gears can indicate the actual instrument readings at impact.

As the SIB members work together at the site, the investigation takes on a life of its own, reflecting the people involved, Towne said. "The personalities and skills the members bring with them make each mishap board unique. The more background experience and cooperative spirit they have, the better things go."

Just "getting there"—getting to the actual crash site and recovering debris for analysis—can be a major challenge, Towne said. In one crash, the aircraft engines were in an inaccessible area on a mountainside. "We had to go to the Army to get heavy lift helicopters to get the engines out. Typically, the more remote the crash site, the more you have to improvise. There are no cookbook answers to all the problems you'll encounter on a mishap investigation."

Phase Two—Analysis

After the investigators determine exactly "what" happened, they start looking at the "why." This is the most complex phase of the investigation. Eyewitnesses to the accident are interviewed, and, just as in car accidents, stories often don't match, according to Towne.

"Eyewitness testimony is always good to have. However, it needs to be backed up with material evidence," he said. "There are always different opinions of what happened according to each eyewitness." As an example, he explained that a film of an actual mishap is shown during Air Force Safety Center mishap investigation courses. And although students are warned in advance to watch for the mishap sequence, only one person in four accurately identifies the series of events leading to the crash.

Still, without cockpit voice and flight data recorders, eyewitnesses are the only "real time" observers of the crash and, as such, are questioned thoroughly.

"You want to get information from all of the witnesses' senses—what they saw and heard," Towne said. "Did they hear the explosion before they saw the fire, or vice versa? What was the aircraft's attitude—was it gradually descending or in a dive? Was it spinning, rolling, or going end over end?"

Witnesses' memories can fade quickly. Because of that, investigators interview eyewitnesses as soon as possible after the mishap.

"Short-term memory is often just that," Towne explained. "Often the more time that passes, the less accurate the story. Sometimes eyewitnesses start unconsciously embellishing their story—trying to make their story fit what they think they saw. They'll add details they didn't actually see in order to make sense of what they observed. That's understandable. We all subconsciously try to make sense of what we see, especially if it is something tragic."

The real key is the material witness, an expert who can sift through the wreckage, examine a specific part, and find tangible clues to the mishap's cause, Towne said. Such experts come from the Air Force's logistics centers, aircraft manufacturers, and companies which build the airplane's major systems. Material witnesses can also include operations, maintenance, and technical experts from the Air Force Safety Center or the base nearest the mishap location. The facts they uncover frequently drive the investigation's direction.

"That's how the 'golden BB' is found," Towne said. "For instance, in one mishap, the cockpit indications prior to ejection suggested engine problems. The engines were recovered and sent to one of the logistics centers where they were torn down and analyzed by depot experts. They found what had malfunctioned and caused the mishap."

It is also important to talk to the people who planned and generated the mission, according to Dougherty. They are also important material witnesses—people who sometimes shed light on clues that can't be found at the crash site.

"Mishaps never occur in a vacuum," Dougherty said. "All missions operate within a 'process.' Those who take part in that process have a wealth of information that's key to finding a mishap's root cause. Every mishap is contributed to by a human. Whether it's drafting the Statement of Need, design, manufacture, installation, or operations, somewhere people are involved. In *almost* all

continued on next page

Putting The Missing Pieces Together—

mishaps, the event was set up well in advance. So it is extremely important to accurately identify all process factors to correctly tag root causes. Much of this information comes from interviews."

And the people "on the floor" represent human factors which must be considered during an investigation," according to Towne. "The operations tempo may be too high, they may lack proper equipment, or the working conditions may pose a problem. There may be a lack of training or proper supervision. In addition, a unit's morale is also an extremely important factor."

As the investigators begin drawing together the facts, they have a number of techniques to help organize the information and direct their focus, according to Dougherty.

He explained they can "brainstorm" ideas—listing all of the possible reasons a crash may have occurred. As time passes, some causes may be eliminated while others gain more weight. At the same time, investigators can establish a time line for the incident, adding facts in chronological order as they are discovered. In addition, they often create a three-column list depicting "What we know," "What we believe," and "What we need to know." All of these approaches are designed to give the investigators a direction to go in as they get started.

Phase Three—Preparing the Report

Once the board members are in agreement as to the accident's cause, the facts must be put into black and white in the mishap formal report. At between 15,000 and 20,000 words, it's divided into two parts—the first releasable, the second privileged. Tabs A through S contain concise statements of the mishap facts. Tabs T through Z, which are not releasable outside Air Force safety channels, contain a thorough analysis and conclusions. And it is Tab T which contains the heart and soul of the report. This is where the board spells out its analysis of the facts and conclusions, along with the findings, causes, and recommendations to prevent the mishap from happening again. Each SIB member contributes to the report and has their observations carefully reviewed, according to Towne.

"We check each other's writing for content and organization," he said. "We check content to make sure we've gotten the facts straight and the information is correct. We check the way the information is organized to make sure it fits together and makes sense."

The report must be persuasively written so it will be acted upon, Dougherty said. This means the investigators cannot simply compile all of the facts and hope others will draw the right conclusions.

Towne explained, "A well-written report will tell the reader what happened, how it happened, and why it happened with all of the evidence and details required to explain the mishap."

The findings, causes, and recommendations each contribute an important piece to the overall picture, according to Towne. "The findings reflect the factual sequence of events which led to the mishap, while the causes address who or what was responsible. The recommendations are those things you believe, if accomplished, will prevent the mishap from happening again."

Phase Four—Preparing the Briefing

Finally, the report is briefed to the convening authority, normally the MAJCOM commander of the unit having the mishap.

"The briefing is a thorough accounting of the mishap from the root cause through the actual impact," Towne said. The briefing is kept short—30 to 45 minutes—often done in Powerpoint to allow pictures of the aircraft components to be shown.

"Once that is over, the MAJCOM associated with the mishap works the recommendations, and a final message about the mishap is released," Towne said. "It's privileged and only released to the appropriate people. Typically, that would include aircrew, maintenance personnel, and senior commanders." He added the message can go further if other communities—such as air traffic control—had a significant role in the mishap.

When the final SIB message is received at AFSC, it is thoroughly reviewed, and comments are solicited from other MAJCOMs and affected agencies. Then AFSC prepares the Memorandum of Final Evaluation (MOFE) signed by the Air Force Chief of Safety which becomes the Air Force's final position on the findings, causes, and recommendations of the mishap. The MOFE is then distributed to the same organizations as the SIB final message.

And so the word gets out. The loss of an Air Force aircraft—and in some tragic cases, the loss of aircrew—becomes a piece of history, hopefully from which lessons are learned that will prevent other tragedies. And while history can never be undone, mishaps don't have to be repeated. Such is the goal of the Safety Investigation Board. ✈

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When Things GO RIGHT!

SMSGT ROY BELKNAP
113 FW
Andrews AFB, Maryland

■ As we all know from either television, radio, or first-hand knowledge (being here), on 27 June 1996, a 113th pilot made a flawless emergency landing in an F-16C with an engine failure at Elizabeth City, North Carolina. As this article is being written, it has been determined the No. 4 bearing had disintegrated, causing the engine to seize. We now know what went wrong. For a change, we're going to analyze some things that went right and illustrate the importance of never becoming complacent when accomplishing day-to-day, routine aircraft inspections.

The pilot's training and ability to fly the aircraft were outstanding! His situational awareness and professional reasoning were important parts of his ability to safely recover from the engine failure and to land the powerless aircraft. The wingmen worked feverishly to ensure every reasonable action was taken to save the aircraft. They chased and "talked" him to the runway.

Whenever an aircraft is involved in a mishap, aircraft maintenance technicians search their minds to determine "Did I do everything possible to prevent the mishap?" I might add the loss of an aircraft is probably the most mentally devastating situation a mechanic could be subjected to. However, at the time of takeoff, everything on the aircraft was operating and all of the emergency systems were ready to respond.

The crew chief performing the walk-around inspection followed every card. Card #7004 told him to check the emergency gear and arresting gear pneumatic bottle for specified pressure. Pressure was accurate, and the system operationally checked good. The pilot said, "When I pulled the emergency gear extension handle, the gear showed down with three green lights." Make note that the many landing gear system checks and emergency gear operational checks were accomplished during phase maintenance, not only by the phase sortie support personnel, but also by the hydraulic shop to ensure system reliability. When the pilot needed it, it worked!

Another card the crew chief followed on the walk-around inspection was card #7005, emergency power unit pressure (EPU) and oil servicing. Both were maintained "by the book." Without the EPU, flying the aircraft during an emergency, let alone landing it, would have been impossible. *Hats off* to both the fuel shop and electricians for ensuring this system was also ready to respond to the pilot's demand—and it did!

The next subject needing to be mentioned is the weapons system. The Aircraft Generation Squadron makes periodic pin protrusion checks and jettison system functional checks. Well, when the pilot jettisoned the tanks, they came off "as designed"! The weapon system maintainers' monthly functional checks paid big dividends. This system worked and made the pilot's headache much smaller!

When the EPU fires and is running, the inertial navigation unit (INU) battery keeps the INU operating, and the flight control batteries provide continuous flight control operation. Without them, the aircraft would be totally uncontrollable—and they worked!

We were able to watch the flight and landing on television because the head-up display camera and airborne video tape recorder tapes were operational. They recorded the entire episode from engine failure to successful landing. They worked, too!

Oil samples and chip detectors? In this case, the last oil sample and chip detector readings were normal. The inside of the engine of this aircraft, at the time of the last post-flight inspection, was clean and operational. There was no way of knowing a disaster was waiting to happen on this particular flight. Specialists' constant monitoring for internal failures has caught potential trouble in the past, and their constant oil sample surveillance will catch obvious trouble in the future. Even though the process did not catch or predict this failure, this is another human factors system that works!

Last, but not least, the end-of-runway inspection crew ensured that the "last chance" inspection was expertly accomplished and all systems were serviceable and operating. The pilot could not have been in a better humanly prepared aircraft when the unsuspecting catastrophic material failure struck.

With all this in mind, while accomplishing everyday, routine jobs, remember each and every system is important when the worst may happen. Each 100 PSI of pressure or half pint of oil has a job to perform, and the job cannot be done if the servicing is incorrect!

We are extremely proud of the way "OUR TEAM" did their job! When the pilot needed to flip a switch or move a lever to save the aircraft, everything worked! ✈

MAJ ERIC "TRIGGER" JENKINS

SHAPE UP AN
(A Pilot's Guide to

Pilot error! Every time I hear or read these two words, I cringe with disbelief and anger. Unfortunately, within the last few years, a large number of F-15 mishaps have been attributed to pilots departing the Eagle. Current literature and guidance do an excellent job *describing* Eagle departures and out-of-control situations, but fall short when discussing *tangible procedures* to avoid departures. This article will take a closer look at departures, autorolls, the Bitburg roll, and nose high/low airspeed recoveries, and offer some "stick and throttle" techniques to avoid becoming a passenger when you are supposed to be in control.

Departures are defined in the Dash One as "an uncommanded flight path change such as a nose slice, roll away from a lateral input, or excessive yaw rates..." Departures can be categorized into two types. The first type involves motion predominantly around the yaw axis—as in a spin. The second type has some yaw, but primarily involves motion around the roll axis—more like a barrel roll. Four factors can cause a departure.

Factor #1 involves the **region of reduced lateral-directional stability.** This region is usually encountered with the following parameters:

Altitude: **Above approx. 15,000 feet MSL**

Mach: **0.5 to 0.76**

Angle-of-Attack **(AOA): 40 to 44 cockpit units (CPU)**

Time: **Stabilized in this region for more than 1 second**

If stabilized in this region for more than 1 second and yaw is introduced, there is a good chance for a departure. At 20,000 feet, the region of reduced lateral-directional stability, 0.5 to 0.76 Mach, can be achieved between 230 and 350 KCAS. At this airspeed and altitude, the pilot has full aft stick available and enough energy to stabilize in the 40 to 44 CPU region for a few seconds. **To avoid 40 to 44 CPU while in the region of reduced lateral-directional stability, decrease the AOA immediately when the aircraft nose stops tracking or you experience wing rock.** Decrease AOA by decreasing back stick pressure.

Factor #2 involves the **misapplication of flight controls.** The largest contributor to adverse sideslip at high AOA is aileron application. With lateral (side to side) stick input, deflection of the ailerons and differential stabilator are "washed out" (decreased) as the longitudinal (fore and aft) stick position is increased. Problems occur when, in a high AOA situation, the pilot rapidly moves the stick forward with a lateral stick input. As the stick moves forward, the ailerons are no longer "washed out," and the high AOA condition has not yet been reduced. This is enough to cause the yaw required for a departure. The **solution** is to **"fly the cross" (i.e., stick laterally centered, then forward, before left or right).**

Departures from the misapplication of flight controls can also involve the rudder. If rudder input is present as AOA decreases through 35 CPU, the resultant yaw can lead to an **autoroll**. Autorolls are most likely to occur within the following parameters:

Airspeed: 200 to 300 KCAS

AOA: 20 to 30 CPU

Rudder input at high AOA often occurs because the pilot unknowingly rests his/her feet on the rudder pedals unevenly. **To help avoid autorolls, take out the rudder input before moving the stick forward.** In other words, **"Stick-aft, rudder-in, rudder-out, stick-forward."** If you experience an autoroll, counter it with opposite rudder, but not aileron. Aileron against an autoroll is a pro-spin input.

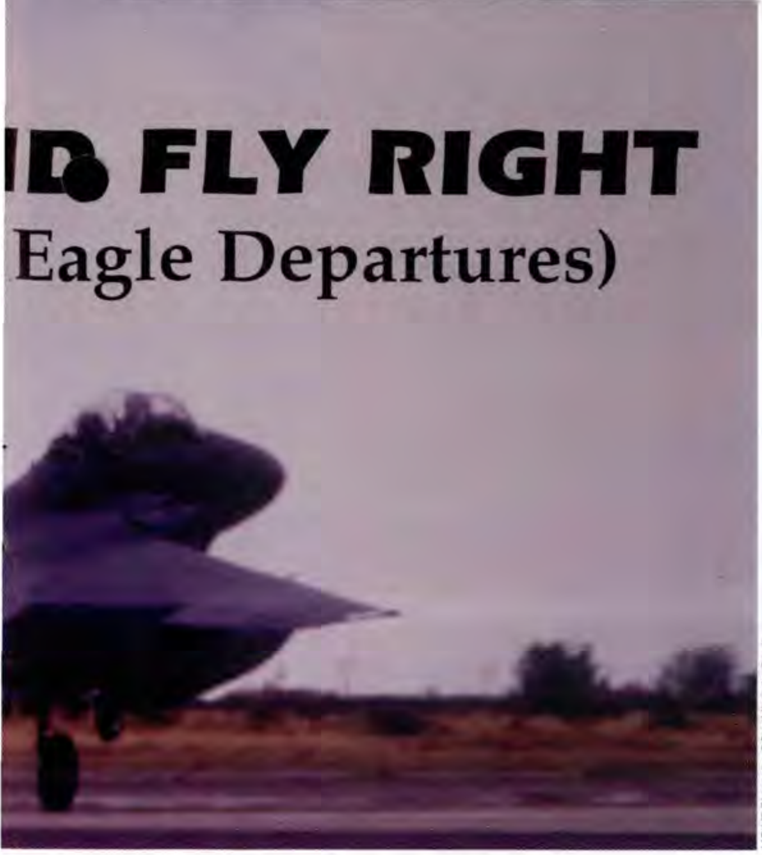
Factor #3 involves **lateral asymmetry.** Aircraft load asymmetry can result in departures at AOA less than 40 to 44 CPU. This asymmetry can be caused by either fuel imbalance or missile configuration. As an asymmetric condition develops, rudder deflection is increased through the aileron/rudder interconnect (ARI) to maintain coordinated flight. As AOA is increased (and rudder effectiveness is decreased), a point will be reached where the rudder can no longer offset the asymmetric load. When this point is reached, yaw is introduced and a departure can occur. The solution to avoiding this situation starts with **performing a good preflight to ensure a missile load which minimizes asymmetry.** Inflight, **perform proper and complete fuel checks.**

If you experience an asymmetrical load, abide by the guidance provided in Air Combat Command (ACC) message #131010ZMAY93, Subject: "FCIF ITEM: F-15 Maneuvering Restriction With a Known Fuel Imbalance" and the "Dash One," which states:

If **total fuel imbalance (internal and/or external) exceeds 600 pounds,** or **200 pounds with 3 or more missile asymmetry,** then,

- Limit maneuvering to a **maximum of 30 units AOA** and

ID FLY RIGHT
Eagle Departures)



USAF Photo by SSgt Nichole Snell

• Maintain a **minimum of 300 KIAS** except during:

- Max. range descents, holding, instrument appr. and landing.
- Cease tactical maneuvering and investigate.
- Limit mission to instruments/straight-in approaches, deployment sorties, or loitering to burn down fuel.
- Non-maneuvering intercepts may or may not be flown, depending on local wing guidance.

Factor #4 involves **flight control malfunctions/anomalies.** Malfunctions can be categorized as failed control surfaces, broken actuators, or structural failure. While these items are rare, when they occur, they can have catastrophic results. A more likely malfunction can result from an out-of-rig condition. This is often manifested by "play" in linkages, faulty actuators, or excessive friction in cables. If excessive friction builds up in the rudder cables, the rudders may remain deflected after the pilot returns the rudder pedals to the neutral position. If this situation occurs as the pilot is unloading from a high AOA maneuver, yaw may develop and result in an autoroll. To avoid this situation, **perform proper flight control checks and write up the jet if you suspect an out-of-rig condition.** During ground flight control checks, look for rudders that don't return to the neutral position.

Another flight control anomaly is the **"Bitburg roll"** which occurs **above .5 Mach and 18 CPU AOA.** This roll is characterized by a strong right roll/ yaw tendency which can result in roll rates up to 60 deg/sec and yaw rates of about 15 to 20 deg/sec. A typical scenario involves a full aft stick break turn at 300 to 375 KCAS with AOA increasing above 28 CPU. If in a left turn, the jet appears to want to roll out of the turn. If in a right turn, bank angle will increase. **To alleviate this anomaly, as the Bitburg roll develops—decrease AOA.** Either decrease aft stick position or use rudder to counter the roll. Using lateral stick to counter the Bitburg roll might result in pro-autoroll inputs and could produce the requisite sideslip for a departure.

The last anomaly occurs during **nose high/low airspeed recoveries**. As the aircraft transitions to the nose-low attitude, it can drive past 90 degrees nose low to an inverted "negative-G" attitude. This condition is more likely to occur if the power is in idle versus military power. So, **to avoid negative-G "hang-up," select mil power during nose high/low airspeed recoveries and be ready to apply aft stick force to eliminate the negative-G situation.** Realize the aircraft may need 1 to 2 inches of aft stick for about 4 seconds before it will respond.

For you folks who skipped the body of this article and jumped right to the summary, here it is.

• To avoid departures in the **region of reduced lateral-directional stability:** When the jet's nose stops tracking or you experience wing-rock, **decrease AOA** by relieving back stick pressure.

• To avoid departures due to the **misapplication of flight controls:** Ensure there is no lateral stick or rudder input when decreasing back stick pressure. With the ailerons, remember the memory jogger, **"fly the cross,"** which means to have the stick centered before moving it forward or aft. With the rudders, remember the memory jogger, **"Stick-aft, rudder-in, rudder-out, stick-forward,"** which means to take out rudder input before moving stick forward.

• To alleviate problems with **lateral asymmetry:** First, **ensure a symmetrical missile load.** Inflight, **perform complete fuel checks.** If an asymmetrical situation develops, then abide by ACC and "Dash One" guidance.

• To avoid departures due to **flight control malfunctions:** Perform proper ground **flight control checks** and specifically look for rudders which fail to return to the neutral position. If you suspect an out-of-rig condition, **write up the jet.**

• During a **Bitburg roll: Decrease AOA** by momentarily decreasing back stick pressure. Either decrease aft stick (without lateral stick or rudder input) or use rudder to counter the roll.

• If experiencing a **nose high/low airspeed recovery: Select MIL** power. Aft stick force may be required to eliminate a negative-G situation. During a negative-G "hang-up," the stick may have to be held 1 to 2 inches aft for approximately 4 seconds before the aircraft responds.

Editor's note: Maj Jenkins has approximately 2,000 hours in the F-15 which includes 2½ years as an instructor pilot in the FTU. He is the former 325 FW Chief of Flight Safety. He would like to give special recognition to Maj Michael "Nike" Winslow, who headed up a Tiger Team which produced benchmark data on the F-15 departure problem. Nike's research paper, "Solving the F-15 Departure Problem" (dated Jan 95), provided valuable inputs for this article. ✈

SUCCESSFULLY MEETING THE CHALLENGE

MAJ STEVE PRETESKA
HQ AFSC/SEFF

Greater challenges rarely exist

in an Air Force career than being selected to be a safety investigation board member. The assignment will test your teamwork, critical thinking, communications, technical, and many other professional skills. You'll be pressed for time from Day One, and what you produce will be critical to Air Force flight safety. The experience will often demand physical, mental, and emotional endurance that you've probably never tapped.

What you will be asked to do is nothing short of monumental: Co-produce a 20,000- to 50,000-word written documentary—a book!—with five or more strangers. Then, condense your book into a 30-minute persuasive briefing, and use it to convince the MAJCOM commander, the Chief of Staff of the Air Force (in the event of a fatality), and possibly the Secretary of the Air Force that you know what happened, why it happened, and how it can be prevented from happening again! Oh yeah, and you'll do this away from home using borrowed facilities and equipment.

At the helm of this juggernaut is the board president (BP) whose roles include, but are not limited to: leader, spokesperson, resource manager, mentor, coworker, confidant, facilitator, typist, cheerleader, and most importantly, standard bearer. The integrity of the safety board process is paramount as the Air Force cannot afford even the appearance of compromise or bias.

Despite the overwhelming responsibility of this job, it is possible to survive intact and even do well! Col Kurt Cichowski, 49 OG/CC, Holloman AFB NM, has seen safety and legal investigations from many points of view—recorder, pilot member, investigating officer, board president, and operations group commander—and offers his thoughts to help future board presidents and board members alike on how to prepare for success.

Col Cichowski was the board president for a recent F-16 mishap in which the pilot survived but the aircraft was destroyed. This experience reinforced his belief in the high caliber of both military and civilian personnel who are selected for investigation boards. One of the more difficult decisions that a BP has to make is to know when there is a need for someone with unique qualifications or training to augment the board.

"If no one there has expertise, then get an expert!" says Col Cichowski. "They are able to take the veil of uncertainty away." You don't want to enlist a cast of thousands, but what you do want, as Col Cichowski continues, is to "...be in a position where you have great confidence that you have the right answer. The boards where we didn't have one [expert]...we seemed to be moving in mud...people with their own positions that they were advocating...it was sometimes difficult to move forward."

Equally as critical to the process is an excellent recorder whose job it is to manage the board's "housekeeping." There can be no room for compromise on anything less than an extremely capable and confident young officer in charge to ensure that things are organized and administered well. The board will capture a tremendous amount of data and collect a lot of physical and testimonial evidence. Staying ahead of this mound of information is vital.

Similarly, the investigating officer (IO) needs to be highly self-motivated in order to direct the day-to-day operations of the team and to ensure that the final products are strictly quality controlled. According to Col Cichowski, this "...saves the BP a tremendous headache so that he doesn't have to feel he's got to go back and proofread and analyze." Col Cichowski adds that, though not a show-stopper, he would rather have an IO who's familiar with the jet. What some board presidents don't know is that they have some say, if done early

Official USAF Photo

enough, in the selection of board members. Ask for the best support available right from the beginning.

Once your team is assembled, the board president must "set the tone," according to Col Cichowski. The team-building skills you've acquired throughout your professional education and experiences will be put to the test. "Draw on the strengths of your individual team members..." so you can deal with the "...distracters that come with any kind of group."

Sage advice, since a typical board president must often be concerned with issues like getting visas for your civilian technical advisors or getting a ULN line number for your military board members' transportation overseas. This is hardly the dramatic image of a mishap investigator combing through the wreckage looking for those important clues, but equally as vital to a successful board process. The exact details may vary, but inevitably board presidents need to be available to apply "horsepower" where needed. You can well serve the board as the president by making yourself available for these unseen roadblocks through effective team management.

Col Cichowski recommends that you ensure each of your board members are refreshed about their specific responsibilities on the first day. There are a number of sources (Board President's Handbook, AFSC Board Representative, local safety office) that have these tasks outlined and can be briefed to the board. Also, develop a long-range plan on how to get where you need to go. At the end of 30 days, the SIB should have three products ready: the final report, the final message which is an "executive summary" of the report, and the briefing to the MAJCOM convening authority. Don't wait until Day Twenty-eight to begin addressing the briefing. Forecast in your agenda briefing workdays from Day One so the rest of your efforts are focused on being completed by Day Twenty-seven or so. The briefing is the culmination of your board's man-year worth of work. Don't leave it as an afterthought to your efforts.

Besides the "long range" planning, include short-range planning and timeline maintenance. Daily debriefs (best at the end of the day) are a good way to quickly review what's been accomplished during the day by each team member and to decide where the next day's efforts will be best spent. Remember, too, the option to ask for an extension of the 30-day time limit is always available and rarely refused—just don't disband the board until you have all three products in hand.

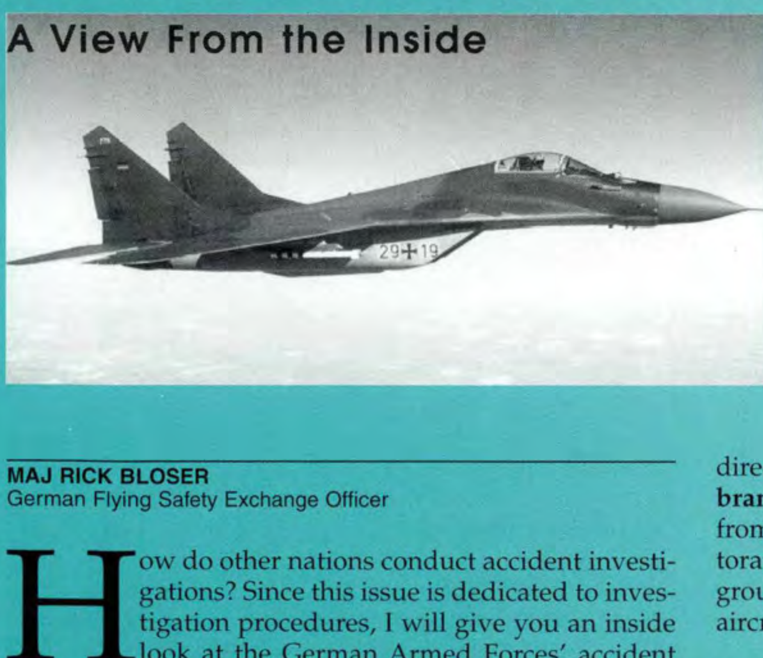
In addition to effectively employing his experts and other board members, Col Cichowski was not surprised when, in order to speak credibly and effectively, he, himself, had to become an "expert" on that portion of the engine that had the anomaly. He states, "I had to go into areas that were new things I didn't know before. I knew...that I was going to have to learn, assimilate, and then be able to discuss on an intellectual level, not on a purely conversational one." The entire voting membership of the board will be at the briefing to help with the fastballs, but being able to speak to technical details adds to the "confidence" factor.

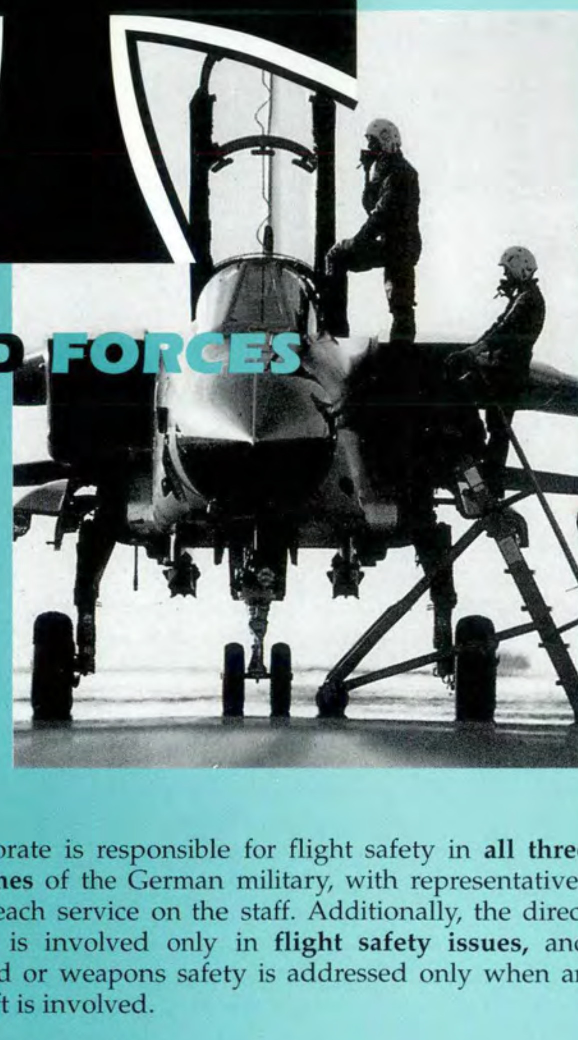
Likewise, knowing what to say for media publication is important. In the most recent mishap, however, Col Cichowski's public affairs skills were not required. Dealing with the media, in spite of any formal training, is often best left to the experts (Public Affairs). You'll be busy enough with the investigation itself. If the mishap does garner a lot of media attention, consider bringing on a PA expert as a board member!

Col Cichowski feels that the current safety investigation board process is the "...fairest way to do things..." and vital to protecting Air Force assets, but it does involve sustained long hours, lots of gnashing of teeth, and wringing of hands. It is, however, a unique opportunity to effect very positive changes in the way the Air Force does business. Successfully meeting the challenge involves effective leadership, quality training, and sound preparation. Are you ready?

AIRCRAFT ACCIDENT INVESTIGATION AND REPORTING IN THE GERMAN ARMED FORCES

A View From the Inside





MAJ RICK BLOSER
German Flying Safety Exchange Officer

How do other nations conduct accident investigations? Since this issue is dedicated to investigation procedures, I will give you an inside look at the German Armed Forces' accident investigation process.

What makes me such an expert on German accident investigations? Well, I am currently a USAF Exchange Officer with the Directorate of German Flight Safety, Federal Armed Forces. I work in the Fixed Wing Incident and Accident Investigation Section of the directorate. Along with a German officer, I am responsible for investigating and reporting incidents and accidents involving the PA 200 Tornado. I have been involved in all areas of the accident investigation process, including a MiG 29 crash site investigation and the board proceedings for a Tornado accident.

You may have noticed I keep saying the German Armed Forces and not the Air Force. The reason? The directorate is responsible for flight safety in **all three branches** of the German military, with representatives from each service on the staff. Additionally, the directorate is involved only in **flight safety issues,** and ground or weapons safety is addressed only when an aircraft is involved.

Mishap Categories

German regulation categorizes mishaps into **Incidents, Category I Accidents**, and **Category II Accidents.**

Incidents are similar to our Class C mishaps. Incident investigations are completed by the wing and submitted to the directorate. All incidents are reviewed within the directorate, and those of a particular interest or statistically significant are published in a monthly report for all aircrews, maintenance personnel, and the aviation industry.

Category I Accidents are similar to our Class B mishaps. When the funds or man-hours required to repair the aircraft are exceeded by a specified amount (as defined by German regulation), a Class I Accident is declared. These accidents are normally investigated at the wing level (in special cases, the investigation is conducted by the directorate), and a report is forwarded to the directorate. An action officer in the directorate then reviews this and generates a final report. This report is reviewed by the section commanders, deputy director, and the director before being published in the same monthly report mentioned above.

A Category II Accident occurs when an aircraft is destroyed, a death results, or a criminal investigation is required (civilians are severely injured or major damage to private property). I will now discuss the investigation process for a Category II Accident.

Accident Board Investigations

Upon learning an accident has occurred, the directorate dispatches an investigative officer from section b (fixed wing aircraft) or section c (helicopter) to run the investigation as the board president. In addition, technical specialists from the directorate in engines, aircraft systems, and life support (section d) are sent as on-site investigators in their area of expertise. Additional manpower comes from the wing as required. A command post is activated at the directorate to coordinate the response effort. During the MiG 29 investigation, in which I took part, the investigating team from the directorate was on scene within 3 hours of the accident. (This was possible due to all investigators working in the directorate and the size of the country.)

The crash site investigation normally lasts no more than 3 days. During this phase, evidence is gathered, witnesses are interviewed, and site cleanup is coordinated.

After the crash site investigation, the board president releases the members. Unlike the USAF, the investigators do not continue to work exclusively on the investigation. The members return to their units and may continue other tasks while working on the investigation. Each member is responsible for producing his own portion of the report. After all reports are finished, the board president calls a final meeting for the accident investigation board (often held several months after the accident).

The Board has the following composition:

- Board President—Appointed staff officer from section b or c of the directorate.
- Investigating officer—FSO from the mishap wing.
- Pilot Representative—Highly experienced pilot from the mishap wing (often chief, stan/eval).
- Maintenance Representative—Maintenance officer from another wing (in many cases supported by technical experts from the directorate).
- Life Support Specialist—Specialist from the directorate.
- Flight Surgeon—From another wing.
- "Psychologist"—From the German Flight Medicine Institute. The psychologist was added to investigate the human factors aspects of the accident.

The accident investigation board meeting is held at the base where the mishap crew was stationed. During this phase, the individual final reports are read and additional interviews are conducted if required. The board then determines the cause of the accident (one main cause with possible contributing causes) by "majority vote" and makes its recommendation (board president's vote overrules a split decision). The board report is then written. This report is a combination of all the reports and serves as the basis for determination of the cause/contributing causes of the accident. (If any board member disagrees with the majority's findings, he is required to write a minority report.)

After the board meeting is conducted, the board president returns to the directorate. At this time, the report is given to another officer in the directorate. To ensure objectivity, this officer is responsible for writing the final report, after reviewing the evidence and deliberations. The final report is then reviewed by the section commanders, deputy director, and the director, in turn, before it is released. The director's approval of the final report closes the investigation, and the report is published.

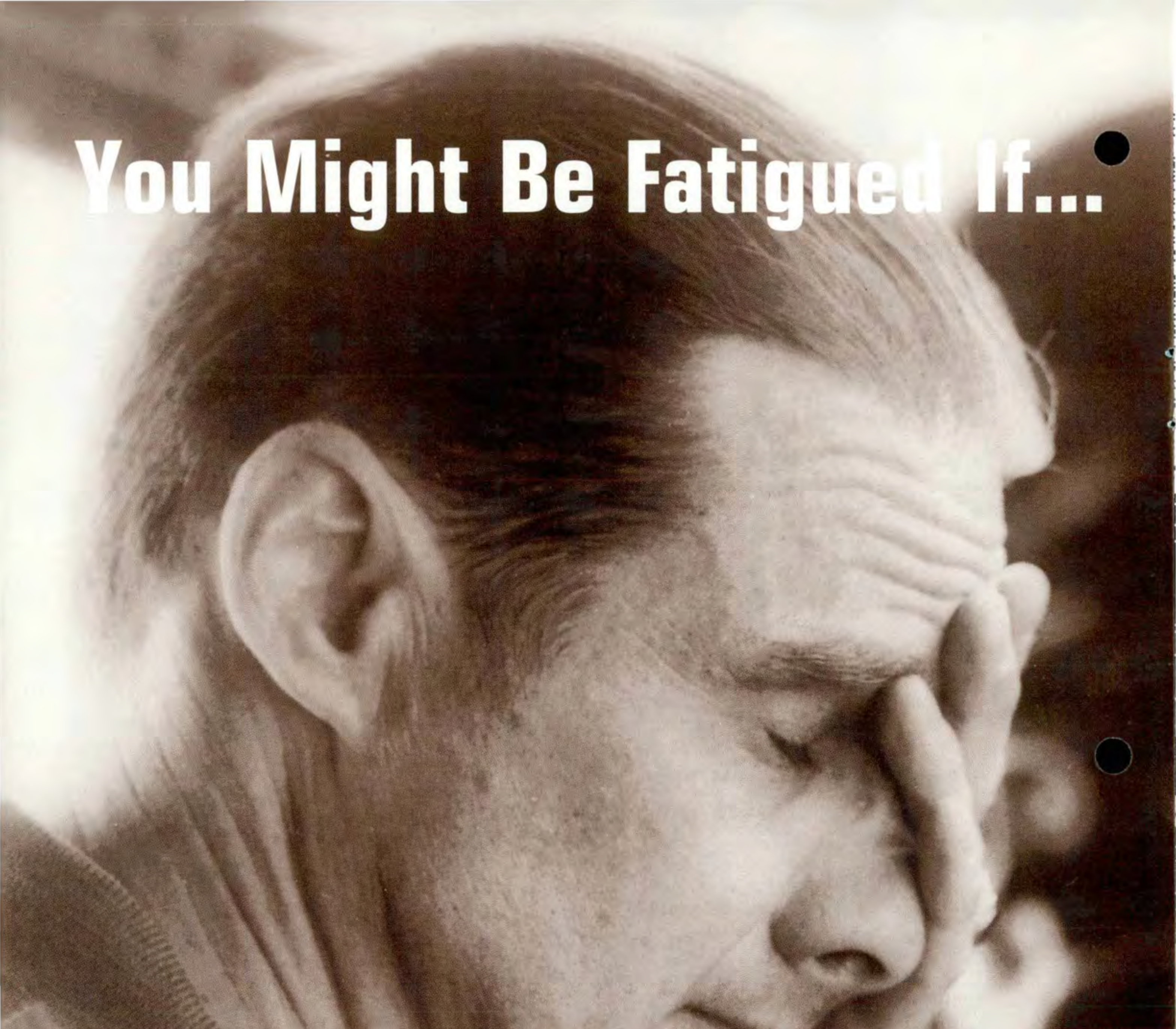
Although the purpose of the investigation is for accident prevention and not to determine guilt, the directorate's reports are not protected by executive privilege. This means information contained in the report could be released for litigation.

Conclusion

When compared to the USAF investigative process, you can see there are some similarities and some major differences in the way the German Armed Forces conduct accident investigations. The German Safety Center is currently in the process of changing their regulation governing accident investigations. Some of these changes will make their system more similar to our own.

As for the remaining differences, the size and basic philosophy of the two forces account for many of these. I believe, however, there are some things each does better than the other and some areas we can improve jointly. For this reason, the exchange tours in flying safety will continue to benefit both countries as we strive to improve the accident investigation process and ultimately our accident prevention programs. ✈

You Might Be Fatigued If...



FREDERICK V. MALMSTROM, PH.D.
Certified Professional Ergonomist

■ The National Transportation Safety Board (NTSB) doesn't consider fatigue a "cause" of aviation mishaps. Rather, the NTSB lists fatigue as a "contributing factor." Personally, I think this kind of reasoning is more an exercise in semantics than reality. But, whatever the causes, the results of fatigue can be deadly.

So, what on earth *is* fatigue? It is, as we psychologists are fond of saying, a theoretical construct. Nobody can measure it, weigh it, time it, smell it, or place any physical units on it—yet everyone agrees it exists.

It's been said that for every two Frenchmen who meet in a coffee house, a new political party is formed. It's also said that for every psychologist who writes an article on fatigue, a new definition of fatigue is created.

Fatigue is typified by symptoms of inattention, degraded judgment, poor motor skills, exhaustion, confusion, and a whole long list of other effects. (See table 1.)

I have experienced the near-fatal side effects of fatigue. This was an instance when we'd been up flying combat all night and coasted in sleepily for a dawn landing. The brakes somehow had collected water and froze. During that half-second of fatigue-induced inattention after touchdown, our EB-66C's brakes locked up, and we spun into the infield grass. Happily, all six of us walked (well, *ran*) away from that one.

The Four Causes of Fatigue

As researchers Richard Adams of Advanced Aviation Concepts and Dr. Alan Stokes of the Florida Institute of Technology (1995) warn, fatigue is much more than just sleep deprivation. There are at least four known causes:

1. Inadequate rest.
2. Desynchronized physiological circadian rhythms.
3. Weariness following physical

activity.

4. Impaired judgment following prolonged mental activity.

And any or all of the above-mentioned causes are enough to induce fatigue.

Fatigue-Induced Errors

Even though the NTSB says fatigue doesn't "cause" mishaps, research shows it sure causes errors. As students of the theory of signal detection know, there are only two categories of flying errors: (1) *errors of commission*, and (2) *errors of omission*. Unfortunately, fatigue causes both categories of error, although the *error of omission* is by far the most common.

Adams and Stokes cited a classic 1948 U.K. study in which fatigued subjects flying a simulator made numerous errors of omission followed by several "catch-up" errors of commission. Talk about making a bad situation badder!

What are the most common fatigue-induced flight errors? Well, for instance, in 1995, Dr. J. C. Wilson of Leicester University and Capt A. Elsey and Mr. P. Hunton of the British Airline Pilots' Association (BAPA) surveyed over 1,000 U.K. commercial pilots and flight engineers. Although no single type of fatigue-related error is overwhelming, the "miscommunication"* error seems to come up more frequently. Their study found a shotgun spread of fatigue-related errors—probably because fatigue is a *global* thing. When you fly long hours, you fatigue your entire person—not just your eyes, not just your mind, and not even just your backside. The nasty thing about fatigue is that it seems to lower your all-around ability to *integrate* the parts of the puzzle.

Fatigued individuals have limited attention—they see the trees but not the forest. For instance, older (like me) people are especially vulnerable to fatigue. That's probably in no small part due to our reduced brain, skeletal, and muscle mass. There is simply physically less of us to cope with the global problems of the world.

How Do You Recognize Fatigue?

Unfortunately, fatigue, like hypoxia, tends to sneak up on the victim gradually and isn't always easy to recognize. Having worked with mental patients for years, I've noted that the truly psychotic persons are themselves the *last* to know that they're crazy. Hence, they must rely on outside observers to point this out to them, and even then these disturbed persons often won't accept the fact. Likewise, fatigued persons tend to be in denial and wouldn't always recognize fatigue if it bit them.

Dr. Richard F. Haines and C. Flatau, in their book *Night Flying* (1992), have taken the time to table some observable effects of fatigue. I've condensed some of their findings into table 1. Note that some of the effects can be seen only by you (intrinsic symptoms). Extrinsic symptoms are easily seen only by others. Please take the time to note the extrinsic symptoms. They're the kind of behaviors which the individual typically ignores but the outsider should be able to spot rather easily.

If you aren't able to recognize your own fatigue symptoms, the least you can do is recognize these fatigue symptoms in others. And, if you do, you can say, "You might be fatigued if...you have these symptoms." I'd have been grateful if someone had brought that to my attention on that morning 30 years ago while I was landing in that EB-66C.

*Miscommunication is a hot topic in aviation research. CRM—crew resource management (aka cockpit resource management)—analyzes things like crew workload, social interactions, and (mis)communications. For further reading, see Maj Eric Offil's article, "Cockpit Resource Management," in the September 1996 *Flying Safety*. ✈

Table 1. You might be fatigued if...you have these observable effects of fatigue (from Haines & Flatau, 1992)

What you see:
INTRINSIC SYMPTOMS

A. PHYSICAL
1. Frequent, unexplainable head-aches
2. Muscular aches and pains
3. Breathing difficulties
4. Blurred/double vision
5. Burning urination

B. MENTAL
1. Attentional focusing
2. Easily distracted
3. Reduced flying standards
4. Feeling of depression
5. Impaired judgment
6. Poor visual perception

What others see:
EXTRINSIC SYMPTOMS

A. PHYSICAL
1. Degraded motor skills
2. Tenseness and tremors
3. Intolerant/irritable
4. Increased reaction time
5. Social withdrawal

B. MENTAL
1. Absentmindedness
2. Poor short-term memory
3. Lack of interest and drive
4. Confused and fearful
5. Slow startle response
6. Worried and anxious

A "HAIR RAISING" EXPERIENCE

BRETT L. CARNES*

Imagine a huge foreign helicopter landing in your backyard in the middle of the night. We landed beside a creek. It looked like a road through the NVGs until we got closer.

My day began at 0530 hours. I was the pilot in command of the lead aircraft of six CH-47D Chinook helicopters. My unit, Alpha Company, 5th Battalion, 159th Aviation Regiment (Big Windy), is based at Giebelstadt, Germany. We were on our way to Kaposvar, Hungary, in support of Operation Determined Effort/Joint Endeavor.

Our 4½-hour flight through Austria and Hungary was uneventful. When we arrived at Kaposvar Army Airfield (1630 hours), my commander received a follow-on tasking. An emergency resupply mission came down that required two Chinooks and one AH-64 Apache (as an escort). The mission was to fly sleeping bags, cots, and kerosene heaters to an engineering unit whose area had been flooded by the Sava River. Since the mission needed more coordination and we still had to unload, then reload our aircraft, we started looking for night vision goggle (NVG) crews. Pilots were chosen for various reasons. (e.g., currency, experience, etc.), and I happened to be one of them.

Except for a thin layer of fog at takeoff, the weather was perfect. We flew to the landing zone (LZ) with no problem. After about 2 hours of ground time, we began our trip back to Kaposvar airfield. The decision was made to forego fuel at the LZ because it was an unmarked refuel point and we were unfamiliar with the area. We still had about 1 hour and 45 minutes of fuel for the 1-hour flight to Kaposvar.

Kaposvar Army Airfield is located about 7 miles west of Taszar Airbase. Kaposvar had over 100 army helicopters based there, so its size was appreciable. In spite of its size, the airfield had no runway lights, no rotating beacon, no NAVAIDs, and no precision approach radar (PAR).

The fog was rolling in very quickly. The lead aircraft had to make a decision: Do we spend time looking for the airfield while the fog is rolling in, or do we go to Taszar and "shoot" the PAR? Well, the lead aircraft decided to let the AH-64, with its sophisticated night system, go ahead and land at Kaposvar. We, with our less sophisticated NVGs,

Photo courtesy the author

decided to go for the PAR.

We were up with Taszar Tower, and they began vectoring us for the PAR approach — to Kaposvar. Since Operation Determined Effort was just beginning, Taszar Tower did not know that Kaposvar Tower was closed and did not have any instrument approaches. The pilot in command of the lead Chinook requested a PAR approach. He and I both knew we wanted to land at Taszar, but Taszar Tower thought we wanted to land at Kaposvar.

Taszar put us in a VFR-on-top holding pattern while trying to coordinate with Kaposvar. After about 10 minutes of holding, Taszar called us back and advised us that Kaposvar was closed. Lead responded with, "Okay, but we want to land at Taszar NOW!" The stress factor was definitely on the rise. Lead also requested short patterns to save fuel. After about 5 minutes, Taszar finally decided what they were going to do with us. We finally were separated and sequenced for the approach.

The lead aircraft, at last, landed on terra firma. Now it was our turn for the approach. My copilot, flight engineer, crew chief, and I were over 20 hours into our duty day, in unfamiliar territory, and in a very demanding mode of flight (NVGs). I knew the approach was going to be tricky — tricky because tower told us that visibility was 200 meters and the landing would be at our own risk. Wow! My copilot and I were focused and in control.

The recorded transcripts showed there was confusion about which frequency I was to be on. The bottom line was, I never got "handed off" to the final controller. According to the GPS, we were flying right over the airfield and had not gotten further instructions for landing. I never received the "do not acknowledge further transmissions" call. My copilot and I were confused but still followed the vectors that were being given to us. We desperately wanted to hear the final controller.

After the tower realized we never heard the final controller, they vectored us around for another try. By this time, my life began flashing before my eyes like a head-up display. I declared an emergency. I had approximately 20 minutes of fuel until flameout. We were eventually vectored back to final.

Believe it or not, the same thing happened again! We were never "handed off" to the final controller. We knew we were lined up with the runway and had to land very soon. I made the decision to head for the glow of the airfield. We were "in the soup" and "going for it" via azimuth calls only.

My copilot began slowing down. By the time we were over what we thought was the runway, we were at 10 knots airspeed and descending at 1,000 feet per minute. When the radar altimeter registered 200 feet AGL and the ground was not in sight, I decided I did not like what was happening. I made a massive power application to stop the rate of descent and start a climb. We were down to 10 minutes of fuel. I made a Mayday call because I knew we probably would not make another pattern.

While at 800 feet AGL and VFR-on-top again, my copilot noticed a break in the fog. He saw a landing area on the outskirts of town. (Imagine a huge foreign helicopter landing in your backyard in the middle of the night. We landed beside a creek. It looked like a road through the NVGs until we got closer.) We finally had made it! I was glad to be on the ground.

Several lessons were learned and, hopefully, you may have read something that will help you on your next flight. Here are some things to remember:

1. *Risk management.* Always manage and reduce your risk as much as possible.

2. *Never pass gas.* Enough said about that.

3. *Communication.* Not just communication, but *positive* communication — clear and concise.

4. *ATC procedures.* Visit a control tower and an approach control center. Seeing how they work will help you understand why they do what they do. When at an unfamiliar airfield and not sure of a clearance, ask for clarification.

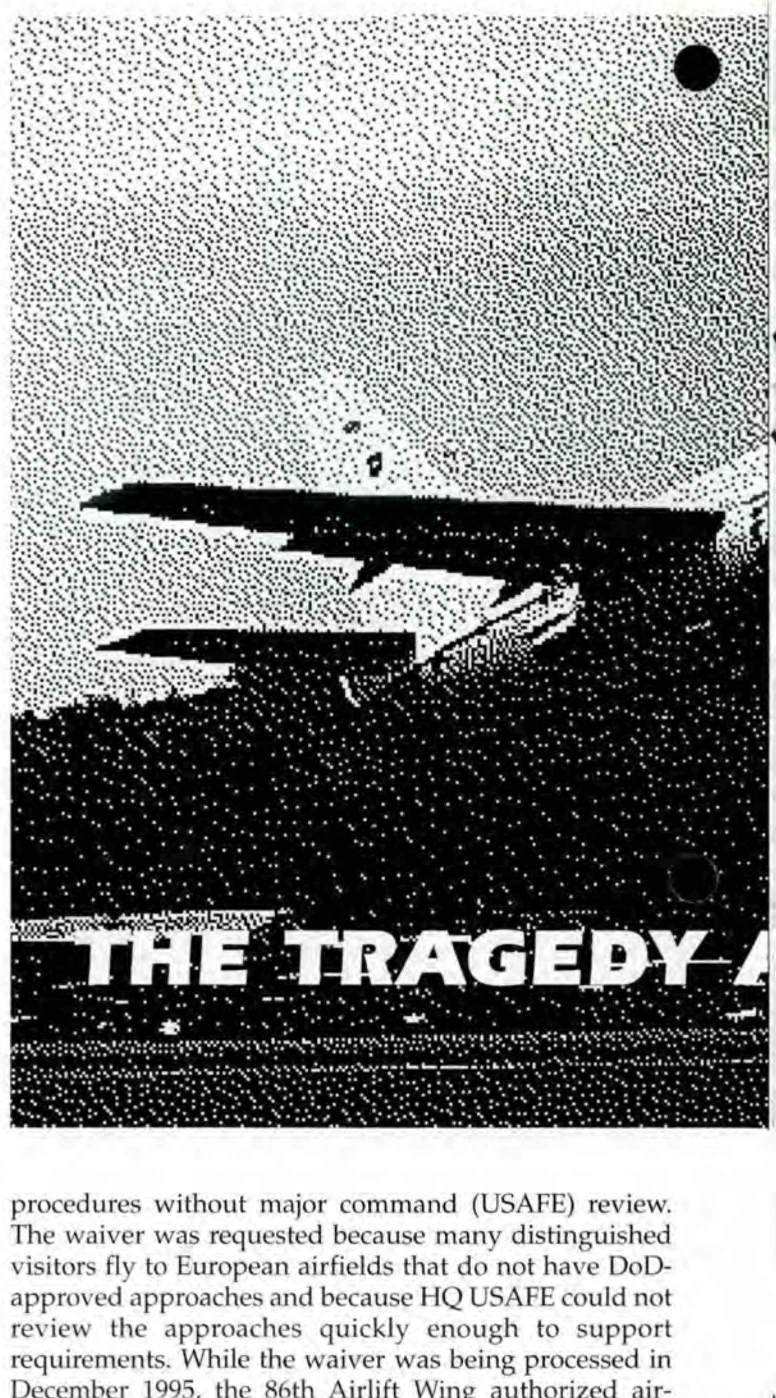
5. *Composure.* Make a conscious effort, when in a stressful situation, to remain calm. If you don't, matters will quickly get worse.

6. *Emergencies.* Do not hesitate to declare an emergency. It *will* get you the priority if you need it. It's true…it's better to be safe than sorry!

The CH-47D holds 1,028 gallons. The next day, we had fuel delivered to the aircraft and put in 978 gallons. Fifty gallons to spare! In a Chinook, that is about 7 minutes of fuel until flameout. ✈

*Brett L. Carnes is a CH-47D Instructor Pilot with 1,700+ hours. He has rotary wing commercial/instrument and fixed wing instrument ratings.

Courtesy Air Scoop, Jun-Aug 96



Many of you have wanted to know the causes of the tragic crash of IFO 21 (CT-43) at Dubrovnik, Croatia, 3 April 1996. The following is the opinion of the investigation board president, Maj Gen Charles H. Coolidge, Jr., as to the findings and causes of this mishap. The information for this article is taken directly from the Accident Investigation Board Report, Volume One. (Lt Col Henry J. Fisher, HQ USAFE/SEF, Ramstein AB, Germany)

(Under 10 U.S.C. § 2254 (d) any opinion of the accident investigators as to the cause of, or the factors contributing to, the accident set forth in the accident investigation report may not be considered as evidence in any civil or criminal proceeding arising from an aircraft accident, nor may such information be considered an admission of liability by the United States or by any person referred to in those conclusions or statements.)

Mission

The 86th Airlift Wing Operational Support Airlift mission has been instrumental in providing airlift support for officials and organizations attempting to continue the peace process in the former Yugoslavia. The visit by U.S. Secretary of Commerce Ronald H. Brown and his delegation of American business executives was to develop closer economic ties as part of the civil mission to assist in the overall peace implementation.

Areas Which Were Not Substantially Contributing Factors

The following areas were investigated and did not substantially contribute to this mishap: aircraft maintenance, aircraft structures and systems, crew qualifications, navigational aids and facilities, and medical qualifications. Although the weather at the time of the mishap required the aircrew to fly an instrument approach, the weather was not a substantially contributing factor to this mishap.

Causes

The CT-43A accident was caused by a failure of command, aircrew error, and an improperly designed instrument approach procedure.

• **Command failed to comply with Air Force Instruction 11-206.** This was a cause of the mishap. Commanders failed to comply with governing directives from higher authorities. Air Force Instruction (AFI) 11-206 required major commands to review non-DoD approach procedures prior to their being flown. Although multi-command guidance authorized use of non-DoD approach procedures, the guidance was contrary to AFI 11-206. In Nov 95, when the 86th Airlift Wing realized the impact the Air Force Instruction would have on their daily operations, the 86th Airlift Wing requested a waiver to fly the non-DoD approach procedures without major command (USAFE) review. The waiver was requested because many distinguished visitors fly to European airfields that do not have DoD-approved approaches and because HQ USAFE could not review the approaches quickly enough to support requirements. While the waiver was being processed in December 1995, the 86th Airlift Wing authorized aircrews to continue to fly the non-DoD approach procedures without review based on inaccurate information from HQ USAFE that they had authorization to do so. On 2 January 1996, the waiver request was denied by Air Force Headquarters (HQ USAF), because the accuracy, safety, and obstacle clearance of non-DoD approach procedures are not always reliable. On 23 January 1996, HQ USAFE informed the 86th Airlift Wing the waiver was denied; however, commanders erroneously believed the approach procedures to be safe and failed to rescind aircrew authorizations to fly the non-DoD approach procedures without review. The approach flown by the mishap crew had not been reviewed by the major command and, in accordance with AFI 11-206, should not

have been flown.

• **Command also failed to provide adequate theater-specific training.** This was a substantially contributing factor in the mishap. Knowing Operational Support Airlift aircrews in Europe were routinely flying into airfields using non-DoD published instrument approach procedures, commanders did not provide adequate theater-specific training on these instrument approach procedures. Aircrews relied on familiarization training and experience gained during training flights and scheduled missions. Pilots with a thorough understanding of these non-DoD instrument approach procedures would have identified the requirement to have two Automatic Direction Finders (ADF) to fly the nondirectional beacon (NDB) approach into Dubrovnik—one for final approach guidance and one for identifying the missed approach point. The CT-43A was equipped with only one ADF. Proper training would have enabled the aircrew to recognize they could not fly the Dubrovnik approach with the navigational equipment on the aircraft. They should not have attempted to do so.

• **The aircrew made errors while planning and executing the mishap flight.** These errors, when combined, were a cause of the mishap.

Mission planning. Although the flightcrew had known for approximately 36 hours that their mission would take them into Dubrovnik, the pilots' review of the approach procedure failed to determine the approach could not be flown with only one ADF receiver. Additionally, the aircrew improperly flight planned their route. The error added 15 minutes to their planned flight time.

Rushed approach. As a result of their planning error, the aircrew would be late arriving at Dubrovnik. The pilots rushed their approach and did not properly configure the aircraft prior to commencing the final segment of the approach. They crossed the final approach fix without clearance from the Dubrovnik tower and were 80 knots above final approach airspeed in accordance with the flight manual. They did not enter holding at the final approach fix, which was required, because they had not received approach clearance from the tower. Additionally, holding would have allowed them to slow and fully configure the aircraft.

Distraction. As a result of the rushed approach, late configuration, and the extraneous radio call from a pilot on the ground at Dubrovnik, the crew was distracted from adequately monitoring the final approach course. They flew a course 9 degrees left of the correct course. The following possible reasons for the course deviation were ruled out: equipment malfunction, performance of navigational aids, and lightning or other electromagnetic effects.

Missed approach point. Most significantly, the pilots failed to identify the missed approach point and execute a missed approach. If the pilots had not been able to see the runway and descend for a landing, they should have executed a missed approach no later than the missed approach point.

• **The Nondirectional Beacon Approach for Dubrovnik was not properly designed.** This was a cause of the mishap. The approach procedure was improperly designed. It did not provide sufficient obstacle clearance in accordance with internationally agreed upon criteria. Additionally, the depiction reflected the Kolocep (KLP) nondirectional beacon as the navigational aid providing the primary approach guidance, but the approach was designed using both KLP and Cavtat (CV) for approach guidance. Had the approach been properly designed, the minimum descent altitude (MDA) would have been higher. The MDA is the lowest altitude the aircraft is allowed to descend to until a safe landing can be accomplished with visual reference to the runway. The mishap aircraft descended to the incorrectly designed MDA and impacted the terrain. A properly designed MDA would have placed the aircraft well above the point of impact, even though the aircrew flew 9 degrees off course.

"This mishap resulted from a combination of the three

continued on next page

causes listed above—any one of which, had it not existed, would have prevented the accident.

Corrective Actions Taken

As a result of this mishap, corrective actions were implemented at three levels.

■ **At the USAFE level:**

The USAFE commander directed:

• The 86th Airlift Wing (86 AW) to stand down in order that they could:

-- Ensure operational support flying is professional and safe.

-- Receive command focus in light of the T-43 mishap.

• A higher headquarters evaluation of the 86 AW's standardization and evaluation program be accomplished.

-- It was found in "viable and in good condition."

• All 86 AW aircrews complete refresher instrument training concentrating on instrument procedures.

-- All aircrews were restricted from flying until completing this training.

• All 86 AW aircrews flying passenger aircraft be recertified.

-- Aircrew were restricted from flying with passengers until check rides were completed.

• The use of non-DoD approaches in weather be prohibited until the approaches complete a review and approval process.

• Dubrovnik be limited to day VFR for Air Force flights.

-- The publisher of the Dubrovnik approach was also notified of USAFE concerns with the approach at Dubrovnik.

Additionally, USAFE has been taking actions to strengthen command, control, and supervision command-wide.

• USAFE has tightened tasking control for all airlift and tanker aircraft by placing the function in one headquarters center.

-- Previously, these functions were "stovepiped" to the extent that the headquarters did not have sufficient oversight of total tasking.

• USAFE has centralized oversight of mission execution at the wing level.

• USAFE is restructuring the standardization and evaluation program to include expertise for each aircraft model at the wing and major command levels.

• USAFE is reviewing the headquarters' organization to fix responsibility and accountability for policy and direction; the commander has approved reorganization of the USAFE/DO organization to improve staffing and coordination with the field.

Secretary Perry also took action to ensure all passenger-carrying aircraft—for all the services—were equipped with more advanced navigation and safety equipment.

• USAFE is revising its Cockpit/ Crew Resource Management (CRM). This program provides instruction and practical procedures for prioritizing and coordinating crew actions.

• USAFE has taken individual corrective actions responding to deficiencies in performance identified in the accident investigation and in a subsequent UCMJ inquiry.

■ **At the Air Force level:**

Since USAF crews increasingly use a significant number of newly accessible airports with instrument approaches—particularly in Eastern Europe—they need the best possible information about them.

• HQ USAF will determine the best means to include relevant host nation approaches in DoD FLIP and to institutionalize our airfield suitability and restriction reports Air Force-wide.

• Given the increased access to less developed airfields, HQ USAF will establish minimum equipment standards for all our operational support aircraft.

• The Air Force will also review pipeline training for adequacy of worldwide instrument procedures training to ensure our aircrews receive the proper training prior to flying into strange airfields.

-- HQ USAF is reviewing all applicable MCIs for consistency with Air Force guidance.

-- The Air Force will also revise the departmental publications process to provide a review of MAJCOM directives.

■ **At the Department of Defense level:**

• Secretary Perry directed DoD aircraft to discontinue the use of non-U.S. Government approach procedures that have not been validated by the FAA or appropriate military authority as being safe and accurate.

• Secretary Perry also took action to ensure all passenger-carrying aircraft—for all the services—were equipped with more advanced navigation and safety equipment.

-- The Air Force immediately reprogrammed funds to accelerate the planned upgrade of our passenger-carrying fleet with:

— GPS

— Terminal collision avoidance systems

— Ground proximity warning systems

— Flight data and cockpit voice recorders

— Emergency locator transmitters. Although this equipment may not have prevented this accident, it could have provided the aircrew with better situational awareness.

With the prompt and comprehensive actions taken at all levels, we hope to prevent a similar situation which led to the tragedy at Dubrovnik. ✈

GLOC

AN AVIATION PSYCHOLOGY CHALLENGE

COL GEOFFREY W. McCARTHY, USAF MC
Chief, Aeromedical Services
Wright-Patterson AFB, Ohio

Psychology, he says? Naah, no way! All USAF fighter pilots and flight surgeons know that G tolerance is a unique, high-sustained G, *physiologic* problem. After all, it is caused by lack of oxygen and adenosine triphosphate at the level of the ascending reticular activating system of the brainstem owing to the weight of the column of blood from the left ventricular outflow tract up to the substrate-dependent brain cells resulting in a null flow condition. (Null flow? Hmm, is he talking about compressor stalls?) Further evidence that I'm OTT (over the top) here: We train on the centrifuge, run by highly competent USAF physiologists, and we know that the G-suit and Combat Edge help to offset the "null flow" condition, as does your inelegant anti-G straining maneuver (AGSM).

Plus, the training is very effective. Around 99 percent of pilots tolerate 9G for 15s at the end of the training. Yet…we still have GLOC, including at least two with Combat Edge. Must be some extra physiology up in the air that eludes us in the ground training environment, right, Guv?

A painless, bloodless dissection may be of some use. Here are the conditions likely to be found in a typical GLOC: 1v1, offense has 50 knots and 2,000 feet or so of energy advantage, 6,000 feet range at the "fight's on" call (see the figure on page 22).

At the side of each role I have listed some of those tedious, pedantic tasks for each of the players in this aerial contest—those elements which together conspire to prevent your serene enjoyment of this most pleasant of fighter aviation pastimes. In other words, the distractions!

The AGSM strain requirement varies at each turn. (What? He means we aren't expected to max AGSM every time the G goes over about 6?) Please, let's get real! I don't strain to the max every turn, and you don't either. Like the 55 mph limit and those fuzzy "business expenses" on your IRS form, we shade the "law" towards common sense.

So, how much should you strain? And more importantly, *how much of your attentional resources does it require?*

A brief review of G tolerance is regrettably necessary to settle our friendly dispute. I divide G tolerance into passive and active tolerance. We do both on the 'fuge—the slow onset run identifies your relaxed, passive tolerance, then you strain to add your active component. The life support hardware adds some more.

I simplify relaxed tolerance into Geff's "5678Minus" rule: Y'all have about 5G relaxed tolerance; it was 4.85 ± 0.6 in the air in my Hunter study. Our '44 model G-suit makes it about 6G. Adding Combat Edge brings it to about 7, ATAGS to 8. What did he say? We can sit in the jet at *8G* and not strain?! Yes, on a good day, starting from 1G. Wearing the similar Eurofighter kit, I could sit happily at 8+G and count the Welsh sheep in my BAE Hawk. (More Welsh sheep than Welsh in Wales, but that's another story.)

And what of the "Minus," Guv? Yes, there is some extra physiology in the air. Think back to September's issue of *Flying Safety* and see if you can derive the Minus component of the rule.

And now (Paul Harvey-like tone to the voice) "the rest of the story." By now you will have discerned my devious purpose here—to stimulate you to think about the real *core* cause of GLOC. It's a WORKLOAD problem of insufficient attentional resources and sub-

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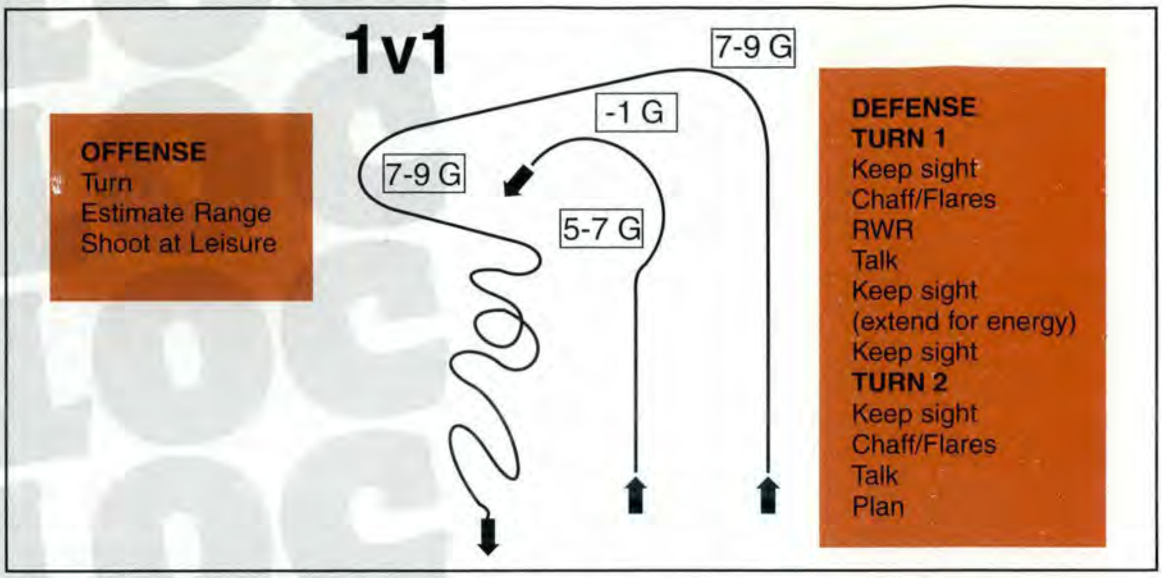


optimal task switching and prioritization. "He forgot to strain." Yes, quite so, he did, indeed.

A few pointed questions if you disagree: Why is the guy on offense much less likely to GLOC? Why do test pilots never GLOC despite repeated 9G test points? (We know their answer…) Why is it perfectly safe for the Thunderbird solo to do that 360° turn at 9G at show center, aiming toward the crowd at the 270° point? Your conclusion is, I trust, the same as mine: All these guys, like you on the centrifuge, have very little on their minds! They are focused comfortably on a fairly simple phase of the sortie and have moderate demands on their attentional resources. Tolerating the G is at the top of their script at that point.

Test time. (You just knew there would be a pop quiz here.) Go back to our hapless defender above, the designated mort. Enumerate again, please, the demands on his attentional resources. Add in the tasks I have omitted—like listen to AWACS—and the future ones—such as interpret the JSTARS display, launch your personal radar decoy, lower your laser protection visor, focus back to your helmet-mounted display, etc., etc. Do the same for the guy on offense. Fill in your estimate of their level of AGSM needed.

The defender has the far more demanding role, one which requires superhuman division of attention and task switching, performed at the period of highest *physiologic* AGSM demand.

Why the highest in this example? The Minus rule. Even wearing CE + ATAGS, he cannot sit blithely at 8-9G, coolly calculating his next three moves that will result in his Lead Computing Optical Sight superimposed on your canopy, because of the extreme workload and *because of the preceding extension at -1G.* His passive tolerance is now down to around 5-6G, and he will need a 110 percent AGSM, requiring, I'd say, around 75 percent of his *attentional* resources.

Take-to-the-jet points of this article, cher reader (stomp foot for the test questions): *The AGSM is a very complex brain psychomotor program. It cannot be done automatically in the heat of battle while switching attention among other tasks. It must be more forceful when starting from negative G. You cannot strain max and think max simultaneously.*

Yes, I know you can fly defensively BFM + chew gum + serve an ace + calculate the bullet drop after two seconds of flight + solve the Sunday *Times* (the London *Times*) crossword—all at once—cuz you're a fighter pilot. Right? I *know* I could do all those things together at your age. Sorry, back to reality again. The AGSM takes 100 percent of your attentional resources during the ground training, but your skill declines with time since training. (Know how much CPR we docs retain 1 year after cert? The best estimate is about 40 percent…)

Have I convinced you? Isn't my title correct?

Incidentally, in this discussion I have hinted at the Armstrong Lab goal for G tolerance: G tolerance should ideally require about as much attention and psychomotor activity as altitude tolerance. Namely, none. But until ATAGS, it's Geff's "567 Minus" rule. With ATAGS you will be able to relax somewhat at 7-8G (if you started from positive G) and GLOC will be as rare as stealth fighter victory rolls.

The real value of CE and ATAGS is *operational,* not physiologic: They buy you attentional resources, they reduce your workload in a major way. (You are lobbying for ATAGS, aren't you?)

Until then, flying BFM/ACM will remain the most physically and cognitively dynamic activity performed in the air. Compared to your workload, the World Aerobatics Champion, the Shuttle Commander, the Thunderbirds are on easy street. For some phases, all you can—and must—do, is strain. All else drops off your priority list for that crucial 5 to 15 seconds, especially after negative G.

Understand workload psychophysiology. *Never ever depend on light loss to start straining!* Plan when to strain. Prioritize it. Brief it. Reprioritize it. Practice it. Reprioritize it higher, and always strain to the max after negative G. And as for the psychology, your resident physiologist is the workload expert. Cheers! ✈

IT'S A PRIVILEGE
The Promise of Confidentiality—What Is It?

COL KEVIN L. DAUGHERTY
HQ AFSC/JA

As we know, the Safety Investigation Board (SIB) has a single, overarching purpose—find out the cause of a mishap so the same thing doesn't happen again. We also know that this must be done quickly so the Air Force can go about doing its job—national defense. In order to get all available information quickly, witnesses must be interviewed as soon as possible, and to ensure the witnesses tell the SIB everything, they are given a promise of confidentiality.

What exactly is this promise? Basically, it is a promise to the witness that whatever information he or she provides will be used only for mishap prevention, that their statement will not be used to support any adverse action, and that their statement will not be released to the public. (This promise is given to witnesses in aircraft, space, missile, nuclear, and ground with aircraft-involved mishap investigations. There is no promise of confidentiality given in ground industrial or weapons investigations unless first approved by the Air Force Chief of Safety.)

If a promise of confidentiality is given to a witness, the Air Force will use its best efforts to honor that promise. The Department of Defense has been successful in doing so by asserting the Secretary's "Safety Privilege" in court when various interested parties have sought to get a SIB report. Because the privileged information ultimately goes to the national defense, the courts have willingly protected the release and upheld the privilege.

However, there are two exceptions to the promise. First, witnesses cannot expect their statements will be protected if they lie to the investigators. For a board to get to the bottom line of a crash and prevent future mishaps, investigators must be able to rely on the truth of the information provided by a witness. If you can't trust your evidence, your investigation is worthless. Therefore, if there is evidence a witness lied, the promise is void, and the statement may be released to investigate the fraud.

The second exception is where a statement is ordered released by a military judge in a *criminal* trial. Now certain rules apply here: The release is to the accused and his defense counsel, they may not release the information to anyone else, and the prosecution may not use it. It may be used to help only the defense. This way, the accused's constitutional rights are protected, but the evidence may not be used to support the prosecution.

The safety investigator advises the witness at the start of the interview so everyone knows and understands what the ground rules are during the investigation. It's an unfortunate fact of life that after a crash people have to go through the distressing ordeal of an investigation—investigator and witness alike. Still, everyone's ultimate goal should be the same—saving lives and resources. The promise of confidentiality is one tool available to do just that. ✈

ON TRACK

THE AFFSA QUIZ

MAJ BOBBY FOWLER
HQ AFFSA/XOI

Welcome to the Instrument Refresher Course—OOPS, wrong introduction. Actually, it's going to feel like an IRC exam ***IF*** you look up the answers and don't just go to the end of the test and look there.

Lately, there seems to be a lack of mission preparation, or mission study, or just lack of knowledge in the instrument world. Several recent mishaps have been attributed to pilot error caused by possible lack of knowledge. Not to say that AETC isn't teaching the right stuff, but maybe we, as pilots, aren't getting into the books as often with a 17-month instrument evaluation cycle that concentrates more on aircraft knowledge than instrument procedures.

Hopefully, this little quiz will help you realize you don't know it all, and a little study is a good thing. So enough with the Flight Standards lecture. On with the quiz!

1. This is your mission planning day in a T-37—yes, you have been sent back to UPT as an IP and get to play solo pilot having fun (legally). You decide to go to Sheridan County, Wyoming, on your way to Colorado Springs—no offense to non-zoomies. As our fantasy unwinds, assume you can fly your Tweet to an uncontrolled "P" field, and the weather is forecast to be 1000-2. Looking at the IFR supplement and IAP for Sheridan County (figures 1 and 2), can you go there?

A. Yes, the weather is good enough, and my Tweet has an ILS.

B. Yes, the runways are long enough.

C. Yes, all the above are true, and they have the services I need to get out of there.

D. No, it's not covered by radar, and I can't get to the field VFR.

2. Are you under radar control while you are flying approaches at the airport?

A. Yes.

B. No.

3. The next step in your flight planning process, you notice the ▼ and ▲ on the approach plates. What do they mean to you?

A. Nothing. As an Air Force pilot, I don't have to abide by them. They are there for those sissy services to abide by.

B. I'm not using the field as an alternate, so I don't need to worry about the ▲.

C. I need to look in the front of the approach book to determine if I can comply with the IFR departure procedure for the airfield.

D. I have to plan to fly the IFR departure procedure when departing IFR.

E. Both **C** and **D** above.

4. On arrival, you discover the winds are out of limits for RWY 14/32, so you must land on RWY 23. The weather is 800-2. How are you going to get down to minimums for the circle?

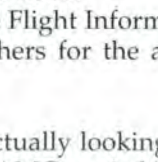
A. I'm not. You cannot circle out of an ILS.

B. Fly the glideslope down to circling MDA.

C. Fly the ILS course guidance, but descend using non-precision approach procedures down to circling minimums.

D. Go home. It's too windy to have any fun there anyway.

5. New day, new destination. The airport you decide to fly into today has the following symbol in the airport depiction. What is it, and where do you find out about it?



A. The new METAR symbol for few clouds in the new weather handbook.

B. Pilot controlled lighting symbol in the front of the approach procedures book.

C. ODALS in the Flight Information Handbook.

D. Sequence flashers for the approach lighting system on the airfield.

6. As a reward for actually looking up the question, you get to fly your T-37 (AMC carried it over in a C-5) around the UK to lots of airshows. You are flying a non-precision approach and see the procedures in figure 3. What do the restrictions at 18, 11, and 6 DME require you to do?

A. Fly between those altitudes down to the 6 DME

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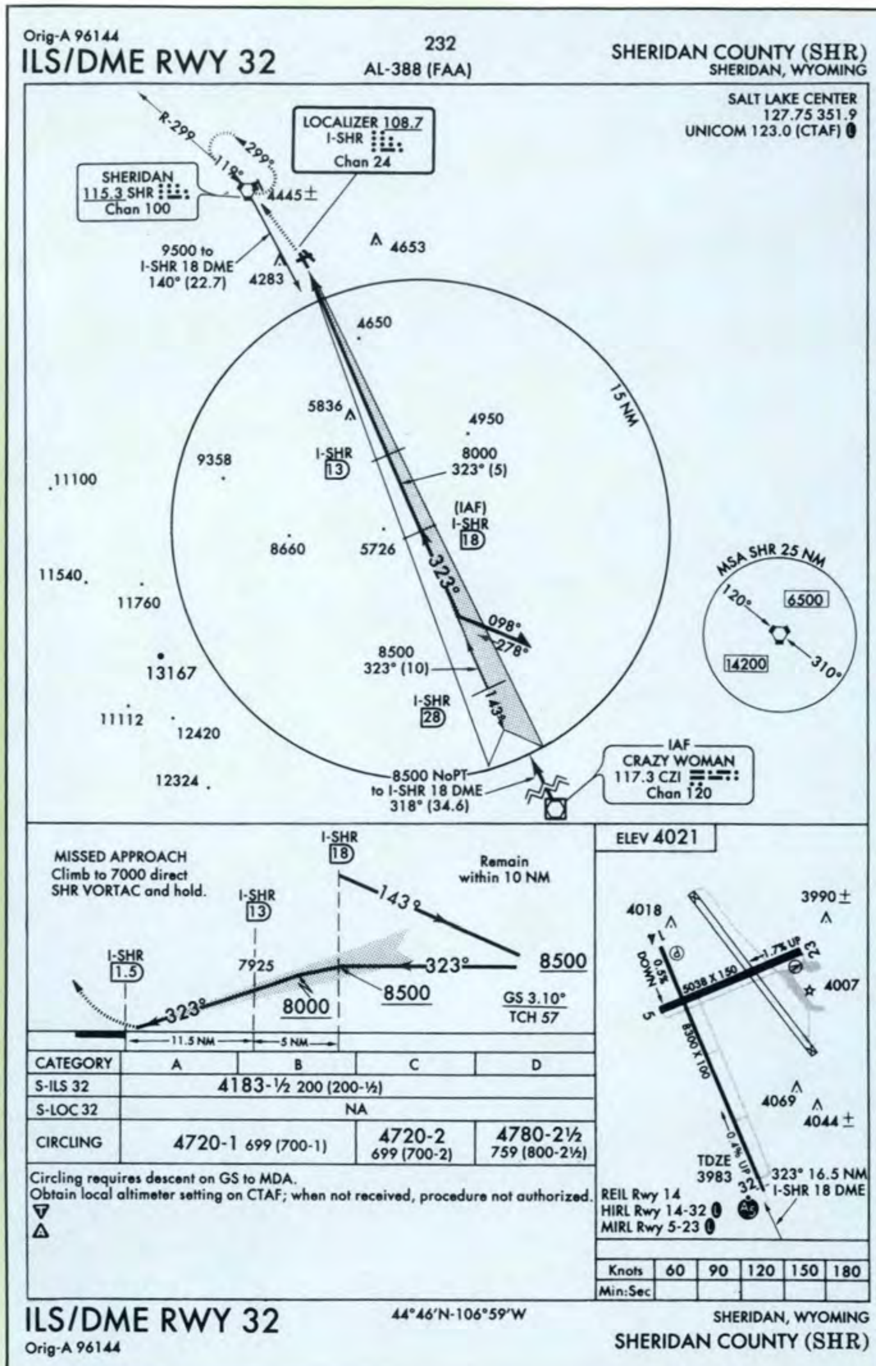
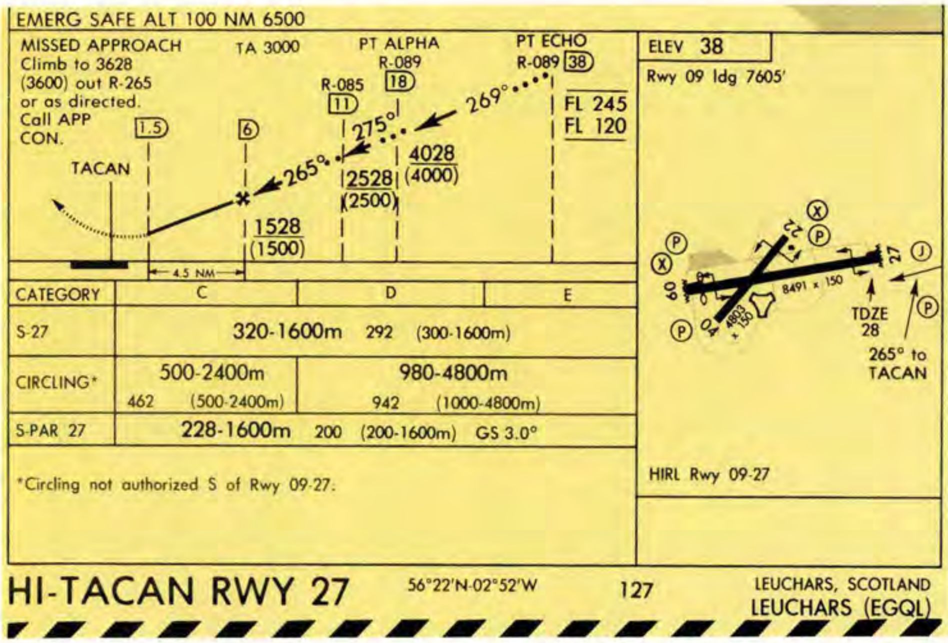


SHERIDAN CO, WY **SHR** P 44°46.2'N 106°58.8'W 4021 UTC-7(-6DT) **H-1C,L-9C**
(B) **RWY-05** L4 ——— (5038x150 ASP S140 T145 ST175 TT225) ——— L4,9 **RWY-23**
RWY-14 L6,10,12 ——— (8300x100 ASP) ——— L5,6,8 **RWY-32**
SERVICE - LGT - ACTIVATE-MIRL Rwy 05-23, HIRL Rwy 14-32 and MALSR rwy 32-CTAF.
FUEL - (NC-80, 100, A, A1+)
REMARKS - Attended daylt hr. **RSTD** - PPR unsked acft opr with more than 30 PAX seats. Ctc ARFF stn C307-672-2950. F/W acft rstd to rwy and twy only. **CAUTION** - Ultralight, glider and deer haz. **MISC** - Class E Airspace eff 1100-0500Z++, OT Class G.
COMMUNICATIONS - CATF/UNICOM - 123.0 **(FSS-CASPER CPR-NOTAM SHR** Wx unavbl 0600-1130Z++, auto voice altimeter 115.3.) **RDO - (V)** 122.5 (CASPER FSS) **SALT LAKE CITY CENTER** - 127.75 351.9 (APP/DEP CON svc)
NAVAIDS - VORTACW - (L) 115.3 SHR CH 100 44°50.5'N 107°03.6'W 128° 5.6 NM to Fld. 4410/(A)13°00'E **VHF/DF**
VORTAC unuse 160°-200° byd 30 NM blw 14,700' 200°-270° byd 30 NM blw 12,400'
ILS/RADAR - ILS



fix, then fly standard non-precision descent rates.

B. Use the upper numbers if you are flying QNH.

C. Use the lower numbers if you are flying QFE.

D. **B** and **C** are correct.

Bonus. Based on AFMAN 11-210, what subjects should be covered during your 6-hour Instrument Refresher Course (IRC)?

A. Flight Planning and New & Revised Regulations.

B. Spatial Disorientation and Weather.

C. Instrument Procedures and any identified weak areas.

D. Other topics required by MAJCOM/Wing.

E. All of the above.

Answers

1. **C**. This question is designed to get you to look at AFI 11-206, 8.4.1, and the IFR Supplement. AFI 11-206, 8.4.1 covers the requirements for having a published instrument approach at an airfield. Sheridan is in the DoD book, and you can navigate to the approach via the SHR or CZI VORTAC without radar vectors.

2. **B**. While Salt Lake Center has control of the airspace, there is no (R) in the IFR Supplement, therefore, the airfield is not radar monitored. AFFSA is working to have "Radar Facility" printed in place of (R) to clarify the airfield's capability.

3. **E**. The "Trouble T" and "Alternate A" rear their ugly heads again. Both are covered in the front of the IAPs and AFMAN 11-217. AFMAN 11-217, Vol 1, para 8.3.3, states that for Air Force pilots the T minimums must be used in accordance with AFI 11-206, and the published gradient must be met or achieved when flying the published procedure. The procedure also contains obstacle information that the pilot should be familiar with when planning departure routing. Further reading in the paragraph states that if neither a SID nor radar vectors [non-radar facility] are available, the published departure procedure should be used to avoid obstacles. The A is covered in 11-217, 8.6.2.7, and is important to USAF pilots when the A has "NA" after it. Then it DOES apply to military pilots and tells you that the approach cannot be used as an alternate for one of several reasons. Look them up.

4. **B**. This is the famous "Can you circle out of an ILS or PAR?" The answer is yes. Two reasons apply here. The first is on the approach plate. It tells you that circling requires descent on GS to MDA. Looking at the obstacles on short final shows you why. The other statement that allows this is the 11-217, 15.6.1. Circling procedures and techniques are not compatible with precision approach criteria, and *under normal circumstances,* should not be attempted. Obviously this is not a normal circumstance.

5. **C**. This just goes to show you that all lighting systems are not covered in the front of the IAPs and reminds you where the rest of them are.

6. **D**. The index in the front of the IAPs has a section covering altitudes. The altitudes in parentheses are QFE altitudes. Although any restrictions are depicted with the QNH altitudes, they apply to them both. Incidentally, this approach was designed for QFE users (probably the RAF) and was converted to a QNH approach for us. You can tell because the QFE altitudes are rounded to the nearest 100-foot increment and the QNH altitudes are not.

Bonus. Of course it's all of the above. This should show you how much your instructor has to cover, and 6 hours isn't a lot of time. If you need more information on any of these subjects, call Maj Kevin Jones at AFFSA/XOF, DSN 858-5418 or commercial 301-981-5418. ✈

I'd rather be down here wishing I was up there, than to be up there wishing I was down here.

IFR DEPARTURE PROCEDURES

MSGT BILL FRENZ
HQ AFFSA/XOI

IFR departure procedures assist pilots conducting IFR flight in avoiding obstacles during climbout to the minimum enroute altitude. They are established at locations where instrument approach procedures are published, and then only if an obstacle penetrates a 40:1 obstacle identification surface. In pilot talk, the 40:1 slope equals a climb gradient of 152 feet per nautical mile. When you add in 48 feet per nautical mile of required obstacle clearance, you get 200 feet per nautical mile—the minimum climb gradient pilots are required to climb at unless a higher gradient is published. At airports with a published instrument approach, an IFR departure procedure will be published if an obstacle requires a climb gradient greater than 200 feet per nautical mile. If an airport has an instrument approach and no IFR departure procedure, you *should* be able to avoid obstacles by delaying any turns until 400 feet above the departure end of the runway's elevation and climbing at 200 feet per nautical mile or greater. I use the word "should" because there are locations where an instrument approach is published, an obstacle requires a climb gradient greater than 200 feet per nautical mile, yet an IFR departure procedure has not been published (for example, Cape Romanzof in Alaska). If you encounter one of these fields, urge your local TERPs specialist to develop a departure procedure for that location.

IFR departure procedures may be published in several ways: "see and avoid" weather minimums, minimum climb gradients, detailed departure instructions, or a combination of all three.

• **"See and Avoid" Weather Minimums.** Most IFR departure procedures contain nonstandard weather minimums which are used by civil pilots to "see and avoid" obstacles in lieu of meeting a published climb

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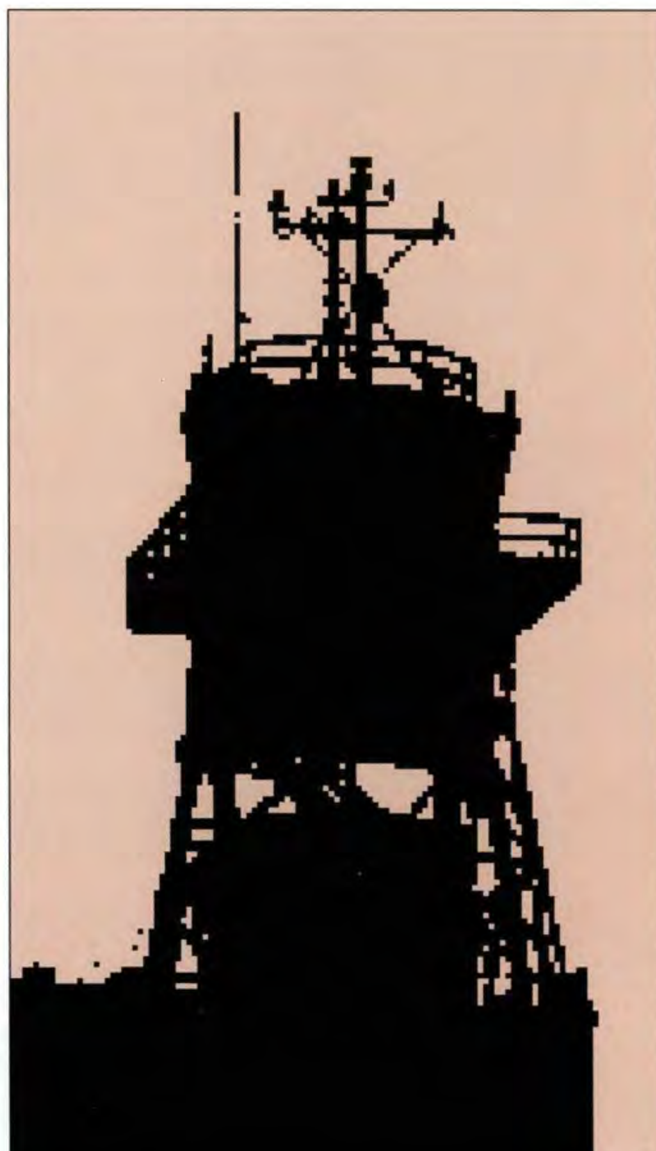

gradient. For example, this is the IFR departure procedure for Deming Muni, New Mexico: "RWYs 22, 26, 300-2." USAF aircrews are not authorized to depart IFR using these nonstandard weather minimums.

• **Minimum Climb Gradients.** Normally, minimum climb gradients will be presented in an IFR departure procedure in the following way: A nonstandard ceiling and visibility will be published first for those who can use "see and avoid." After the nonstandard ceiling and visibility, there will be an "*" which will refer you to a statement describing a minimum climb gradient for use with standard departure weather minimums.

For example, let's look at Elko Muni in Nevada. Their IFR departure procedure's first line is "RWYs 5, 23, 400-1.*" The asterisk refers you to the following statement, *"Or standard with a minimum climb of 370'/NM to 9000."* Since USAF aircrews are not authorized to use "see and avoid" weather minimums, you must be capable of climbing at 370 feet per nautical mile to 9,000 feet MSL.

Let's look at another example at Eagle County in Colorado. Here's their IFR departure procedure: "RWY 7 5300-3.*" The asterisk refers you to *"Or 800-2 with a climb of 650'/NM to 11,800."* If your aircraft can climb at 650 feet per nautical mile to 11,800 feet MSL, can you take off IFR using this procedure? The answer is ***NO!*** Remember, USAF pilots are not allowed to use "see and avoid" weather minimums. The 650 feet per nautical mile is only authorized when the weather is at least 800-2, meaning you must be able to "see and avoid" some close-in obstacle *and* maintain 650 feet per nautical mile to clear another obstacle.

• **Detailed Departure Instructions.** Sometimes the TERPs specialist can keep you away from obstacles by giving specific routing to be followed. For example, look at the IFR departure procedure for Fort Huachuca-Sierra Vista in Arizona: "RWYs 26 and 29 turn right, RWYs 2, 8, and 11 turn left. All aircraft climb 9500 to TOMBS INT via FHU R-019 or 018 degree bearing from DAO NDB." Remember, unless assigned a SID or radar vectors, you are required to comply with IFR departure procedures when they are published.

• **Combination.** Finally, you may also see a combination of all three methods. Rawlins Muni in Wyoming is a good example. This is their IFR departure procedure: "RWY 4, 600-1* RWY 22, 1500-2.**" The asterisk means *Or standard with min climb of 440'/NM to 7500."* The double asterisk means *"Or standard with min climb of 365'/NM to 7700."* There is more: "RWY 4 turn rgt, RWY 22 turn left. Climb to 10,000 via RWL R-200 and CKW R-080 to CKW VOR/DME then via assigned rte. ACFT dep eastbound V4 or V6 climb via RWL R-200 to assigned rte then climb on crs."

Your first encounter with an IFR departure procedure should be during the flight-planning stage of your flight. Normally, we expect to depart via radar vectors or a SID, but it is also important to check for the existence of an IFR departure procedure. The existence of an IFR departure procedure is indicated in DoD FLIP by a ▼ symbol. Other publications may annotate IFR departure procedures in different ways. For example, Jeppesen publishes the airfield's departure procedures on its airfield diagram page. One note of interest here: IFR departure procedures are published in the front of the approach book containing the approaches for your destination. If you look in the civil SID/STAR book, you won't find all the IFR departure procedures—they are only published in the SID/STAR book when a SID or STAR is published.

One last note. Let's say you are going to El Dorado, Kansas, where there is no radar service, IFR departure procedure, or SID. Now what do you do? You cannot depart El Dorado IFR—the weather at El Dorado will have to be good enough to permit a VFR climb to an appropriate IFR altitude or to an altitude where you can get radar vectors.

What is ATC's responsibility when it comes to IFR departure procedures? Not as much as you may think. It depends on the class of airspace the airport is located in. If the airport is in Class B, C, or D airspace, ATC will specify direction of takeoff/turn or initial heading/azimuth to be flown after takeoff. If the airport is in a Class E surface area, ATC will provide specific instructions only if pilot compliance is necessary for separation and only if the pilot concurs. At airports in Class G airspace, the controller will not provide any instructions until the aircraft enters controlled airspace.

That pretty much sums up IFR departure procedures in a nutshell. Flying organizations are being tasked to perform more and more missions in operating locations that may be far different than what may be considered the "norm." Your knowledge of how to fly IFR departure procedures may be tested sooner than you think. ✈

LT GEN GORDON A. BLAKE AIRCRAFT SAVE AWARD

MSGT GEORGE INGRAM
HQ AFFSA/XATP
Save Program Manager

■ **To be a recipient of the General Blake award, "The controllers' actions must be distinguishable, professional, and cast no reasonable doubt that, without these actions, probable damage to the aircraft would have occurred."**

Since 1957, air traffic controllers have saved more than $4.5 billion worth of aircraft, but more importantly, they have saved more than 8,000 lives, both military and civilian. To date, the "Lt Gen Gordon A. Blake Aircraft Save Award" has been presented to more than 2,500 air traffic controllers. The Lt Gen Gordon A. Blake Aircraft Save Board recently convened and awarded six aircraft saves. The save board would like to extend congratulations to the latest recipients.

MSgt Neil T. Spissu (RAPCON, Coordinator), 8 OSS, Kunsan AB, Republic of Korea. While stationed at Kunsan Air Base, MSgt Spissu's outstanding attention to detail and vigilance are directly responsible for the prevention of a disastrous situation involving a valuable Air Force asset. An aircraft's onboard radar malfunctioned and locked onto an aircraft which was approximately 5 miles in front of him. Instruments showed the pilot was 5 miles south of airport causing the pilot to begin a steep descent for landing when, in fact, he was actually 12 miles south. MSgt Spissu caught the error deviation, thereby preventing the aircraft from crashing.

TSgt William S. Towles III (Tower, Watch Supervisor), 314 OSS, Little Rock AFB, Arkansas. A C-130 aircraft was beginning takeoff roll when TSgt Towles noticed smoke coming from the No. 4 engine. His quick recognition of the unusual situation and direction provided to fellow controllers prevented a disastrous situation. TSgt Towles' actions clearly impacted the safety of the periled aircraft.

SSgt Brent D. Houdek (RAPCON, Approach Controller), 51 OSS, Osan AB, Korea. An aircraft was given a frequency change and ATC instructions to comply with. After changing frequencies, the aircraft deviated from ATC instructions, thus causing a potential midair collision. Without SSgt Houdek's calm disposition, keen vigilance, and accurate assessment of a potentially serious mishap, numerous lives and multi-million dollar Air Force assets may have been lost.

SSgt Phyllis K. Simpson (RAPCON, Approach Controller), 14 OSS, Columbus AFB, Mississippi. VFR pop-up aircraft was on an imminent conflicting course with a non-radar hand-off from an adjacent approach control. Without the accurate traffic call by SSgt Simpson, the two aircraft could have collided.

MSgt Eddie Wells (Local Controller), 46 OSS, Eglin AFB, Florida. An aircraft was instructed to hold short of runway for departing traffic. A T-38 was cleared for takeoff when MSgt Wells noticed the previous aircraft that was instructed to hold short had entered the runway. MSgt Wells' keen situation awareness and quick response undoubtedly prevented serious damage and saved numerous lives.

SrA Royal Preston (Tower, Flight Data), 80 OSS, Sheppard AFB, Texas. A T-38 aircraft attempted departure without takeoff clearance, with vehicles on runway. A good heads-up call by SrA Preston avoided a disastrous situation.

These controllers have upheld the highest standards of professionalism, dedication to flight safety, and teamwork. Without their actions, loss of life and damage to these aircraft would have occurred. Keep up the good work! ✈

NEW RULES IN AIRCRAFT WEIGHT CLASSIFICATION AND WAKE TURBULENCE SEPARATION MINIMAS

MSGT GEORGE INGRAM
HQ AFFSA/XATP
Chief, FAA/Military ATC Procedures

■ Recent questions regarding the sweeping changes in the reclassification of aircraft and wake turbulence separation criteria has highlighted the need to clarify this issue.

Federal Aviation Administration Order (FAAO) 7110.157 superseded some of the guidance in the current edition of FAAO 7110.65J, relating to selected wake turbulence separations and aircraft weight classifications. New definitions of heavy, large, and small weight were included in this order. The addition of separation minimas involving Boeing 757s (B757) and small aircraft weighing less than 12,500 were also included.

So how do these changes affect the way we do our business? In the Air Traffic Control (ATC) system, we have always applied wake turbulence separation in one form or another. In the interest of enhancing flight safety in the National Airspace System (NAS) to all users, the Federal Aviation Administration (FAA) has implemented a mandatory reclassification of aircraft weight categories and change in wake turbulence separation criteria.

Numerous questions have been brought to the attention of this office regarding this issue and the effect these changes would have on the Air Force's ability to continue business as usual. The FAA has taken a hard stance on the issue of waiving wake turbulence separation, and the bottom line is **"wake turbulence separation involving any type of heavy jet or B757 is non-waiverable."***

Simply stated, *"When a departure or an arrival is a heavy jet or B757, the wake turbulence separation cannot be waived."*

Let's face it, folks. There are new rules out there, and like it or not, there is no escaping that fact. Noncompliance to the FAA-mandated changes in wake turbulence separation criteria and weight reclassification would place the USAF in a very embarrassing situation should something unfortunate happen. More importantly, it compromises the safety of the aircrew. Changes don't occur without a good reason. Before you ask us if you can still play by the old rules, ask yourself, "Can I answer the mail?"

Editor's Note: "Is the expected value worth the risk?"

*FAA Order 7110.157 (paragraph 4d) and FAA Order 7110.65. ✈

ON COURSE, ON GLIDEPATH

CAPT MIKE MARGOLIS, USAFR
Laughlin AFB, Texas

■ *There we were,* on radar downwind awaiting vectors for a PAR approach to Navy West Coast. Approach control reported the visibility at 1 1/4 miles due to fog and haze, with the ceiling obscured. My student, flying instruments in the backseat, was doing a pretty good job.

As usual, things did not go quite as advertised. The weather had been forecast to be VFR. However, this was good IFR training for my student. Another fly in the ointment was the fact the TACAN had stopped transmitting DME information upon our arrival to the terminal area. Of course, the next closest TACAN was out of range due to mountainous terrain. So our situational awareness was based on heading, bearing to the station, and our trusty radar controllers.

We were vectored to final and handed off to the final controller via single frequency approach procedures. My student slowed, configured, and was told to begin descent. His approach was safe but not very consistent. The controller, however, continued to call "On course, on glidepath."

My vantage point from the front cockpit should have allowed me to see the runway 200 to 300 feet above the 200-foot AGL decision height. However, as we descended through 400 feet AGL, there was no runway—only a small farm with a nice white fence around it. I assumed control of the aircraft and initiated the missed approach/climb-out procedure. During the transfer of aircraft control and transition to a serious climb, the controller continued with the standard approach calls. "One mile from runway...Over the approach lights...At decision height...Contact tower on..." This was certainly strange since we were climbing through 1,500 feet and accelerating through 230 knots.

I responded with "Lucky 13 would like to contact tower, but we're passing 2,000 feet on the missed approach at this time." After a short pause, the reply came from a more distinguished and seemingly miffed voice. "Lucky 13, radar contact *now,* maintain present heading and climb to 4,000 feet, expect vectors PAR." I suggested a phone conference after we landed to sort this out. The new controller concurred.

After landing, the supervisor promised a full investigation into the incident and gave us a free tour of the RAPCON facility.

Now, how did we end up 5 miles short of the runway at 400 feet on a PAR? It turns out there were two aircraft on final at once. The airplane who was No. 1 for the approach was an F/A-18 about 5 miles ahead of us. Our controller picked up the F/A-18 who was already talking to another GCA controller. Unfortunately, our controller was talking to us while watching the F/A-18's approach (which was very nice, by the way—we heard the whole thing). So nobody was watching us, and we didn't know it. The supervisor noticed the error when we appeared climbing out of the lower left corner of the GCA scope.

I tried to impress upon the controllers the nasty implications of this sort of mistake. What if there had been other complications associated with being at 400 feet, 5 miles from the runway. How about night with lower visibility, or a serious aircraft malfunction, or a radio tower on final, or even a chunk of terra firma rising above DH....

Observe the clues. If something doesn't feel right, it probably isn't. ✈

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OP's Topics

Two Engines Out—Two Engines to Go

■ *A four-engine aircraft had not one, but two different engine "indication" faults that resulted in **both** engines being shut down— only minutes apart. What are the chances of that occurring?*

Well, such an unlikely event did, in fact, happen to an airlift pilot on his initial aircraft commander training sortie! Luckily, his instructor pilot was in the right seat. There were two experienced, high-time flight engineers behind him. Plus, he had two more good engines to get him safely back on the deck.

But talk about getting a healthy dose of real-world crew resource management (CRM) and operational risk management (ORM) education and experience during an actual in-flight emergency—and on an initial aircraft commander training flight, to boot! Now that's about as good as it gets, folks, for some actual hands-on training for an aircraft commander upgrade candidate. For other pilots of multiengined, multiple-crewed aircraft, put this mishap scenario in your flight simulator training packages, e.g., for the benefit of CRM and ORM education and training!

The aircrew was flying local pattern touch-and-go's and was about 500 feet AGL after the fourth touch-and-go when the flight engineer got a No. 3 engine thrust reverser pressure light. However, there wasn't a similar indication on the pilot's panel, plus the scanner (second flight engineer) had also confirmed the thrust reversers were visually closed. Just to be safe, though, an emergency engine shutdown was accomplished. The open thrust reverser indication light on the flight engineer's panel finally went out just prior to pulling the No. 3 engine T-handle. As for the impending three-engine approach and landing? No sweat for this seasoned crew, right?

As Murphy's Law would have it, though, the mishap plot immediately thickened when only 1 minute after shutting down the No. 3 engine the pilots and flight engineer both got a flashing overheat light for the No. 1 engine! With no other adverse cockpit indications or warnings, and having received another clean-bill-of-health observation from the scanner, the pilots still pulled the No. 1 engine throttle back to idle and commenced the engine overheat checklist. This time an in-flight emergency was declared, and the crew requested and received beeline vectors for a final approach.

Next, the crew went through the two-engine landing procedures and had to first make sure they were within a safe margin for an approach and landing with their gross weight and available engine thrust out of the two remaining good engines. Satisfied they would still have enough thrust, they performed a precautionary shutdown of the No. 1 engine when about 1 nautical mile from turning on the base leg. The overheat light, however, remained on even after the engine was shut down. The rest of the approach and landing was uneventful.

Seems what we had here were the old "indication only" headaches. There wasn't any evidence of an overheat or fire on the No. 1 engine nor had the No. 3 engine's thrust reversers actually unlocked or opened!

As it turned out, the No. 3 engine had a simple thrust reverser stow switch out of alignment, which was easy to fix with minor adjustments. However, the No. 1 engine posed a little more of a troubleshooting challenge. At first, maintenance thought the overheat indication problem was in the fire loop and control box, but after replacing these two components, the overheat light still remained on (case of swap-tronics troubleshooting?). Further troubleshooting and head scratching finally discovered a short in a cable assembly going to the overheat connector (J548AA). ✈

Experience is a hard teacher. It gives the test first, the lessons afterwards.