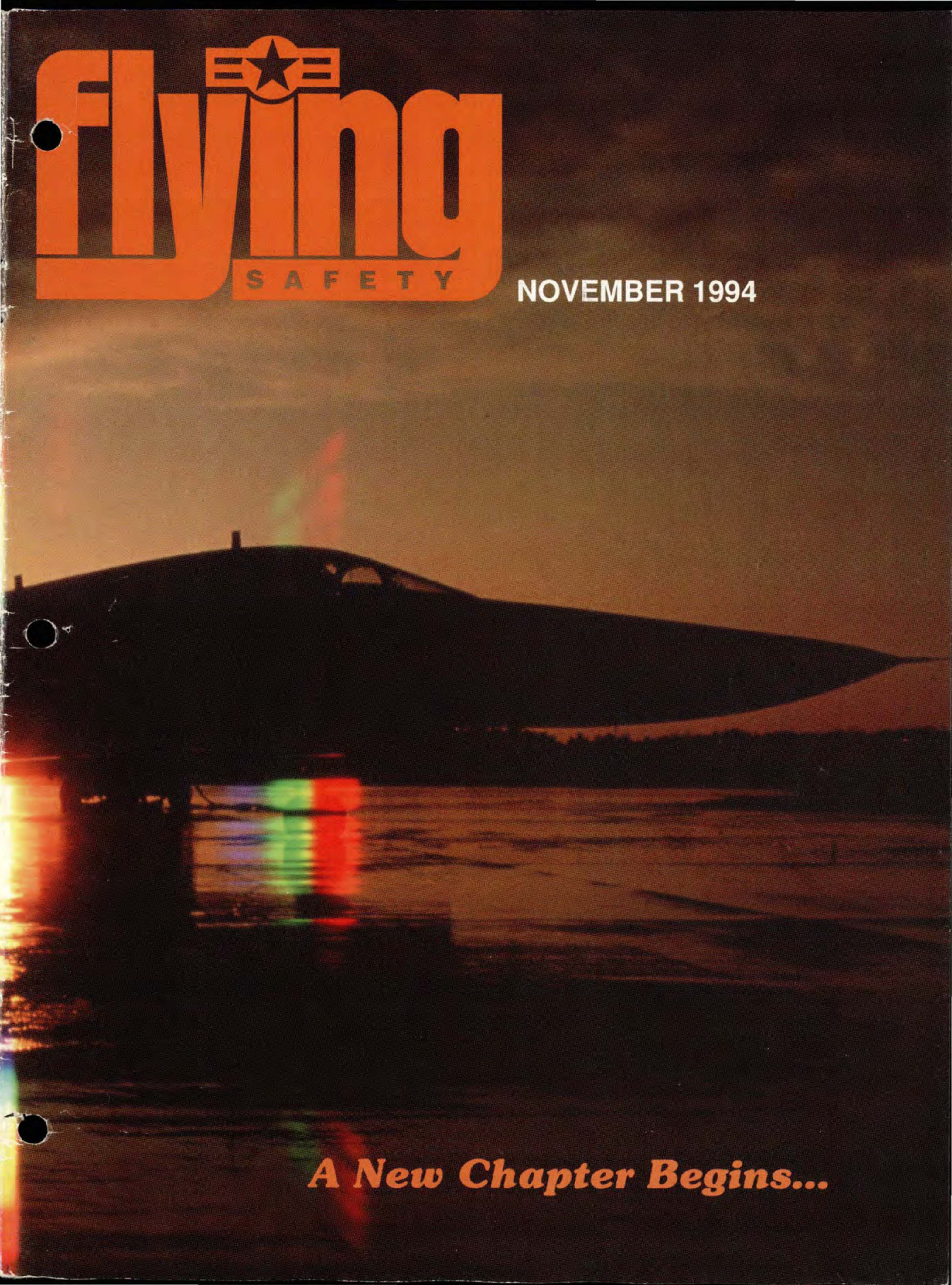
flying SAFETY

NOVEMBER 1994



A New Chapter Begins...

THERE I WAS

■ I was the aircraft commander on an HC-130 aircraft participating in an air power demonstration with allied air forces. The scenario for the demonstration called for a simulated airfield takedown by US and allied special operations forces interspersed with flybys of participating aircraft from both the USAF and the host country air force.

In the premission planning, each type aircraft was assigned holding patterns and altitudes from which they would then depart and perform their portion of the demonstration at the airfield. Two HC-130s were tasked to participate in the demo. My aircraft was assigned a holding altitude 1,000 feet below the other HC-130. Additionally, the demonstration airborne mission commander was aboard my aircraft and would coordinate all aircraft activities via VHF and UHF radio.

My copilot was a high-timer getting ready to upgrade to aircraft commander. I let him fly the majority of the time, with the exception of the actual flybys.

The flight proceeded uneventfully through the first two flybys and returned to holding. On the third return to holding, the other HC-130 aircraft was already holding 1,000 feet above us. My copilot began his turn into holding early, and the other aircraft, as if in answer, turned early also.

My copilot apparently took this as a challenge, tightened his bank, and reduced airspeed to get some "positive cutoff" and beat our buddies around the turn. The other aircraft made a corresponding bank increase and airspeed reduction. The airborne mission commander, a former fighter pilot, then got involved by advising the copilot on how to "get his guns on the other guy."

The turns became more aggressive, and airspeed continued to drop. Still, I did not step in and call "knock it off." Finally, my copilot had the "bogey" in his sights and jammed in full left rudder to swing our nose around on the other aircraft.

Suddenly, the aircraft began to buffet and, looking down at my instruments, I found the aircraft in an extreme sideslip with rapidly decaying airspeed. In short, the aircraft was on the verge of a stall. Just as I was about to take the aircraft, the navigator stated (in quite an excited voice, as I remember), "Let's knock this off!" Truer sentiments were never spoken, and I seconded his motion by taking the aircraft and recovering from the near stall.

How could an experienced, disciplined special ops crew nearly crash a perfectly good airplane? On the ground, after the flight, I asked myself that question as I prepared to debrief the flight.

Several contributors immediately came to mind. First, the HC-130 is not a fighter aircraft and is not designed to perform max performance turns and air intercepts, nor is the crew trained in these maneuvers.

Second, I let confidence in my copilot's abilities lull me into a false sense of security. I had flown with him on numerous occasions and considered him the best in the squadron in terms of flying skills and judgment. Yet, as I found out, no one is immune to a lapse in judgment.

Third, I let the experience of the airborne mission commander affect me. We had flown together on numerous occasions, and I respected his varied experience in both fighters and special ops. But, as much as I wanted to, I could not avoid acknowledging the primary contributor, and that was me, the aircraft commander.

The aircraft commander is ultimately responsible for both the successful and safe completion of the mission. I let a false sense of security, along with a healthy dose of complacency, affect my judgment, and the result was the near loss of a valuable aircraft and seven irreplaceable crewmembers.

If something you are doing, or are allowing your crewmembers to do, invades your comfort zone, fails the "bad karma" check, or just doesn't seem right, then earn that extra aircraft commander pay by taking positive action to safeguard both your aircraft and crew! ■

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SPECIAL FEATURES

REGULAR FEATURES

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

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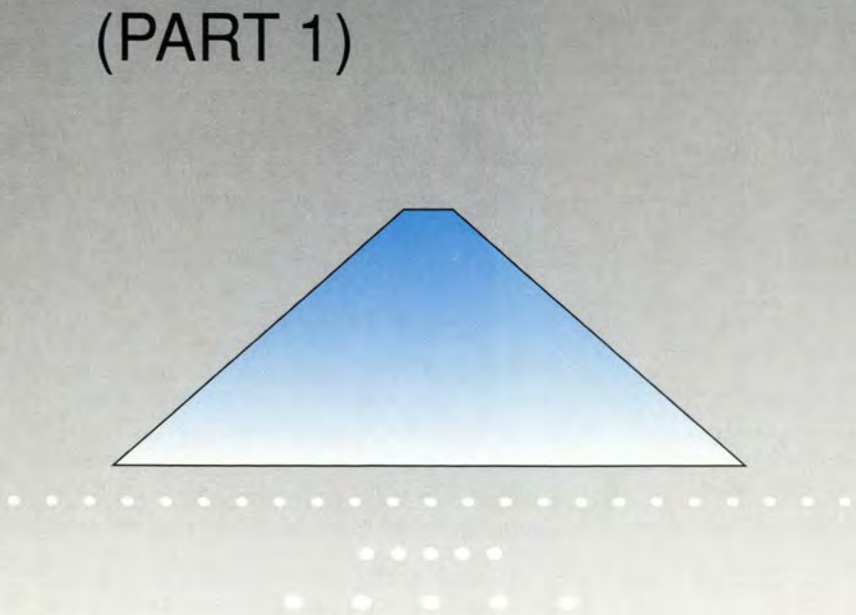
The Low Visibility Landing —

STACK THE ODDS IN YOUR FAVOR
(PART 1)



MAJOR R.D. WILLIAMS
USAF, Ret.*

■ Low visibility landings, over the years, have proven to be inherently dangerous, especially so during the particular segment of the approach when pilots must transition from their *instruments* and land the aircraft *visually*. Statistically, the approach/ landing phase of flight is responsible for about 50 percent of all aircraft mishaps.

In 1975, to better understand why such a disproportionate share of mishaps occurred during the approach/ landing phase, the National Transportation Safety Board (NTSB) conducted a special study of weather-related mishaps. After examining the factors involved in 17 approach/landing mishaps and incidents between 1970 and 1975, the NTSB concluded:

(1) The major hazard was not the height of the ceiling *but restrictions to visibility.*

(2) Almost every mishap occurred after someone on the flightcrew had seen the ground, the airport, or the runway environment.

(3) In almost every case, the visual segment of the approach was conducted in meteorological conditions affecting visibility, and the pilots were apparently then unable to correctly assess the flightpath or descent angle during the visual segment of the approach.

Thirteen of the mishaps occurred because the pilot landed short of the runway. The probable causes varied. However, in all but one of the mishaps, the flightcrews failed to adhere to prescribed crew coordination procedures, failed to cross-check flight instruments, and/or attempted to land with inadequate or marginal visual cues.

One might deduce a good number of the unfortunate pilots must have had the mistaken impression that having only the approach lights in sight gives pilots the capability to visually fly their aircraft to the runway and land. **NOTHING COULD BE FARTHER FROM THE TRUTH!!** Having "a visual" on the approach lights will allow you to continue the approach, but it should not be considered enough to "go visual" and land the aircraft.

I'm sure you're saying that since we can't fly to those "airline minimums," such mishaps are not likely to occur. Don't be too sure! Sixteen of the referenced mishaps occurred in weather conditions above AFI 11-206, formerly AFR 60-16 (2,400 RVR) minimums, and 12 of the mishaps occurred above "field grade" instrument minimums (better than 300-1)!

Can you think of any approach/landing mishaps that have occurred during marginal weather? If not, talk to someone who has been around a while.

The remainder of this article is an attempt to set some rational guidelines for a pilot's decision-making process during a critical phase of flight. It is offered in the hope it prevents a pilot from blindly trusting his or her eyes in marginal conditions.

Okay, You Got My Attention — So Where's the Beef?

One of the best ways to prevent yourself from becoming "cooked beef" is to follow the scout motto, "BE PREPARED." Some of the questions you should be able to answer include:

- What can I expect to see at DH or MDA?
- How far below DH/MDA can I descend, using the definition of runway environment, and still be safe?
- When should I safely transition to visual references?
- If flying a crewed aircraft, what crew coordination procedures have I developed with the crew — who flies the approach, who lands, who monitors the gauges, and what callouts do I want to hear?

If you have positive answers to these questions, you have stacked the odds in your favor. If you don't have all the answers, read on.

What Will I See at Minimums?

It all depends! (This is the standard Advanced Instrument Flight Course (AIFC) answer to instrument questions.)

If you are flying an ILS with a 3-degree glideslope and the reported visibility is 1/2 mile (2,400 RVR), theoretically, at a 200-foot HAT, you should be able to see the approach lights up to 400 feet short of the runway. (See the figure.) The problem is that, in many cases, slant range visibility is considerably less than ground visibility, and/or the visibility in the approach zone may be less than the prevailing visibility.

In conditions of fog, especially shallow fog, the reported RVR (or PV) may not be a true representation of what you will see on the approach or on various segments of the runway. RVR is only an accurate representation for the approach zone and total runway in homogeneous weather conditions.

The bottom line is that with a reported RVR of 2,400 feet (or with any obstructions to visibility), expect the unexpected. *You might not see anything until the DH, or you might have the runway (and/or approach lights) from the FAF all the way down to 100 feet and suddenly find yourself seeing nothing but murk. Time for a go-around!!* This leads us to the next question.

How Far Should I Go?

Ann Landers hasn't covered this subject adequately, so let's take another look at it. AFI 11-206, our bible, tells us not to continue the approach below the MDA/DH unless the aircraft is in a position to make a normal approach and landing and the runway threshold, approach lights, or other markings identifiable with the approach end of the runway are clearly visible to the pilot. The grouping of runway threshold, approach lights, and other markings (touchdown zone markings, touchdown zone lighting, runway lighting, VASI, etc.) is referred to in the Airman's Information Manual and FAR Part 91.175 as the **runway environment** and will be referred to as such throughout the remainder of the article.

Unfortunately, little guidance has been provided on just how far one should continue based on seeing part of the runway environment—only the approach lights. Additionally, nowhere does it tell us, with clear-cut finality, what cues/references are necessary to transition to a visual glidepath and landing. Ironically, this critical area of flight requires continual judgmental decisions while traveling in excess of 240 feet per second toward the runway. There's lots of room for interpretation, and a pilot must use good judgment in determining if, when, and how far he or she can safely continue an instrument approach. If you land safely, little, if anything, is ever said. But woe be unto the pilot who clips an approach light stanchion!

As might be expected, in the "Landing From the Instrument Approach" class at AIFC, I have found a wide range of ideas on just what is necessary to continue an approach once DH is reached. They range from going missed approach if the runway is not in sight at DH to continuing right on down, based on seeing the approach lights (or in some cases, roads, buildings, or the "Golden Arches" — obviously incorrect).

Before any insight into continuing the approach below MDA/DH can be discussed, it is necessary for three very important areas to be covered. These are *decision height, visual references,* and the importance of *a stabilized aircraft.*

- Usually, the minimum DH is 200 feet (or higher, if so published) and is defined as "the height at which a decision must be made to either *continue the approach* or to *go missed approach.*" **It is not a decision to land or go missed approach.** If the runway environment is in sight at DH, the approach may be continued. However, the pilot must evaluate right down to touchdown whether he or she can safely continue. Once below DH, if visual contact with the runway environment is lost, or the aircraft is not in a position to safely continue to landing, an immediate go-around must be initiated.
- To safely fly a visual descent and landing, it is necessary for the pilot to be able to determine the approach angle (visual glidepath) and to see the touchdown area at some point on the approach. Although this is probably not "earth shattering" information, many pilots have not placed it in the proper context when dealing with low visibility approaches. If they had, the approach light stanchion repair business would be bankrupt.

continued

The Low Visibility Landing —

continued

To determine the proper approach angle (usually $2\frac{1}{2}$ to 3 degrees), it is necessary to be able to see the horizon or to mentally picture the horizon by projecting the runway edges. It has been hypothesized that a pilot may be able to project the horizon with a minimum of 500 feet of runway visible. The proper glidepath is maintained by noting the extent to which the touchdown point (usually the fixed distance markers) is depressed below the horizon. This depression remains constant as the aircraft descends, providing the angle to the runway does not change.

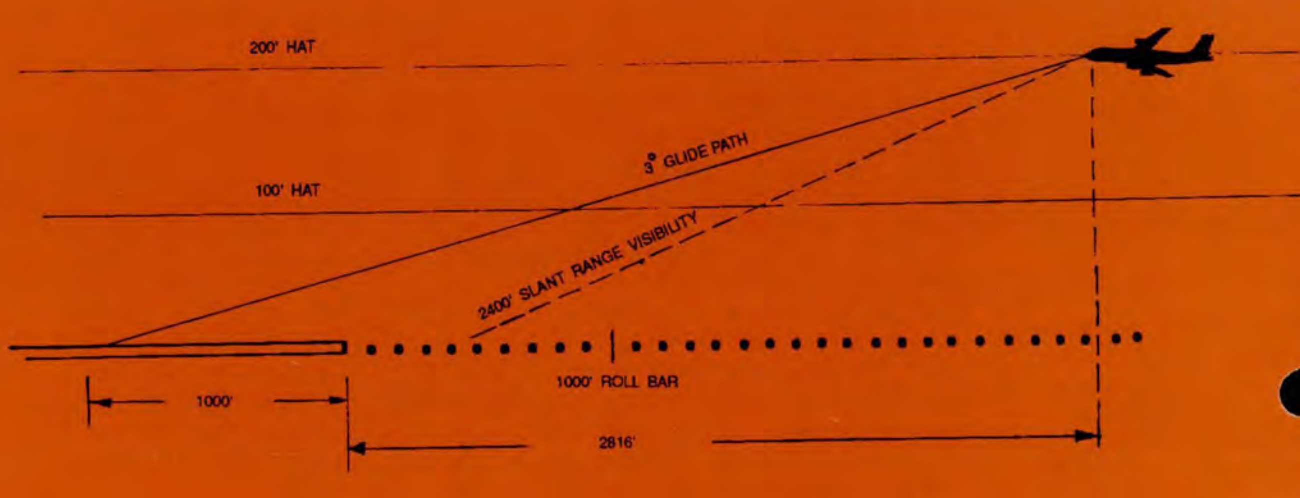
Unless you are into "blind" landings (a maneuver best left to the autopilot on Category III ILS approaches), you must be able to see a good portion of the touchdown zone in order to visually land the aircraft. Normally, if visibility is sufficient to determine the visual glidepath, there will be enough of the touchdown zone in view to provide the necessary references.

■ The average time to identify, decide, and react to stimuli is 4 seconds. It is imperative the aircraft be in stabilized flight — on glidepath (within 1 dot), on centerline (within $\frac{1}{4}$ dot), on airspeed, and trimmed for such at DH. AFM 51-37 requires an immediate missed approach if GSI deflection exceeds a 1-dot fly-up command once below the localizer MDA. Although $\frac{1}{4}$ dot seems to be a tight tolerance for the localizer, this translates to 43 feet off centerline (based on a 700-foot wide localizer signal at the runway threshold).

Corrections to the glidepath and/or centerline, when greater deviations occur, destabilize the aircraft and are, at best, difficult when visibility is limited. Any attempt to depart DH in other than stabilized flight may very likely lead to a major aircraft mishap! If you are not flying a stable platform or the aircraft becomes destabilized, you should be going around!!

In a nutshell, "seeing" only the approach lights at DH allows you to continue the approach, but it's not enough to "go visual." Remember, approach lights alone do not provide vertical guidance. Any attempt to totally "go visual," whether above or below DH/MDA, without adequate visual references (runway threshold and part of the touchdown zone in sight) will most likely lead to disaster. A transition to visual references requires you to be able to judge the visual glidepath angle and to "see" the touchdown point/zone.

If you can't see the touchdown point and/or can't judge the glidepath angle upon reaching the MDA/DH, you must use **composite flight** (both the instruments and visual references) to continue the approach. This means you must use the attitude indicator, vertical velocity indicator, and the electronic glide slope (ILS/PAR) to detect deviations



until such time as adequate visual references are available to safely transition to a visual glidepath and landing.

But how far should I continue an approach based only upon seeing the approach lights?

For nonprecision approaches, a descent below the MDA without the touchdown zone in sight is, at best, a speculative venture and can cause you to lose several points in the judgment block of your OPR! The AIFC "best bet" is do not depart the MDA on a nonprecision approach unless at least 1,000 feet of runway are visible. Once departing the MDA, if conditions do not continue to improve, a go-around is in order.

For precision approaches, there is no simple answer. Trying to put a tangible figure on how far to continue below DH, using composite flight, is difficult. The answer really boils down to "pilot judgment." However, I will attempt to provide you with some "ammunition" on the subject. Let's take a look at just what you can expect to see out the front windscreen as an approach is continued below DH.

At an approach speed of 142 knots, the aircraft is traveling at 240 feet per second. On a 3 degree glidepath with a 200-foot DH, it takes about 16 seconds to travel from DH to the touchdown point (fixed distance markers). Based on these figures, the aircraft is 3,816 feet from touchdown and 2,816 feet from the runway threshold at DH.

If the slant range visibility (SRV) is 2,400 feet, you will not see the runway or the red termination bar on the ALSF-1 approach light system at DH. The runway threshold should appear about 2 seconds after passing DH and the fixed distance markers about 4 seconds after seeing the threshold. At DH + 6 seconds, you will be 1,376 feet from the threshold and 125 feet AGL. This means you would have to use composite flight for 3 to 6 seconds after passing DH.

The point at which you "see" the threshold and touchdown point in the above scenario is based on a 2,400-foot SRV. As we all know, though, the SRV can be considerably less than the reported RVR and/or prevailing visibility.

If the SRV is 1,600 feet in the above example, the threshold of the runway will not come into view until DH + 5 seconds and the fixed distance markers for another 4 seconds, or DH + 9 seconds. AT DH + 9 seconds, you will be 650 feet from the threshold and 87 feet AGL. You would now have to use composite flight for 6 to 9 seconds.

As mentioned earlier, however, a minimum of 500 feet of visible runway might be sufficient to judge a visual glidepath. With the 1,600 SRV scenario, you will see the first 500 feet of runway at DH + 7 seconds, be 1,700 feet from touchdown, and 110 feet AGL. *Five hundred feet is an absolute minimum, and a figure of 700 to 1,000 feet of visible runway would be a smarter choice.*

Using the above figures and an assumed visibility of 2,400 feet on the runway, AIFC believes continuing an approach longer than 6 to 7 seconds after DH without at least 700 to 1,000 feet of the touchdown zone coming into view is starting to press the limit. If the majority of the touchdown zone is not in view by this time (6 to 7 seconds), chances are visibility will be insufficient to land.

If you can't see 700-1,000 feet of the approach end of the runway by the time you get to 100 feet above the touchdown zone elevation, you should go around.

We are not advocating you "hack the clock" at DH. But, we are trying to show it's only a matter of a few seconds before you should see the runway or go around.

Now let me give you a more practical guide to use on how far you may continue past the DH without the necessary visual cues to safely land.

While AFI 11-206 only requires you to see the runway environment to continue past the DH (approach lights fall in this category), if you can't see 700-1,000 feet of the approach end of the runway by the time you get to 100 feet above the touchdown zone elevation, you should go around. Why 100 feet above the touchdown zone?

First, Category I ILS approaches are not flight checked below 100 feet above the touchdown zone elevation. Secondly, depending on the type of aircraft you're flying, 100 feet above the touchdown zone elevation is probably about as low as you should go before you start a missed approach.

For those aircraft concerned with a minimum threshold crossing height (i.e., KC-10, B-1, etc.) 100 feet may be too low — determine what's appropriate for your aircraft and stick to it. Otherwise, you might make a touchdown whether you want to or not. And finally, although this particular FAR specifically excludes military aircraft, 91.175 states that "no pilot may operate an aircraft at any airport … below the authorized DH unless … at least one of the following visual references for the intended runway is distinctly visible and identifiable to the pilot: (i) The approach light system, except that the pilot may not descend below 100 feet above the touchdown zone elevation using the approach lights as a reference unless the red termination bars or the red side row bars are also distinctly visible and identifiable …" Maybe the FAA is on to something.

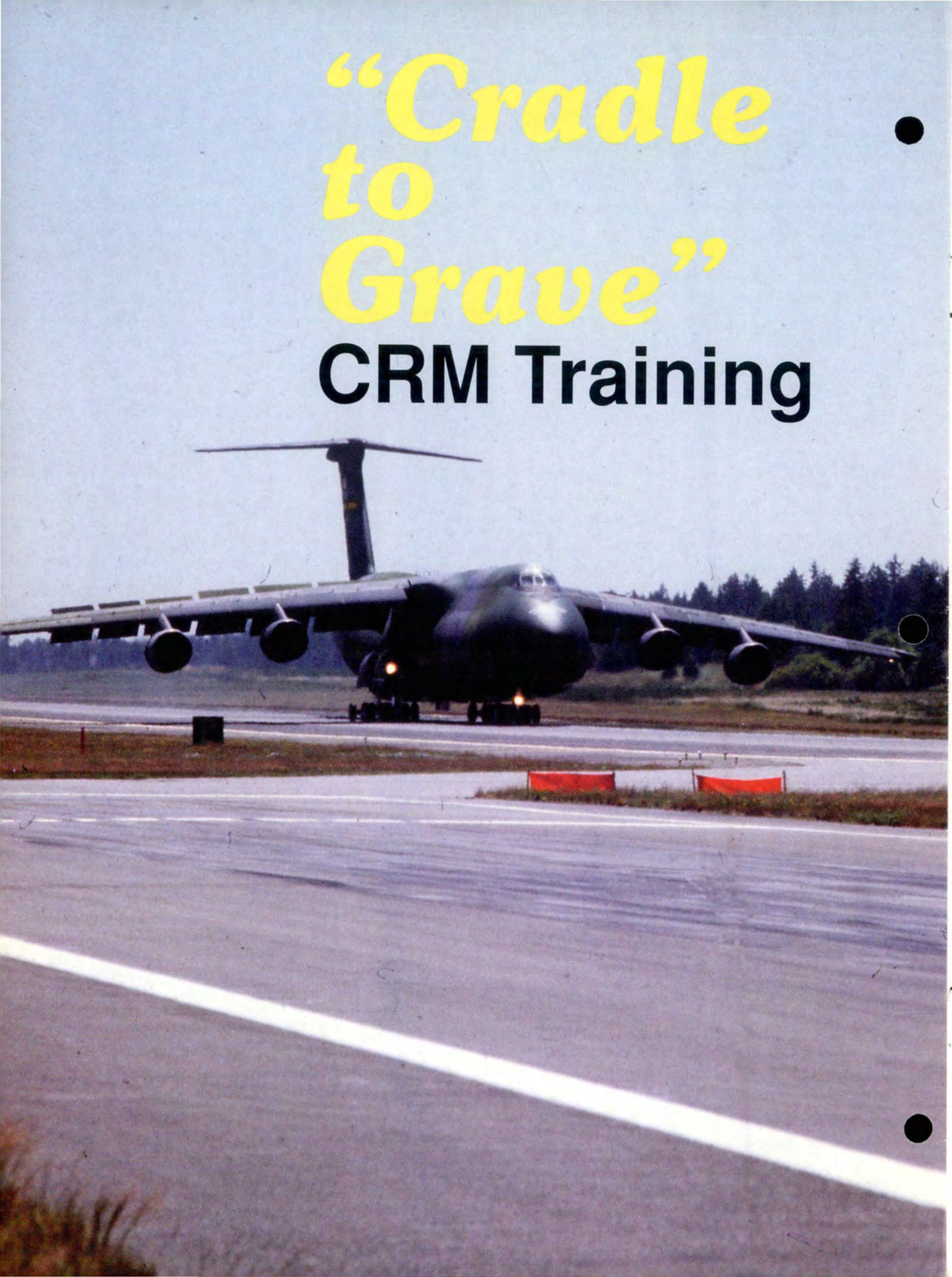
Does that mean we are advocating establishing a new DH of 100 feet above the touchdown zone elevation? Absolutely not! *What we are saying is that when you continue an approach below DH based on the approach lights only, you must continuously assess whether you will have enough visual cues to make a safe landing up to the point where further delay will jeopardize a successful go around.*

Regardless of the type of approach, attempting a visual glidepath without adequate visual references translates to a good chance of landing in the approach lights. To detect deviations to a normal glidepath, composite flight must be utilized. It is imperative a continual cross-check of the instruments be made until touchdown.

Next month I will take a look at some techniques to most effectively fly using composite flight. ■

*This article was originally written by Maj Williams while he was an instructor with the SAC Instrument Flight Course (now AIFC) and was first published in SAC's *Combat Crew* magazine. At the time this article was written, Maj Williams was one of the Air Force's premier experts on low visibility landings. Capt Bill Kelly and the AIFC faculty made a significant contribution in bringing this article up to date. Maj Williams is currently a first officer with United Airlines.

"Cradle to Grave" CRM Training



MAJOR CHUCK PHILLIPS
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Photos by Maj James H. Grigsby

■ Cockpit/crew resource management (CRM) for every USAF rated specialty, a *"hot"* topic the past 5 years, has taken on even greater emphasis with the recent publication of AFI 36-2243, *CRM Program.* Significantly, the AFI mandates five separate, time-phased levels of CRM training for aircrews that will make CRM training an integral part of all Air Force initial, continuation, and instructor upgrade aircrew training programs.

This *"career long"* CRM training philosophy also includes the establishment of an Air Force core curriculum for initial and refresher CRM training. The Air Force core concepts for CRM training are:

- **Situational awareness.**
- **Group dynamics.**
- **Effective communications.**
- **Risk management/decision making.**
- **Workload management.**
- **Stress awareness and management.**
- **Mission Planning/Review/ Critique.**

Although this AFI provides the framework to successfully standardize and institutionalize CRM training, and although every MAJCOM has made monumental advances in their CRM programs, much work remains to *"flesh out"* and internalize CRM concepts in all USAF crewmembers.

The need for continuous CRM training throughout an aviator's career and the applicability of these core subject areas to every one of us is underscored in the following excerpts from a recent *"Air Mail"* report (*"Air Mail"* is AMC's anonymous CRM aircrew reporting system). Here's the scenario:

"As Flight Safety NCO, I spend a lot of time out on the ramp watching a lot going on. On 31 August, the flight safety officer and I were visiting an aircrew which had lost a small panel in flight. My attention was directed to an inbound aircraft coming in . . . to [the] runway which happens to be 9,500 feet long . . . he was over the overrun at about 60 to 80 feet high in level flight ... power sounded at idle, but there was no loss of altitude as he assumed his flare position ... the plane just kept floating ... he was eating up some runway in a hurry. Still with his landing gear around 30 feet from the runway, he passed midfield ... roughly 4,000 feet remaining.

"The pilot added slight power and I immediately yelled, 'Yes, he's going around!' But no ... he shoved the nose over in a last ditch to get to the runway. The plane floated more, and now we were sure we were going to witness something not nice. Our line of sight and the tower confirmation verified his distance remaining to be less than 3,000 feet when he touched down!"

This attempt to land in the last half of the available runway is a perfect illustration of a loss of **situational awareness**. Now, I know this crew didn't plan to land this far down the runway, but sometime during the last 5 minutes of flight, their overall situational awareness eroded until a potentially dangerous situation had developed.

"Had it been possible, I would have yelled to Tower for a go-around. The aircraft full-stopped on the runway and then turned off. There was no rollout whatsoever. The plane sat for around 30 seconds (probably computing brake temps), and then taxied to parking. When I got over there, the crew had left, and the crew chiefs were refueling. Yes, they were rattled. They said the engineers were rattled. Transit MX was rattled. And us? Me and the FSO were rattled, too."

The engineers were rattled? The CRM concept of **group dynamics** includes, among other topics, hazardous attitudes and assertiveness. Quite often, it is the combination of the aircrew commander's hazardous attitude and the other crewmembers' relative lack of assertiveness when uncomfortable situations develop that prevents the proper level of intervention.

"I slept on it overnight. Talked it over with a few people. I worked on C-5s for 6 years, was a flight engineer with special ops for almost 6 years. Never, ever have I seen something like this. Sure, we all spend a lot of our careers 'learning' from our own or others' stupid mistakes. And most of the time we get away with stuff. But somewhere, somehow, you'd think there would come a time when CRM, crew discipline, whatever, would let somebody stand up and yell, 'This ain't right!' And do something about it."

One of the reasons crewmembers do not *"speak up"* when the situation demands they do so is because of a breakdown in **effective communication.** Often rank, age, or position present a barrier to this kind of communication. The aircrew commander is the one who sets the tone here to ensure both effective listening and solicitation of feedback are regularly occurring. Incidentally, effective communication is also a critical part of our interface with other aircraft in the formation and with outside agencies such as maintenance and air traffic control.

"So, as we watched this C-5 wandering down the field at 30 feet up, it was clear this crew did not consider the go-around option ... we are taught early in our training to make that go-around decision at the earliest hint of trouble because after that, things can only get worse."

As soon as the aircraft floated outside the desired touchdown zone, and the aircrew commander did not execute a go-around, the entire crew assumed all the potential risks of a long landing. The concept of **risk management/decision making** includes risk assessment and risk management styles, as well as breakdowns in judgment and discipline.

Taking the riskier of the options available complicated this aircrew's in-flight scenario. All subsequent decisions would be made under severe time constraints. And the farther they floated down the runway without either touching down or executing a go-around, the greater number of complicating factors, such as runway surface condition and braking capability, they would encounter.

"Put a C-5 near the ground with only 40,000 pounds of gas, full flaps, light winds, a little high, a little fast, and now throw in ground effect. These things are

continued

"Cradle to Grave" CRM Training continued

okay, given they are dealt with properly. That's how pilots learn their jobs or their airplanes. That doesn't bother me a bit. What bothers me a lot is when a crew with six in the cockpit narrowly averts putting a big jet in the dirt when there were other options."

As I've already indicated, this scenario became more complicated when the crew deviated from standard operating procedures. In terms of **workload management**, this crew overloaded themselves by entering into the *"gray zone"* of a long landing.

"We wondered all the next day what inspired the crew to elect to 'chance it.' I would have shaken the hand of that pilot had he gone around. To this day I wonder why nobody spoke up. We were convinced the crew would've attempted to put this bird on the ground with only 1,000 feet left."

Why aircrews make less-than-optimum decisions often involves the concept of **stress awareness and management**. Ironically, the final approach and landing are the last events of the mission but require the highest level of concentration. And the required concentration is extremely susceptible to a number of internal and external stress factors: Was there pressure to land on time? Did the crew have someplace else they wanted to go after the flight? Was the crew fatigued? Did the pilot have previous landing problems?

"We were worried about a fundamental problem in either the processes involved in go-around decision making, the cockpit leadership which appeared to be missing (by any of the crew), or just a plain old problem in being in charge of the situation. This is a definite incident which needs mention other than at the bar. While the crew may have learned a valuable lesson here, they put themselves, their aircraft, and our airfield in jeopardy in 'learning' it. Maybe other crews should read this. Or sit down with an instructor again and get refreshed in the negative consequences of continuing a bad landing, and the benefits of rehearsing, recognizing, and executing a good go-around."

Central to incident-free mission completion are effective **mission planning, review, and critique strategies.** In this case, did the crew know the planned landing distance and the pilot's desired landing zone? Had the pilots discussed the go/no-go point on the landing? Were they aware of both the climbout instructions and missed approach procedures? Being unprepared to fly a missed approach can lead to overzealous attempts to put an aircraft on the ground long after a go-around should have been executed. And did the crew discuss what happened after the flight? Did those "rattled" flight engineers say anything during the post-mission debrief?

The relevance of long-term CRM training can't be overemphasized. Over 50 percent of reportable mishaps Air Force-wide still have human error as a primary cause. The impact of this training depends upon each individual. Every one of us needs to take a hard look at our involvement in the *"mission"* from start to finish. Crew resource management training and its focus on core subject areas is the right tool to help us do just that. ■

BEYOND "See and Avoid"

Looking out the windshield is important, but there are other tasks necessary to avoid a midair collision.

WILLIAM D. WALDOCK

Reprinted courtesy *Aviation Safety*, June 1, 1994*

■ Recently there was yet another midair collision between two aircraft. This time the mishap occurred at Pope AFB, North Carolina, and involved an F-16 and a C-130 maneuvering to land on the same runway.

After the collision, the C-130 was able to land safely. The crew of the F-16 ejected, and the aircraft struck a C-141 which was in the process of loading troops for a training mission.

This tragedy happened only a few weeks after the National Transportation Safety Board (NTSB) released its final report on the September 1992 collision of a Mitsubishi MU-2 and a Piper *Saratoga* — near Greenwood, Indiana. In its statement of probable cause, the NTSB cited "the inherent limitations of the see-and-avoid concept of separating aircraft operating under visual flight rules that precluded the pilots of both aircraft from recognizing a collision hazard and taking actions to avoid the collision."

In a Civil Aeronautics Board report on the collision between two Eastern Airlines aircraft near Aberdeen, Maryland, in 1946, the probable cause was attributed, in part, to "the inability of the pilots to see each other in time to avoid the collision."

Such statements can be found in almost all reports on midair collisions issued during the last 50 years. Obviously, problems with the see-and-avoid concept continue to plague us when we fly. The questions which we still struggle to answer are: Why do midair collisions continue to happen? What can we do about it? Can we learn from the past?

The potential for midair collisions has been around ever since the second Wright Flyer took to the air. In those days, however, congestion and airspace weren't as much of a problem as they are in today's aviation world.

As aviation has developed and expanded, the number of aircraft has increased dramatically. So has the risk of collisions.

While the total number of mishaps occurring each year peaked in the 1960s and has continually declined since, the number of midairs has remained relatively constant at an average of around 23 per year, with a high of 38 (1978) and a low of 12 (1983).

The number of reported near midair collisions (NMAC) has actually increased over the last 10 years.

In international commercial airline operations, the number of midairs

continued

*Specific commercial airliner names have been deleted.

BEYOND "See and Avoid" continued

involving airliners has averaged four per year since 1946. Because of the higher passenger loads, these mishaps tend to have higher fatality numbers than collisions between general aviation aircraft.

Some of the worst disasters in aviation history have involved midair collisions. Many of these have resulted in drastic and extensive changes in ATC procedures and airspace configurations. The table below provides a review of some of the more significant collisions in this respect.

Who's Involved?

A review of NTSB data for the past 14 years shows the types of aircraft most often involved in midair collisions are those engaged in general aviation (GA) operations.

While collisions between airliners and private airplanes invariably get nationwide press and elicit governmental response, most collisions are between GA aircraft.

In reality, collisions between airliners are rare. So are collisions between GA and military aircraft.

In many of the collisions involving GA aircraft, at least one of the aircraft has been involved in instructional operations. Several of the aircraft were engaged in corporate operations, and some were crop dusters. In some special cases, the aircraft were involved with some form of air tour or sightseeing operations.

When the collision occurred over Merion, Pennsylvania, in 1991, the crew of the Bell 412 was attempting to give assistance to the Aerostar pilots who had a gear problem. Though it involved GA aircraft, the mishap attracted media attention because Senator Heinz of Pennsylvania was aboard the Aerostar.

Further review of the mishap data shows most of the collisions occurred in day/VFR conditions, at or near an airport, with at least one of the aircraft in the approach or landing phase. Most involved pilots with private certificates, most with no additional ratings.

Selected U.S. Midair Collisions

Year	Location	Aircraft Involved	Fatalities
1956	Grand Canyon AZ	United DC-7/TWA L1049	128
1958	Las Vegas NV	United DC-7/USAF F-100	49
1960	New York NY	United DC-8/TWA L1049	134*
1965	Carmel NY	TWA B707/Eastern L1049	4
1967	Urbana OH	TWA DC-9/Beech Baron	26
1967	Hendersonville NC	Piedmont B727/Cessna 310	82
1969	Indianapolis IN	Allegheny DC-9/PA-28	84
1971	Los Angeles CA	Hughes Airwest DC-9/USMC F4C	50
1975	Newport News VA	UASF C-131/Cessna 150	9
1975	Whittier CA	Golden West DHC-6/Cessna 150	14
1978	Memphis TN	Flight Safety Falcon/C-150	6
1978	San Diego CA	PSA B727/Cessna 172	144*
1981	Loveland CO	Air US HP 137/Cessna 206	15
1982	Livingston NJ	Aero Commander/Cessna 182	3
1983	Cherry Point NC	USAF F4C/Beech Baron	7
1984	San Luis Obispo CA	Wings West C99/Rockwell 114	19
1985	Newark NJ	Nabisco Falcon 50/PA-28	6*
1986	Grand Canyon AZ	Grand Canyon DHC-6/Bell 206	25
1986	Cerritos CA	Aeromexico DC-9/PA-28	82*
1987	Salt Lake City UT	Skywest Metro/Mooney M20	8
1987	Independence MO	US Army U-21/PA-31	6
1987	Orlando FL	SNJ-4/Cessna 340	4
1987	Oakland CA	Northstar PA-32/Cessna 172	3
1991	Merion, PA	Piper Aerostar/Bell 412	7*

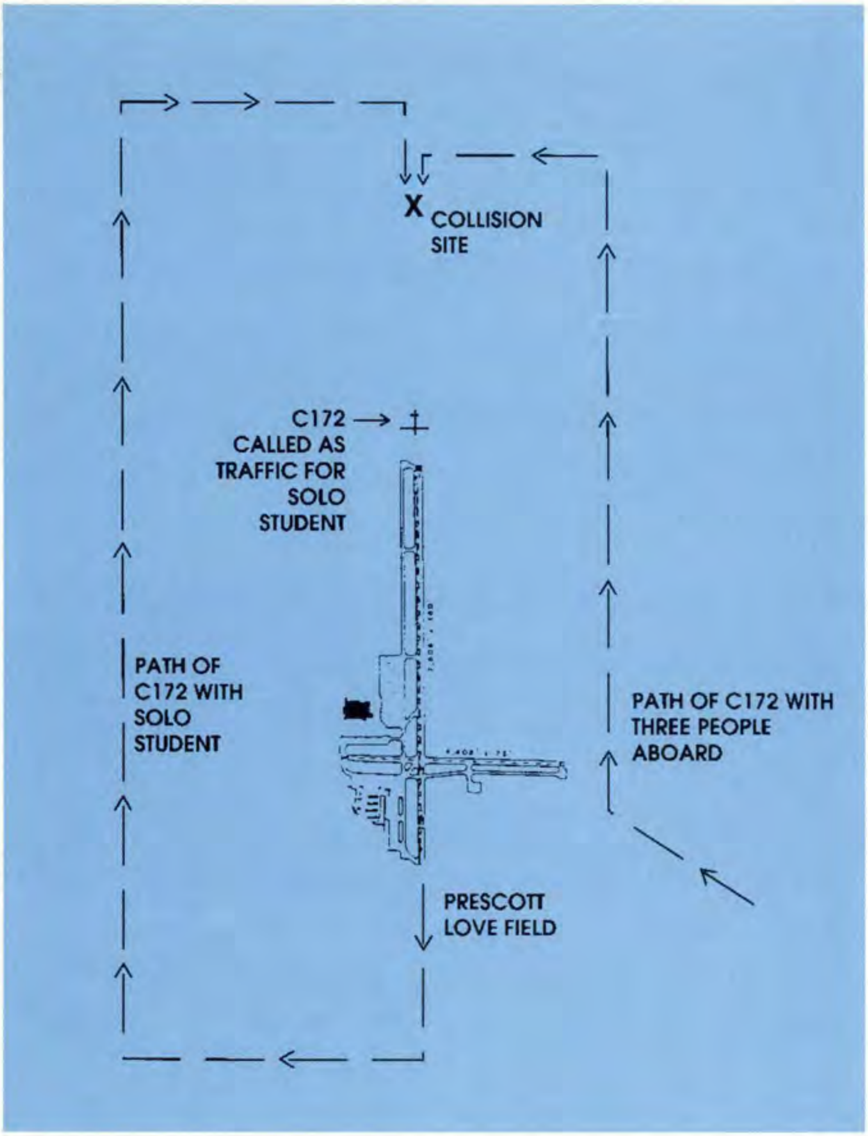
**includes ground fatalities*

Danger Zones

While some midair collisions (about 20 percent of the total) do happen while both aircraft are in cruise flight, most occur in the airport pattern or in the approach-and-landing phases of flight.

About 75 percent happen below 3,000 feet AGL with many of those below 1,000 feet. While many collisions occur at uncontrolled airports, the problem is, by no means, limited to that environment. Some of the worst collisions have happened at major air carrier airports.

Contrary to what many nonpilots believe, the typical midair collision does not involve two aircraft meeting head-on. Only a few are head-to-head impacts. Most involve some angular closure with many happening



while one aircraft is overtaking another. One of the most spectacular near-midair collisions illustrates this.

It happened in 1987 between an L-1011, which had strayed 120 miles off course over the North Atlantic, and a B-747. The aircraft were cruising at altitude when they passed within less than 100 feet of each other at a closure angle of about 15 degrees.

Prior to the encounter, neither crew saw the other aircraft, but a passenger aboard the L-1011 got several close-up pictures of the B-747 as it filled his window.

The crew of the L-1011 first realized they nearly hit another aircraft when a shadow passed across their glareshield and they looked up to see the 747's belly.

Had the airplanes collided, it might have been some time before anyone figured out they had hit each other since the L-1011 was so far off course.

Expecting Company

While the oft-stated probable cause, "failure of the see-and-avoid concept," does point out the heart of the problem, there are several other factors which come into play to cause a midair collision.

Often pilots aren't actively looking for traffic because they haven't been told it might be there. The psychological process of *expectancy* plays a large part in some midairs.

If our expectancy is heightened by ATC advising us of traffic, we are a lot more likely to be looking for the other aircraft, rather than keeping our heads and eyes inside the cockpit, attending to other tasks. If we don't expect something, we often don't look for it.

Unfortunately, if we *think* we see the traffic, our expectancy has been fulfilled, and we quit looking.

This happened to the crew of a B-727 in San Diego when they spotted what they thought was the conflicting traffic called out by ATC. Misidentification of traffic has been a factor in several other collisions as well.

Communication also plays a part. Ambiguity in reporting position, airspeed, or altitude has led to pilots and ATC sequencing traffic incorrectly, and it can thoroughly confuse everybody else in the traffic area.

At uncontrolled fields, ambiguity can be even worse since pilots are, essentially, sequencing themselves. I had a near midair with a green-and-white Tri-Pacer several years ago before our local airport got a tower. I heard the other pilot call "Downwind for 3," and since I was positioned about 2 miles out for a "45" entry to the pattern, I slowed up a bit to let him pass. I didn't see him on the downwind, but there were several aircraft nearing base and final, so I assumed (bad thing to do) he was one of them.

As I entered the downwind, I caught a flash of something in my peripheral vision, turned my head to the left, and faced the largest Tri-Pacer I have ever seen. I maneuvered my airplane away and then rejoined the pattern. Later, while talking to several other pilots, I found out this guy had a habit of calling "downwind" when he was 10 miles out.

As you can see from this anecdote, not only ambiguity, but nonstandard procedure and technique can set the stage for a midair collision.

Quintessential Midair

Let's take a look at a recent midair collision between two aircraft on instructional flights. Although it involved many of the factors which are known to cause fatal collisions, no one was hurt (thanks chiefly to dumb luck).

The crash occurred in March 1992 at a controlled field and involved two Cessna 172s being operated for

continued

Part 141 instruction. The two aircraft were flying opposite patterns to the same runway. (See the figure on page 11.)

The 172 in the right-hand pattern was being flown by a student pilot conducting his second supervised solo flight. Aboard the other airplane were a student, an instructor, and a backseat observer. Several other Cessnas operated by the flight school were in the pattern, with more approaching the field. All had the same blue-and-white paint scheme.

The solo student was making his first touch-and-go of the day while the other aircraft was returning from the practice area. As the situation progressed, the student's right downwind leg got extended quite a bit due to other incoming traffic. As the other 172 made a 45-degree entry to the left downwind, there were four other 172s ahead of it on the downwind leg.

Eventually, the 172 in the left-hand pattern was sequenced by the tower to follow the 172 being flown by the solo student on the right downwind. The two airplanes were assigned as Nos. 5 and 4, respectively, to land.

As the 172 with the three people aboard started to turn left base, the controller asked the pilot if he had his traffic in sight. When there was no response, the controller repeated the question. After a pause, the pilot responded, "Traffic in sight." As can best be determined, he had actually seen the 172 which was then No. 3 for landing, the same aircraft the solo student was following.

As you can see from the figure, the airplanes flew opposing, but offset, bases at about the same time. As the airplanes converged, there was a period in which the pilots could have seen each other. Both of them would later say they were watching the 172 in front of them and not looking around.

They collided about three-quarters of a mile from the runway threshold at an altitude of about 500 feet. The solo student's 172 first contacted the other aircraft by a sideways, sliding impact of his left main tire with the top right wing of the other airplane.

The airplanes then articulated into each other, rolling together like a couple of gears. The upper airplane's propeller went through the cowling of the other aircraft and severed the top spark plug from the No. 2 cylinder. The nose gear shattered the other aircraft's windshield, and the prop then hit the landing light on the left wing.

The leading edge of the upper airplane's wing slid between the other airplane's left flap and aileron, bending the aileron back to the hinge. Somehow, there was no contact between the empennages of the two airplanes which finally flew away from each other.

The solo student was able to make a successful landing. He told his frantic instructor, who had witnessed the encounter, he thought he had "hit something."

The other airplane initially was out of control, but the pilots were able to pull out of the dive at the last second. The airplane hit the ground nose gear first and flipped over. All three occupants got away with scratches and bruises.

Several factors come to light. Both aircraft were flying opposing patterns to the same runway. Several other aircraft of identical appearance (and inconspicuous paint schemes) were in the same part of the pattern at the same time. The crew of the 172 in the left-hand pattern misidentified the traffic they were assigned to follow. Once that happened, they apparently quit looking for other traffic or considering other possibilities. The controller may have seen the conflict — but too late to do any good.

Nobody was paying much attention to the sequencing information being given by the controller to *other* aircraft in the pattern. Situational awareness was lacking for all parties involved.

The bottom line? As usual: The pilots of both aircraft failed to see and avoid each other.

Protect Yourself

What can we do to successfully improve our chances of avoiding a midair collision?

First off, the advent of TCAS (traffic alert and collision avoidance system) equipment is promising. Requirements for TCAS aboard most airliners will reduce somewhat the risk of collisions between airliners and GA aircraft. But TCAS is not required for GA airplanes, and the current high costs of the equipment will limit its usefulness in preventing collisions between GA airplanes.

Secondly, *don't rely on see and avoid, by itself!* As can be seen from the record, it doesn't seem to work very well. While visual vigilance is always critical, it won't, by itself, always prevent a collision. In many, if not most, collisions, the time available to react is minimal since the pilots don't see each other until very late in the sequence of events.

Therefore, practice good external scan techniques and keep your head outside as much as possible. But also:

Read the various publications (*Airman's Information Manual*, advisory circulars, articles in this and other journals) to learn standard procedures and techniques. Read NOTAMs and the *Airport/Facility Directory*, and familiarize yourself with the airport you are headed for.

Listen to what is going on around you — other traffic, ATC, clearances, position reports, etc. Maintain good situational awareness. Avoid the "comfort zone" so many of us fall into. Just because the tower has you under positive control, don't let your guard down.

Most of all, remember you aren't the only aircraft in the air. ■

Bill Waldock is an active pilot and accident investigator. He directs the aviation safety and accident investigation program at a major university.

•What Is Your IIQ?*

*ICING INTELLIGENCE QUOTIENT

■ Over the years there have been several tragic winter-related mishaps in both civilian and military aviation. The Air Force has a good record, but we continue to have mishaps as a result of cold weather operations. Aviators can't afford to become complacent about winter flying.

Knowledge is the key to avoiding winter weather traps. Here's a quiz to test your understanding of aircraft icing and its effect upon aircraft performance and flight characteristics. ■

- T ☐ F ☐ Slight surface roughness can have significant effects on stall speed and power required to achieve or sustain flight.
- T ☐ F ☐ Surface roughness on the afterbody of a wing can have the same effect on aircraft performance as roughness on the leading edge.
- T ☐ F ☐ Increasing surface roughness due to ice formation on the leading edges and afterbodies will produce additional drag and further reduce lift.
- T ☐ F ☐ Aircraft certified for flight in icing conditions cannot take off with ice formed as a result of ground storage or operations.
- T ☐ F ☐ Ice formation on the wing surfaces decreases stall angle of attack and, in some aircraft, the stall will occur prior to activation of the stall warning devices.
- T ☐ F ☐ Icing changes the aircraft's stall characteristics and, depending on aircraft design and the nature of the ice formation, can either cause violent stall or a slower progression of stall.
- T ☐ F ☐ Ice on aircraft wing leading edges may increase pitchup and rolloff tendencies.
- T ☐ F ☐ Icing may reduce controllability and require greater stick deflection for maneuvers or stall recovery.
- T ☐ F ☐ Thrust available may be reduced due to ice formation on jet engine inlets.
- T ☐ F ☐ Ice has been known to cause control surface flutter.
- T ☐ F ☐ Trim effectiveness can deteriorate with the accumulation of ice.
- T ☐ F ☐ Aircraft ice protection systems are designed basically to cope with the super-cooled cloud environment, not for ice formation while the aircraft is on the ground.
- T ☐ F ☐ Avoid positioning your aircraft in the exhaust of aircraft ahead of you when precipitation is present.
- T ☐ F ☐ Deice areas in view of the pilot first so he or she may have assurance other areas of the aircraft are clean. (The pilot can monitor the area deiced first.)
- T ☐ F ☐ Engine failures may occur due to ice ingestion.
- T ☐ F ☐ Ice formation can reduce the efficiency of communication and navigation equipment.
- T ☐ F ☐ Ice formations, under certain conditions, may not have noticeable effects on aircraft performance and flight characteristics; however, the effects may become quite apparent in the event of an engine failure or other emergency.
- T ☐ F ☐ Ice formation may result in airspeed, altitude, and IFR instrument errors.
- T ☐ F ☐ The use of reverse thrust can result in blowing snow adhering to the aircraft.
- T ☐ F ☐ Close inspection for ice formation just prior to takeoff remains the most important factor for assuring a safe takeoff when conditions conducive to icing are present.

ANSWERS

Hopefully, you answered all questions as *"True."* If not, the quiz may have sparked further study. A little knowledge now can make a big difference later for successful winter decision making.

THINK COLD

CAPTAIN AL LUPENSKI
CAPTAIN DRAKE SELMER
210th Air Rescue Squadron
Alaska Air National Guard

Have on your body what you expect to get out with — anything extra you grab on the way out is a bonus. At 65 below and with nothing on but a flight suit and flight boots, you will be in trouble.

■ I walked into what I thought would be a normal day at work, but it turned out to be the farthest thing from the truth.

It was the end of October, and the Alaska winter was fast approaching. We were prepared and had already started carrying our winter gear. The busy search and rescue season was coming to an end, but the call that came in would send us to a place I had only read about.

The call came from the Rescue Coordination Center which had been contacted by the Canadians. A C-130 had crashed near a place called Alert on Elsmere Island in Canada. The location of the crash was near the North Pole. There were survivors, and we were tasked, along with the Canadians, to get them out.

A C-5 showed up, and we loaded our helicopters for the trip to Thule, Greenland. The details on how we actually got out of Alaska and on scene are impressive, but they are not the reason for this article.

We went from a place where we are used to cold and winter to a place where the word "cold" is an understatement. It was frigid when we reached Thule. As we left the C-5 to get on the bus to get some sleep while maintenance put our helicopters back together, I couldn't help but wonder how the survivors were managing. I was in winter gear, but I was *cold*. The folks we were going after were still a 3-hour flight away. It was hard to sleep thinking about what I was going to do in the next several hours and wondering if those people would make it through the night.

We launched just before the sun came up. It would be up for only a short period of time before it would set again, making our job even harder. As we flew north towards Alert, the remoteness of the area was eerie. Alaska is remote, but it is inhabited.

I've spent my entire life, except for the occasional military deployment, in the arctic. It was easy for me to imagine the conditions the survivors were facing.
— Captain Selmer

Photo by Capt Brett Hartnett

North of Thule, there is nothing until you hit Alert — nothing more than a Canadian outpost. If we were to have a problem out here, we would be in trouble. We were a two-ship, and we had an HC-130 as a tanker and an escort.

We arrived at the location. It was like a scene from a horror movie — whiteout conditions and bone-chilling temperatures. We began the airlift of personnel from the area back to Alert. I had never seen anything like it before. Only the tail section of the Herc was intact. This was where the survivors had stayed out of the wind. We finished the airlift and began the long flight back to Thule.

It was not until after I returned home to Alaska that I realized the extent of the mission I had been on. We had flown into an environment as unforgiving as any environment in the world — a place where if you were not prepared you would die.

On that mission, we carried all of our issued arctic gear — you know, fashionable green parka, fat-boy pants, bunny boots, etc. We wore mustang suits which are intended to be water survival suits but work very well at keeping a person warm out of the water. We had to fly over water, and I have doubts anyone could survive in any kind of exposure suit in water that cold.

Then it was hot — I mean, **hot**. In order to keep the guys in back warm, we had to blast the heat. They moved as far forward as they could to stay warm. However, they were still cold, and we were really hot.

You might think you would be more comfortable if you dressed lighter up front since running the heat is a must. I disagree. Rule of thumb: Have on your body what you expect to get out with — anything extra you grab on the way out is a bonus. At 65 below and with nothing on but a flight suit and flight boots, you will be in trouble.

The other side of the coin is this. You can wear only so much as it will interfere with your flight duties. There has to be a middle ground. It is nearly impossible to dress for 65 below and still be able to fly. But you can dress so you will survive until help gets there. You may not be toasty, but you will be alive.

The gear we are issued is not fashionable, it may be clumsy, and it may not fit like designer skiwear. What it **will** do is save your life. In Alaska, we have gotten used to carrying all of this gear and planning for worst cases because we live in a harsh, arctic environment.

But don't fool yourself. You may live in a place, or deploy to a place, where there may not be arctic conditions, but it can be miserable. Remember, it doesn't have to be below freezing to cause hypothermia. You can become hypothermic at temperatures well above the freezing point.

We in Alaska take the environment seriously. We have even gone as far as purchasing expedition-weight survival gear to supplement our survival kit. We need that kind of protection here. We have seen too many folks we have picked up who weren't prepared to survive in this environment. You may not need that kind of protection, but remember — to survive, you need to be prepared. Don't be a casualty just because you didn't want to be a little uncomfortable. Better to feel a little discomfort than to become a statistic. Cold can kill. Don't let something as simple as being prepared ruin your day.

Here's Captain Drake Selmer's viewpoint.

When Captain Lupenski called to tell me I was going to Greenland, I hung up on him, telling him I was too busy to play games just then. It took a call from the command post to convince me it was for real.

In our business, it usually pays to maintain a distance from certain aspects of a mission. That's the theory, anyway. Truth is, it's hard to do, and this time, especially so.

I'm from Canada originally, so for all I knew, I could have had family and friends aboard Boxtop 22. Also, I've spent my entire life, except for the occasional military deployment, in the arctic. It was easy for me to imagine the conditions the survivors were facing.

Once, while flying a ski plane out of Fort Yukon, I spent an unplanned winter's night out when a failed engine gave me the chance to fly a glider for the first time. On that occasion, uninjured and with adequate survival gear, all I had to do was try to stay warm until help arrived the next day. I failed miserably at staying warm, but I did well enough to be able to say it is not an experience I want to repeat.

The survivors of Boxtop 22 were not as lucky as I had been. The crash left most of them injured and had scattered, or made unusable, much of their survival gear. That so many did survive is a testament to individual

continued

THINK COLD

Students from the arctic survival course at Eielson AFB, Alaska, get a "hands on" opportunity to construct basic shelters.

Photos by Capt Brett Hartnett

Having a plan to use, should the unforeseen happen, can mean the difference between returning home or not making it.

Knowing how to use the survival equipment provided in your aircraft by life support is a critical part of any survival plan.

acts of bravery and a collective will to survive. If you haven't experienced the kind of cold the survivors faced, I suggest you read the short story "To Build a Fire," written by Jack London.

Captain Lupenski has touched on some of the equipment issues concerning us in the arctic. I would like to emphasize the importance of training and preparation. Nobody expects to find themself in a survival situation. However, having a plan to use, should the unforeseen happen, can mean the difference between returning home or not making it.

Having a plan is a start. Better yet is having a plan and the skills to implement it. I can't speak highly enough about the Air Force-conducted arctic survival course taught at Eielson AFB, Alaska. The instructors are simply without equal. More often than not, Alaska cooperates in the learning experience by providing bone-chilling subzero temperatures guaranteed to drive home the points the instructors need to make. I encourage any service member stationed where they might encounter such extremes to pursue the opportunity to take this course. And for any aircrew member, the training should be mandatory.

Whether you call Patrick AFB, Florida, or Grand Forks AFB, North Dakota, your home, today's employment tempo means you might easily find yourself far from your home field. Tomorrow's hot spot may be hot in political terms only. ■

Regulations Are Made to Be Broken, Right?

USAF photos

CAPTAIN BILL KELLEY
329 CCTS/DOI (AIFC)
Castle AFB, California

■ Here at the Advanced Instrument Flight Course (AIFC), I teach a class titled Flight Rules Seminar. This class emphasizes the importance of following rules and regulations. I try to drive home the point that rules and regulations are not there to make life difficult for you — they are there for a reason.

During the class, I always use the example of mission planning. I mention the fact every command has specific guidance on mission planning. For example, in the KC-135 world, we are given 4 hours to mission plan. We have a laundry list of items we are "supposed" to cover.

Ironically, when I ask the class if they actually cover all the mission-planning items listed in the regulations, I always get the same response: "It depends if it's a checkride." This normally brings about a pretty big chuckle, and virtually everybody is in agreement. The laundry list of items is for the "new guys" who have not achieved the Steve Canyon status they have. After all, the students at AIFC are "senior" aircraft commanders and instructor pilots. After they wipe the tears from their eyes from laughing so hard, I tell them a story of what happened to me.

There I Was

It all began on a cool day in January, 1987. The reason I say it was cool — not cold — is because I was stationed at Eglin AFB, Florida, flying the C-21. I received a phone call at home asking if I wanted to fly a local training sortie up to Maxwell AFB, Alabama, to pick up some parts from another C-21 unit there. Naturally, I said yes and rushed over to the detachment where I met up with "Tom," the IP and "John," the other copilot.

Tom was a major with over a million hours (at least, it seemed that way to me). He was 1 year away from retiring and had been flying his whole career. He flew gunships in Vietnam and other airplanes to include the C-5. Prior to the C-21 assignment, he was at the C-5 schoolhouse. He was a stan-eval pilot in every aircraft he flew. The point is, he was one of the most experienced pilots I have ever flown with.

continued

Regulations Are Made to Be Broken, *Right?*

continued

I realized this was not a standard maneuver, and we would get critiqued for it when we got back to Eglin. As the dutch roll progressed, the stall warning system started to sound. I knew we were in serious trouble. It was then I realized we were going to hit the ground.

John, the other copilot, was the newest member to our detachment. He had been there for only a short while and had about 100 hours in the C-21. As for me, I was a highly experienced First Pilot. I had managed to achieve a stunning 330 hours in the C-21.

We left the detachment and went over to the hangar where we kept the C-21s. As this was such a short mission, Tom went over to fill out the flight plan and get the weather brief. John and I stayed to preflight the C-21.

Have you noticed I have not yet mentioned the mission planning? The reason I haven't mentioned it is because we did not do any. Yes, even the C-21 had regulations covering mission planning. But after all, this was a C-21. What could possibly happen?

After Tom finished at base ops (about 30 minutes later), he met us at the airplane, and we were off. I flew the first half of the mission. We left Eglin and went up to Dannelly Field in Montgomery, Alabama, to fly some practice approaches. Naturally, being the Steve Canyon I am, the first half of the mission went flawlessly. After we finished the pattern work at Dannelly, we flew over to Maxwell AFB to pick up the spare parts.

John was flying the second half of the mission. We departed Maxwell for Dannelly so John could get some pattern work. John flew three perfect approaches at Dannelly, and Tom seemed surprised at how well John was flying. Tom even made a comment to John that he must have taken flying pills before he went to fly.

John's next approach was a TACAN approach. He was completely configured at the TACAN MDA when Tom pulled the right engine back to idle. He stated to John we just had a "simulated" bird strike and had lost the right engine. No problem. What could possibly go wrong? After all, we practice single-engine work all the time.

Let me tell you what could possibly go wrong. Apparently, John was caught completely off guard. He immediately disengaged the yaw damper and either came in with the wrong rudder or did not come in with any rudder at all. The C-21 instantly rolled over to about 135 degrees of bank.

The IP took control of the aircraft and made a rudder input to correct the attitude. The C-21 then rolled to about 135 degrees the other direction. This went on for about 20 seconds. During the entire time the airplane was doing this, I kept thinking to myself, "Push up the engine!" But guess what I said — NOTHING! After all, who was I to tell Tom what to do? He was the one with all the experience.

Initially, I was sitting on the edge of the jump seat eating my box lunch. I realized this was not a standard maneuver, and we would get critiqued for it when we got back to Eglin. As the dutch roll progressed, the stall warning system started to sound. I knew we were in serious trouble. It was then I realized we

were going to hit the ground.

But no problem. The gear were down and we would hit the ground and slide to a stop. After all, that's how it works in the movies, right? As we approached the ground, I sat back as far as I could in the jump seat and heard the other engine, the one that was pulled back to idle, spool up.

That was all I could remember until I regained consciousness in the back of the plane. When I came to, the back of the plane was on fire. My right leg was broken at the femur, and my left leg was badly cut at the knee. The airplane was full of smoke, and I could not see Tom or John.

I heard what sounded like John's voice, and I assumed he and Tom were outside. I immediately went into the survival mode and tried to get out of the plane. The door was pinned shut, and the aft hatch was engulfed in fire. Luckily for me, when we hit the ground, Tom managed to put the plane into a very small pond, and the pond absorbed the brunt of the impact.

The plane hit the water in a slightly right-wing-low attitude. This caused the wing to break away somewhat from the fuselage, causing a hole about 3 feet around. I managed to pull myself up to the hole and escape from the plane.

I began to look for Tom and John but could not find them. It was then I realized they were pinned in the cockpit and could not escape. As I crawled back to the hole to let them know there was a way out, a low-order explosion occurred. The plane was completely engulfed in fire. Tom and John did not make it out of the plane.

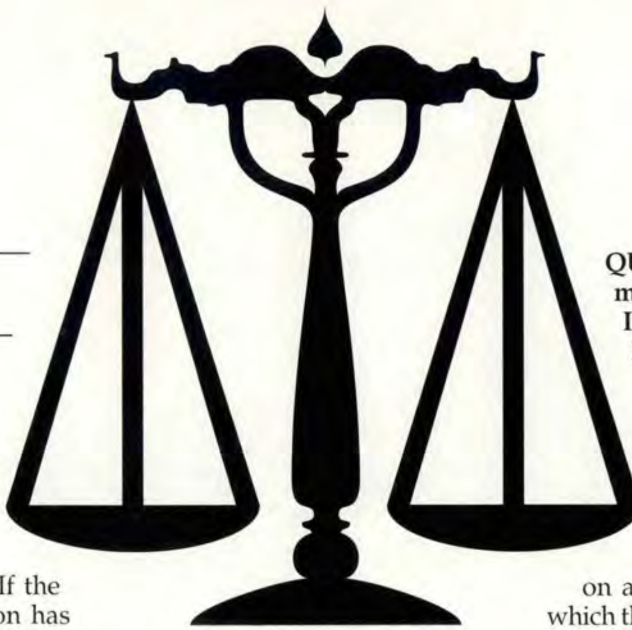
There were a lot of lessons learned from this mishap. If I had only told them to push up the good engine when I thought of it, we would have immediately recovered from the attitude. Just before we hit the ground, the flight data recorder revealed, when Tom did push the good engine up, we went from over 100 degrees of bank to wings level. If we had another 100 feet, we would have flown away. But who was I to tell Tom what to do? The bottom line: Never sit through something you don't feel comfortable with.

But what does this mishap have to do with AIFC and a class on flight rules?

The whole mishap could have been avoided before we left the ground by following a very basic rule. We did have a regulation covering mission planning, and one of the items we were supposed to brief was emergency procedures. Had we spent even the shortest amount of time on this topic, John would not have been caught off guard and would have reacted properly to the situation.

So the next time you come across a regulation you decide to ignore, think about the possible outcome. Here at AIFC, our primary goal is safety. If you have any question about instrument flying or the rules and regulations covering instrument flying, give us a call at DSN 347-4571. ■

It's a privilege



COL CHARLES MATTHEWSON
Staff Judge Advocate
HQ Air Force Safety Agency

■ **QUESTION: Can a witness be forced to testify to a Safety Investigation Board?**

ANSWER: That depends on the status of the witness. If the Safety Board believes a person has relevant and material testimony to provide about an aircraft mishap, they will give the witness a promise of confidentiality. This is done to assure the witness that no adverse use will be made of his or her testimony, in hopes the person will freely and candidly speak to help us prevent future mishaps. We do not have subpoena power to help compel testimony like the National Transportation Safety Board does.

If a military witness refuses to testify under these circumstances, he or she may be ordered to answer questions and to do so truthfully. This situation is much like that of a court-martial witness who is given immunity or who can't be prosecuted because the statute of limitations has expired. Although people can't be compelled to give testimony that will incriminate themselves, they won't be allowed to stand behind the self-incrimination privilege if they can't be prosecuted or if the evidence they provide can't be used against them. They then have a duty to cooperate with the Safety Board, and if they disobey an order to do so, they may be punished for the violation of that order.

If a DOD civilian employee refuses to give information to a Safety Board, he or she can also be disciplined for impeding or failing to cooperate with the investigation. While the military member could face punitive criminal action, the civilian discipline would involve only some degree of administrative adverse action.

If the witness is a nonaffiliated civilian (i.e., neither a military member nor a government employee), then the Safety Board has no power to compel the person to testify. Its only tools are the promise of confidentiality and any moral persuasion that can be drawn from a citizen's civic duty to help his or her government preserve defense readiness and promote public safety.

QUESTION: I think my commander has used information I gave to a Safety Board to hurt my career. It's not like he tried to give me any sort of punishment, but he's kept me from flying and denied my request to go TDY. Can he do that?

ANSWER: You've touched on a very sensitive problem for which there's no clear answer. Let me expand on some of the issues.

It **is** clear that **no one** can use **any** information from a flight mishap safety report for **anything other than** mishap prevention purposes. Our new AFI 91-204 states this in paragraph 1.12.1.5, Prohibited Uses of Limited-Use Privileged Safety Reports. A violation of this provision makes the offender liable for UCMJ punishment or any appropriate adverse administrative action.

If a commander, based on what he or she knows from a safety report, has any desire to pursue disciplinary action, then he or she needs to develop an independent source of evidence. Ordinarily, this source is found in the "legal" report of the accident investigation done under AFI 51-503 (formerly AFR 110-14) after the safety investigation. But if a formal accident investigation isn't being done (as is ordinarily the case with Class B or C mishaps), there are other ways to obtain evidence for disciplinary purposes.

Any commander has the inherent authority to direct an investigation be conducted for an official purpose, and this would certainly qualify. It's even possible to get certain facts somewhat informally by just collecting statements and documents. Circumstances will vary, and it's important for a commander to get his or her SJA's advice on how best to build a case file. The rights of suspects must be scrupulously honored in this process, with self-incrimination and counsel protections being provided. Once this process gives a commander a record of incriminating evidence, he or she may pursue any lawful adverse action even though first knowledge of the infraction may have come from the safety investigation.

Without this independent evidence, though, a commander needs to be extraordinarily careful. Even giving the **appearance** that privileged safety information is being used to support adverse action will cause harm to the integrity of our promise of confidentiality. Commanders should take great pains to show the offender (and those in the unit who are familiar with the mishap's corrective action) that independent evidence — and not the safety report — was the action's basis. The timing of actions and the way actions are described are very important factors in maintaining the credibility of a Safety Board's confidentiality.

Another major issue involves actions which a commander might take in the course of preventing future mishaps. A commander's decision that a pilot shouldn't fly for a while after a mishap may be a very prudent safety action. Obviously, this decision carried to an extreme (e.g., an indefinite grounding) becomes tantamount to an adverse action. A commander might also feel additional training of some type is necessary to reduce the risk of any future mishaps. This, too, would be appropriate if not carried to extremes. A commander must be allowed certain discretion in doing what's appropriate in the name of mishap prevention, but this discretion can't be abused either through design or neglect.

Readers are encouraged to submit questions concerning the Air Force safety privilege to us by calling the Safety Hotline (DSN 246-0950), sending an E-mail message to grigsbyj@smtps.saia.af.mil, or by writing HQ AFSA/SESP, 9700 Avenue G SE, Kirtland AFB NM 87117-5670.

You must always remember, too, some command actions are taken for reasons that aren't always readily apparent. The denied TDY opportunity may have been the result of the more appropriate selection of another person or the perceived absence of some qualification on your part. Similarly, you might think a less-than-glowing OPR was prompted by a mishap report, when there may be other indications of a less-than-glowing performance.

If you have real evidence, however, that a commander is using privileged information as the driver for such actions, then you should file an official complaint with the Air Force. You can go up the chain of command, visit the IG, make an Article 138 complaint, or call us on the Safety Hotline (DSN 246-0950). We have to police ourselves very closely on this, or our promises of confidentiality will fail to give us the quality of information we need to prevent mishaps. ■

FSO's CORNER

What's a Squadron FSO to Do?

JOHN RICHARDSON
Program Manager
Southern California Safety Institute

■ Congratulations! You have been selected as a squadron Flying Safety Officer (FSO). Now the question is: What are you supposed to do?

The place to start is AFI 91-202, *The US Air Force Mishap Prevention Program*. It's the basic guide for USAF safety programs. Unfortunately, the AFI does not specifically address the duties of a squadron FSO. Let's look at what AFI 91-202 says, and then I'll talk about how to apply this new AFI in your squadron.

Who Does the FSO Work For?

For each organization, the chief of safety must answer directly to the commander. This means that if you are a single FSO in a squadron, you are the chief of safety! If you are in a full-time safety position, your reporting official should be the squadron commander. Also, if you are in a full-time safety position, you must be trained to manage a safety program. If at all possible, try to get a quota in the Flight Safety Officer's Course, WCIP05K. This course is conducted at HQ AFSA, Kirtland AFB, New Mexico. It will give you the training you need to manage a program. Your MAJCOM has the quotas for this course.

Some other basic guidelines from AFI 91-202 include the direction that functional managers, not safety, take action on safety problems. This is because commanders and functional managers have the resources and the authority to get things fixed. Your job is to help with technical expertise. As part of this concept, you, the safety officer, are the eyes and ears of the commander and are the advisor to the functional managers in safety matters. The Air Force thinks this is important enough to occupy most of your time. Thus, the AFI recommends that you should not regularly be assigned administrative tasks, details, or augmentation duties not related to safety.

Although you work for the squadron commander and the safety program is the commander's program, you also work very closely with the wing/installation safety staff. The USAF concept of a safety program is that all elements of the program are consolidated as much as possible. As such, there should not be duplicate programs on the same installation. While it is true that every unit will participate in program elements like hazard reporting, there should not be "separate but equal" programs in those units. By the way, this applies to tenant units as well.

So where does your squadron fit into this concept? One point first: Under the new AFI philosophy, most requirements are stated very generally. The methods of implementation are left to the individual units. So you get to decide how things get done. But there should be one agreed-upon way to do a particular element on each installation. Now let's look at some of the major elements of a safety program as outlined in AFI 91-202.

The Mishap Prevention Process

The mishap prevention process is the basis for all safety activities. According to AFI 91-202, the host safety office implements the mishap prevention program for all Air Force units on the installation. As a squadron FSO, you must work with the wing or installation safety office to develop and implement your safety program. So, what are the standards that apply to your squadron? This includes rules, criteria, procedures, Air Force Occupational Safety and Health Standards, TOs, etc., which provide the guidance for operating safely. Most of these should be very obvious.

For flying directives and TOs, you should check with the wing/installation safety office to be sure you are aware of all the less known standards. For example, do you know about AFOSH Standard 127-100? This covers flightline safety including taxiing and towing airplanes. If you have a maintenance activity in your squadron, you need to be *very* familiar with this standard.

Once you know what safety standards are applicable, you need to make sure they are being followed. All squadron personnel must also know what the standards are and how they apply to their jobs. As a squadron FSO, you need to establish some way of checking on compliance with these standards (self-inspections, etc.).

The other major activity for safety is identifying and correcting hazards. You and your commander must be alert to hazards which exist in your operation. If you find such hazards, you need to decide how to control the hazard to an acceptable level of risk. If you are not sure how to analyze such risk, talk to the wing or even MAJCOM safety staff. They are trained in risk assessment and, in addition, may have knowledge and resources you had not thought of.

Hazard Reporting Program

This should be a wing/installation managed program. You should support the hazard reporting program in your squadron by being sure there are Hazard Report Forms (AF Form 457) readily available and that the squadron members know about the program and how to report hazards. The first step in the process is to try to fix the problem internally within the squadron. If you can't, then send a report up to the wing/installation safety office. You do not need to have a full hazard reporting program as described in the AFIs. It's one of the things that should be kept at the wing/installation level.

The same thing is true for the Hazardous Air Traffic Report (HATR) program. It should be managed at wing, and you should support the HATR program through training and availability of forms.

Safety Assessments and Monitoring

This is normally a wing/installation responsibility. But you and the other squadron FSOs must be part of the wing program. The best way to participate is to divide up the areas to be monitored among the various squadrons. AFI 91-202, Chapter 7, lists the requirements. In this activity, you are acting not only for your squadron commander but also in support of the wing FSO. Of course, since you are monitoring flight-related activities, it is directly in the interest of your squadron for you to do so. Any reports or record keeping should be coordinated with the wing/installation FSO. One thing for sure, you should not duplicate inspections or assessments.

Finally, if you are a tenant, your internal safety program is yours. The host safety office assesses only your support of the wing program. Of course, the wing FSO should be more than willing to provide assistance to your request to support your program.

Mr. Richardson gives a demonstration as part of the training for FSO students in classes at the Air Force Safety Agency.

Safety Meetings and Safety Information

If you conduct your own safety meetings and have your own safety bulletin boards, etc., they are your responsibility. If you participate in wing meetings, you owe support and coordination to the wing FSO. Although flying safety meetings are required, the actual process, frequency, format, etc., is a decision you and your commander make for your unit.

Mishap Investigation and Reporting

This should be consolidated at the wing/installation level. It may be that you will be involved, particularly if you have been formally trained in one of the USAF courses. If your squadron has a mishap, you should investigate it and prepare a report. You are investigating for your commander. The commander is the person charged with correcting the problem. Nonetheless, the wing FSO should know what is going on, and the wing must process required safety messages through ASAP*.

Hosts and Tenants

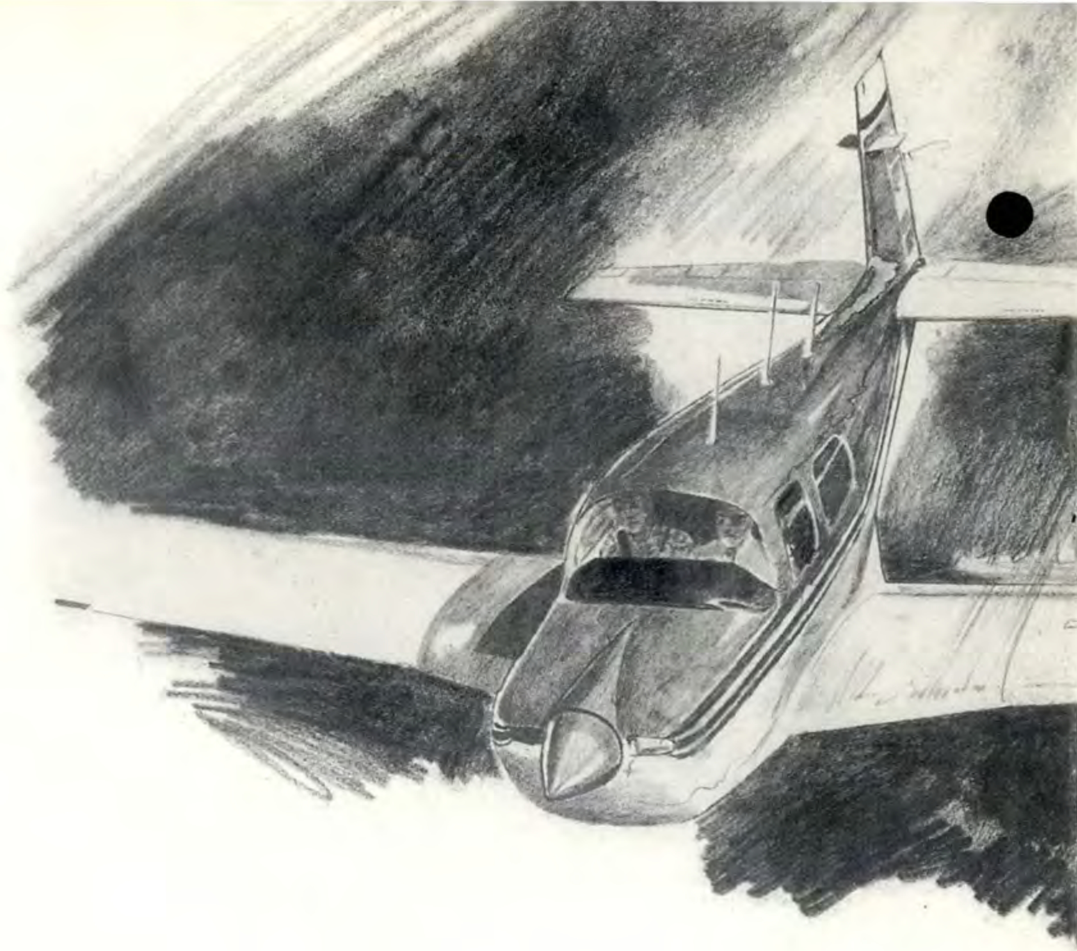
Some of what has been said above does not apply in the case of hosts and tenants of different commands. Often there are different rules and requirements imposed by the various MAJCOMs, and often the missions and equipment are radically different. You must make a special effort to coordinate your program needs and elements with the host. It is extra work for you at first, but I assure you the effort will pay off as you continue the program.

Be sure to read the host/tenant support agreement. Be sure you understand what support responsibilities the host has. If these are not adequate, work to modify the agreement. Remember, though, even if you are in a different command with a different mission, you are to support the wing/base program to the maximum extent possible. This is not the time to "do your own thing."

Wrapping It All Up

So, what's a squadron FSO to do? Run a good flight safety program for the squadron commander and coordinate and cooperate with the wing FSO. Your direction is in AFI 91-202. You should plan to have in your program all the elements of a flight safety program discussed in Chapter 7. Good luck, and WELCOME TO SAFETY! ■

*Aerospace Safety Automation Program



THERE I WAS

■ I had had my private pilot license for about a year and had flown about 200 hours during that year. I thought I was experienced and complacency had missed me. As I was to find out, complacency can strike any person at any time. Perhaps I was complacent about not being complacent!

One hot, summer day in south Georgia, I had just arrived at the airport to take another ride in the Cessna 172RG they had down there. As was my customary procedure, I carefully checked over the machinery and climbed into my trusty steed. The weather was pretty good, with only scattered clouds at about 4,000 feet. I had the current sectional chart for that area, as well as a flashlight, a VHF aircraft hand-held radio, and a VHF ham hand-held, just in case the aircraft hand-held quit. Along with my flashlight, I also had a smaller map light, even though I started at about 10 in the morning. It appeared I was ready for any eventuality.

Leaving home, I decided to fly toward Cairo, Florida, somewhat northeast of Tallahassee. (Or was it Quincy? It's been a long time ...) As usual, I did not file a flight plan*, and as I did not yet have an instrument rating, I flew strictly VFR. This was great. I wasn't required to talk to any agency on the ground. I just had to aviate and navigate.

As I neared the Tallahassee area, I tuned into Tallahassee approach. It was not a busy day, and the only other traffic I heard was a Mooney in a descent for Perry. My intent was to just fly over to Cairo and see if I could watch the skydiving activity there. I had used the sectional to fly to the Tallahassee VOR and then outbound toward Cairo. Since it was such a hot day, I had climbed to 8,500 feet in an attempt to cool off.

Over the VOR, I began a somewhat late and ill-planned descent. This was great! There was nobody to tell me what to do or when. The 172RG was a bit more streamlined than a "straight-legged" 172, so I extended the landing gear and brought the engine to idle with maximum rpm to speed up my descent.

As all this was going on, Approach

**Flying Safety* recommends you always file a flight plan.

was telling the Mooney he had traffic at "12 o'clock, less than a mile." The Mooney pilot replied, "No contact."

This should have set off bells in the back of my head. Less than a mile and not in sight? Since I was VFR and not talking to Approach, this didn't necessarily mean the traffic was *me,* but the visibility had to be really bad. The haze had developed, as it so often does in that part of the country, and today I estimate the visibility had to be about a half-mile or less. And me, VFR ...

I was just descending through 6,500 feet, on my westerly heading, when the Mooney materialized like a Klingon Bird of Prey decloaking! He was just in front of me, and we were pointed at each other.

Now, a Mooney usually cruises at a pretty good clip for a light aircraft, probably at least 160 knots. This one was in a descent, so I have no idea what his speed was. However, his speed, combined with my speed, must have been close to the speed of light! I had just enough time to turn on my landing light when I began a hard right turn in order to avoid the other aircraft.

I began my bank to the right and lost awareness of my attitude in relation with the ground. I was more interested in missing that other airplane! As I turned, I kept increasing my angle of bank and watching the Mooney to see if he would turn away. I finally watched the Mooney go past my left wingtip at about 30 feet. He had never seen me!!

When I looked again, I found I had rolled in more bank than a 172 of **any** kind should ever see. The artificial horizon showed at least 135 degrees, and it looked like more. As the nose dropped (climbed from my perspective) toward the ground, I was fortunate to already have all the drag on the aircraft that was available. The nose eventually was about 60 degrees down. From there, my unusual attitude recovery training came back, and I rolled wings level and continued my flight.

My first reaction was anger. After all, I was at 6,500 feet and westbound. The other aircraft was at the same altitude, but eastbound. He was wrong, wasn't he? But after several years, reflecting on this incident, I realize he had to descend **somewhere**. It's just the way life is that he was descending where I was.

I learned several lessons from this. First, and most important, it doesn't matter what the clouds are — if the visibility is less than 3 miles, it is legally IMC. Whether it's haze, fog, or clouds doesn't matter. Without an instrument rating, I should have been on the ground.

Second, use **all** the resources available. I had plenty of hardware available, but I hadn't used all the *software* available to the maximum extent. I wasn't thinking. If I had been, I would have checked in with Approach Control and avoided this entire incident.

Third, always keep a good scan going, especially outside the aircraft in VMC. Had I been a little more "complacent about not being complacent," I might not have been looking forward at all, and the North Florida newspapers would have really had something to print.

Fourth, complacency can strike anyone at any time. This was really a surprise to me. I had always believed if people *thought* about complacency and avoiding it, it would not happen to them. ■

Head Up Displays and Instrument Flying

CAPTAIN ERIC JESSEN
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■ The Head Up Display (HUD) is a marvelous tool originally designed to help fighter pilots drop bombs and win air-to-air engagements. Over the years, pilots found the HUD extremely useful in all phases of flight, including instrument flying. It's now becoming a common fixture, even in transports and tankers.

The HUD does, however, have some drawbacks when used in instrument meteorological conditions (IMC) you need to be aware of. Research is currently under way to overcome the drawbacks. However, the HUD is still not authorized as a sole-source flight instrument in IMC. This article will point out a few limitations of the HUD and provide techniques on how HUDs may safely be used to aid instrument flying.

Most HUDs provide a poor reference when taking a quick snapshot of the aircraft's attitude. The monochromatic display restricts the HUD from displaying everything above the horizon in one color and everything below the horizon in another color as the primary ADI does. Instead, it relies on minor symbolic changes such as dashed lines instead of solid lines to show up or down. This can make it particularly tough to recognize and recover from unusual attitudes.

An example of how the HUD presentation can delay the pilot's interpretation of attitude is shown in the figure. The 30° right-banked climb could actually be perceived as a 150° left-banked dive or vice versa. Except for the traded positions of the dashed and solid lines, the displays for the two attitudes are essentially identical.

Another problem associated with HUDs is the climb/dive (C/D) ladder. While the C/D ladder is very useful for setting either a pitch using a fixed reference on the HUD (often called a waterline) or an actual climb/dive angle using the flight path marker (FPM), hard vertical maneuvers with large and/or rapid corrections can be disconcerting. The large degree of movement caused by the expanded scale of the C/D ladder and the inability for a HUD to "write" rapid movement smoothly will give you a flickering display as the C/D ladder jumps around the combiner glass.

Altitude and airspeed displays are normally shown in similar formats (digital or vertical scale), with airspeed in the left field of view and altitude in the right. While the accuracy of both displays is superb, pilots may perceive small deviations as large, overcorrect and/or become fixated on these parameters, ignoring others. Another drawback is the lack of trend information these scales provide (i.e., how fast is my altitude changing and in what direction?), making the cross-check of normal instruments essential.

The heading scale consists of a horizontal scale moving left and right around a fixed reference at the top of the HUD. This scale, unlike that on the C/D ladder, is not one-to-one with the outside world but is greatly expanded over the compass card. This larger scale makes small heading corrections easy to make but limits the presentation to a total of 40 to 60 degrees, making it difficult to see the big picture, i.e., course intercepts and fix-to-fix relationships. Therefore, the HUD should be used in conjunction with the HSI compass card when performing these sorts of maneuvers.

The last, and probably most important, HUD limitation is the lack of warning if something should go awry. A malfunctioning HUD may give the pilot inaccurate information, and the problem remains unnoticed. Also, if the unit has a momentary glitch or changes modes due to the loss of a CADC, INS, or NAVAID, the HUD will flash to a different presentation and may cause some momentary disorientation.

Now that you know some basic limitations of HUDs, let's look at some ways to use the HUD for instrument flying. The one essential element is still the cross-check. Since the HUD has not been certified as a sole-source flight instrument, the primary flight instruments must still be incorporated into your cross-check.

For takeoff and departure, study the standard instrument departure (SID) during your preflight duties, and using the normal 60-to-1 formula, determine the minimum climb gradient: climb angle = altitude to gain/(distance to go x 100).

The normal 200 foot/NM used on

most SIDs equates to a 2° climb. During takeoff, rotate to set the waterline (or another fixed HUD reference) or the ADI to the proper takeoff angle, as in any normal takeoff. After takeoff, confirm the HUD is operating properly and transition to the FPM, setting the climb angle at or above the minimum climb gradient. This technique will keep you clear of obstacles since the FPM will correct for any airspeed, pitch angle, and/or configuration differences.

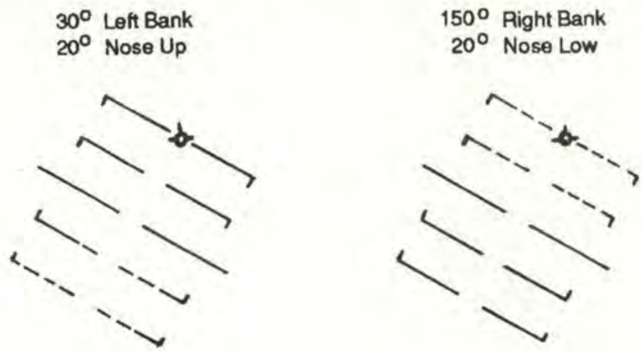
During level-off and cruise, setting the FPM on the level horizon, or 0° line, should give you level flight. Since the FPM uses the INS, you may want to check the reliability of the INS by inserting the coordinates of a TACAN or VOR/DME and noting any differences in bearing or distance between the INS and NAVAID. This should alert you to any pending problems with the INS.

On descent, determine the desired descent gradient using the same 60-to-1 formula you used for the climb gradient: dive angle = altitude to lose/(distance to go x 100). Fly the FPM to the appropriate dive angle, and adjust power to maintain the desired airspeed. The dive angle you computed should be the same for any airspeed. But cross-check the altitude and descent rate throughout the descent to ensure you will meet all altitude restrictions.

For precision approaches, the expanded heading and C/D scales will give you very accurate information but could increase your workload by making deviations and corrections seem larger than they actually are. What looks like a large correction on the HUD might actually be almost imperceptible on the HSI. If you use the old basic rule of bank angle equals number of degrees to turn, your heading control should be smooth. To help you fly the proper glidepath, setting the FPM on the correct glide slope angle (usually 2.5 to 3 degrees) should help you to maintain the glide slope. Remember — continue to monitor your primary flight instruments and make the small, positive corrections you learned about at UPT.

On nonprecision approaches, compute the descent gradient from the FAF to the VDP using the same 60-to-1 formula. Fly the FPM to the desired dive angle monitoring airspeed and VVI to ensure you can make a smooth level-off at the MDA. If you reach the MDA prior to acquiring the runway visually, set the FPM at the 0° line to level the aircraft.

HUD Unusual Attitude References



Once you have visually acquired the landing zone, wait until the desired glidepath reference on the C/D ladder (2.5° or 3°) is over the touchdown zone and fly the FPM to that angle. This should put you on a "normal" glidepath. If the FPM is on the touchdown zone at a dive angle less than 2.5°, you might level off and check your altitude — you are on a low, flat glidepath. Remember the FPM is a great tool to help with glidepath control but is only one input. Use all the reference cues available to you.

One of the greatest benefits of using the HUD during instrument approaches is you may see the runway sooner than on normal instruments. This advantage, however, may have some serious drawbacks. Some HUDs are designed to have as many as three different symbols simultaneously overlay the touchdown zone when the aircraft is on the proper glidepath.

If you stare at the HUD too much, you may not actually see the touchdown zone or any hazards associated with it. Some pilots go to the other extreme and focus all their attention on the touchdown zone once the runway comes into view, disregarding the information the HUD is giving them. Remember, cross-check your flight parameters down to the flare.

With strong or gusty crosswinds, cage the FPM to the center of the HUD, and remember the runway should be downwind of the caged FPM throughout the approach and landing. Trying to keep a caged FPM on the touchdown zone will cause erratic flight and may result in a drift on landing which could cause a departure from the landing surface.

Now for the foot stomper. *For unusual attitude recoveries, use your primary flight instruments!* Remember the problems the HUD has with quick interpretations of aircraft attitude and how hard it is to follow during rapid vertical maneuvers? These limitations may prove disastrous in unusual attitude recoveries. The first instrument *you* should look at is still the multicolored global display provided by the attitude indicator. Once you have confirmed the unusual attitude with the other instruments, use the attitude indicator to start your recovery. The HUD can be used as a cross-reference, but the head-down global displays are still the standard recovery instruments and will be until the HUD becomes certified as a sole-source flight reference.

Advancing technology has increased the reliability of the HUD and INS to the point where pilots, either consciously or subconsciously, depend on the operation of these systems to complete just about every portion of their mission. When it's working properly, the HUD can provide most of the information you need to fly good instruments. However, until the HUD develops to the point it can be depended on for unusual attitude recoveries, and it is authorized as a sole-source flight reference, the head-down primary flight instruments must still be used for all IMC flying. ■

THERE I WAS

■ It was your typical British winter day in 1984 when I, a fairly new F-111F instructor pilot (IP), checked the schedule to see that I was flying the right seat on a TI-1 (first flight in theater) with an "old head" lieutenant colonel. He had been on the staff for the last few years and had no USAFE experience. But he had approximately 2,000 hours in various models of the Vark and had finished the RTU a month or so prior with outstanding performance.

Even though the weatherman had forecast the standard limited ceilings and visibilities, I was very confident in my IP abilities. How can you go wrong with that kind of experience in your left seat? I yawned my way through planning and briefing in anticipation of not having to work very hard to earn my IP pay that day. In retrospect, I can say I did absolutely nothing that day to earn my IP pay, and it almost cost me my life.

The mission to Dutch Low had gone well, and my student's experience was evident. He had done a great job of sorting out European procedures, and my radar work on Vliehors range had been pretty good for an IP. Now, if only we could get some orientation work on one of the wash ranges. I contacted Holbeach and was happy to hear the range was available with estimated weather at 1500/4.3 (the legal limit at that time).

We accomplished a "cloud break" with RAF Marham and did a weather check of the range area. The ceiling was okay, but it was one of those "flying inside a ping pong ball" days where, with a little imagination, you could just make out a horizon. There wasn't a breath of wind, and the water was as smooth as glass — not unlike I had experienced a hundred times before — so I felt confident to continue.

Up to downwind, turn onto base, begin rolling out on final, a little quick radar work, target's wired under the crosshairs, things are looking good. I looked over to see the steering wasn't centered.

"Center the steering — center the steering. If you don't center the steering you'll never see the tar - ..." My words were interrupted by a sudden 4- to5-G pull (pretty hefty for a Vark). What I saw next is etched in my mind forever.

My peripheral vision picked up the water which looked exactly like the runway environment looks in the flare. I felt the cushion of the ground effect (they tell me this happens at about one-half of your wingspan). I took the aircraft and lit the burners, but it was mostly a face-saving move — at that time I was only along for the ride. Whatever was going to happen had already been decided by my left seater's initial pull. After an eternity, the aircraft began to climb out of ground effect, and we went home.

What has bothered me most about my near demise over the last 10 years is I didn't discover the impending danger and make the recovery myself. Had I done so, I might have been able to convince my ego (although falsely) my left seater tried to kill me, and I earned my pay by saving the day with superior flying skill. It did not happen that way.

I was impressed with my student's experience and the ability he had already demonstrated on the same mission. I became complacent and completely trusted him with our lives. As it turned out, he saved us, but with only microseconds to spare — too close for me!

Whether you're performing IP, IWSO, or WSO duties, whether your crewmate (or wingman) is incredibly experienced or a new guy, never become so impressed with their abilities that you completely put your life in their hands. You, too, could feel ground effect at 540 knots. Or, if you're not as lucky as I, you may never feel anything again. ■

*U.S. GOVERNMENT PRINTING OFFICE 1994-573-261/03003

UNITED STATES AIR FORCE

Well Done Award

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

LIEUTENANT COLONEL

Thomas J. McKinley

347th Fighter Wing, Moody AFB, Georgia

■ Lieutenant Colonel Thomas J. McKinley was returning from a night low altitude navigation and targeting infrared for night (LANTIRN) mission, configured with LANTIRN pods, wing tanks, ECM pod, and SUU-20 ordnance dispenser. Shortly after touchdown, the aircraft began to drift sharply to the right and settle abnormally on the right side. Attempts to correct the aircraft's alignment and attitude were ineffective.

With runway departure imminent, he immediately selected full afterburner and initiated a go-around. Despite limited night visual attitude cues, Lt Col McKinley skillfully lifted the aircraft airborne as it crossed the runway edge at a 20-degree angle off. Still uncertain what was wrong with the jet, he declared an emergency and contacted the supervisor of flying.

A chase F-16 joined, and using limited visibility from the strobe light, confirmed the gear appeared down, agreeing with the cockpit indications. Unfortunately, that meant Lt Col McKinley still did not know what was wrong with the aircraft. He set up for another landing, prepared to take the approach end cable if the aircraft again settled abnormally. The second landing attempt was uneventful.

Post flight inspection revealed the right main landing gear had retracted on landing, causing the aircraft to drag the ground on the right ventral fin, right stabilizer, ECM pod, and SUU-20. Lt Col McKinley's split-second decision to go around saved a valuable ACC combat aircraft and probably his life.

According to the manufacturer's representative sent to investigate the incident, the aircraft would likely have ground looped had Lt Col McKinley continued the landing roll, resulting in possible death or serious injury and certain destruction of the aircraft.

On the subsequent landing attempt, the joint and over-center hinge locked into place correctly and enabled Lt Col McKinley to land the aircraft safely. It is believed this malfunction has occurred once before, but resulted in the destruction of the aircraft, precluding analysis of the problem.

Lt Col McKinley's superior airmanship and split-second decision in the inherently dangerous night flying environment saved both the life of an experienced combat pilot and a valuable ACC aircraft.

WELL DONE! ■