Flying SAFETY

Experienced Pilots and Inexperienced Pilots

Black Hole Approach

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GPS — Revolution in Navigation

APRIL 1993

VFR Flying... DEAD RECKONING DOESN'T HAVE TO BE

THERE I WAS

■ Several years ago, a local airport operator offered to pay my expenses to Buffalo, New York, and back if I would ferry a Piper *Cub* from there to Williamsburg, Virginia. I gladly accepted since I figured I would get a lot of fun out of a free trip and some free flying. As it turned out, I got a lot more experience than fun out of the trip, which involved a few fast rounds with ice formation, instrumentless instrument flight, and terrain clearance vs maximum angle of climb problems.

To our dismay, the airplane was found in the extreme rear of the hangar, and it was necessary for us to roll every other ship in the hangar out in the cold rain and wind to get ours to the front. Furthermore, nothing had been done to get the airplane checked and serviced for the flight. Both tires were nearly flat, one wing hung low because of some stretched landing gear shock cords, and our inspection showed two plugs had been broken.

Exhausted, wet, cold, muddy, and hungry, we took off hours later than we had planned. As is always my custom when flying a strange airplane, I assumed the compass was wrong until proved right. A quick check of the compass reading as we flew along a prominent highway near the field indicated the compass was off by about 40 degrees on southerly headings. We introduced this error into our desired compass course and soon found we were tracking close to our course. The airplane had no radio equipment instruments except the minimum required for day VFR flight, so our navigation was to consist of simply the compass and chart method.

Our first refueling stop was to be Lock Haven, Pennsylvania. After we had flown 30 minutes and had increased our altitude because of an increase in the altitude of the terrain, we discovered the little drops of rain which were running back under the wing were beginning to freeze solid. Although I reduced the altitude, ice continued to accumulate on the wing leading edge. I immediately deviated to the left of my course in order to descend further in a river valley and to land at an airfield there if necessary.

After we had let down into the valley, the air warmed sufficiently so we lost our unwelcome load of ice, and as the sun began to shine weakly through some thin spots in the overcast, we decided not to land but to use our fuel reserve to continue to Lock Haven. Flying along crooked rivers in order to avoid icing (which we suspected we might find again if we flew directly across the mountains) used up so much fuel I was wondering whether I could count on normal fuel consumption to get us to Lock Haven. However, we made the field, and the line boy put 11.6 gallons in the nominally 12-gallon fuel tank.

People who have been in Lock Haven will perhaps recall the Susquehanna River Valley runs about east through Lock Haven and is bounded on the south by a prominent east-west ridge which is notched by a small stream which empties into the Susquehanna. After we had cleared the traffic pattern, I headed the little *Cub* toward the ridge to the south and quickly realized our angle of climb was insufficient to permit us to clear the ridge.

Now the ridge on my left and right converged as I flew along, until some distance ahead they met and became a single ridge. This means

continued

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SPECIAL FEATURES

REGULAR FEATURES

CONTRIBUTIONS

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THERE I WAS continued

the valley between the ridges steadily rose in altitude until it vanished at the top where the ridges met. I felt unconcerned about this since I expected to have plenty of altitude in a short while to clear the ridge on the right. As the little airplane droned up the valley, however, I found that, although I had been steadily climbing, I was closer to the trees below than when I had started up the valley.

I added some power and steepened the climb. Very quickly then, I realized the valley was gaining altitude distinctly faster than I was. I applied full throttle and adjusted the airspeed to the point where I thought I was getting the maximum angle of climb. At the same time, I became aware of the awful fact the ridges were now so close on the sides there was not enough room to make a 180! There was nothing I could do but keep the airplane straight and watch with great anxiety the race for altitude between the airplane and the trees just below.

"What a stupid situation to get into," I thought. I was steadily losing altitude. As I alternately looked at the top of the ridge to my right and at the treetops below, my altitude decreased to 150 feet, then to 100, then to 75 feet. Although the ridge to my right was only a little higher than the airplane, there was nothing I could do to climb any faster. Then, as I was nearing the point where the two ridges met, I was overjoyed to see ridges in the distance beyond the one to the right! I put the *Cub* into a very gentle turn and sailed over the ridge and out over the valley beyond with just a few feet to spare.

The overcast was considerably lower than the reports had indicated. We now couldn't see a thing but white stuff in every direction. Hoping we would pop out in a few moments, I attempted to maintain straight and level flight. I had never had any instrument training, and the airplane, as I mentioned before, had no instruments. You can easily visualize what my straight and level flight amounted to — engine and flight speed alternately going up and down, with the compass swinging incessantly, accompanied by weird forces tugging at our bodies in weird directions.

I had no opportunity to see what Don was doing in the back seat, but I marvelled at his silence. To liven things up even further, ice began accumulating on the wing leading edges. Now we were in a spot. We couldn't go higher because of ice, couldn't go lower because of mountains which we couldn't see, and couldn't stay where we were for both reasons.

With constant effort, I was able to keep the airplane headed fairly close to the desired direction, and in about 15 minutes, I caught intermittent glimpses of the green Susquehanna below. A quick descent and landing ended the most instructive crosscountry I have ever made. The lineboy apparently knew why we were back because he opened the hangar doors for us as we taxied up. The next morning dawned bright and clear, and we enjoyed an uneventful flight to Williamsburg.

What did I learn from this lesson? I had just demonstrated to myself something which every flat-land pilot should realize anyhow. The maximum angle of climb of a light airplane is actually small, and you must allow a great deal of horizontal space to attain a substantial increase in altitude. It was also clearly demonstrated ceilings can be quite a bit lower between weather observation stations than directly over these stations. I have encountered this condition many times since on cross-country flights, just as many other pilots have. I have often wondered if perhaps such a potentially dangerous situation doesn't call for a turn and bank instrument in every cross-country airplane and a requirement pilots be able to fly straight and level under the hood before they are issued their private certificates. ■

Experienced Pilots and Inexperienced Pilots

High time - low time pilots ... which are at greater risk for having a mishap?

MAJOR EARL McKINNEY JR.
94th ATS USAF Academy CO

■ "The longer we fly, the better our judgments become." After all, it is experience and flying hours which dictate upgrade to aircraft commander, instructor, or flight lead.

In fact, it seems every upgrade from student pilot to aircraft commander is based on flying hour experience. This seems appropriate. We can think of many examples of experienced crewmembers demonstrating spectacular airmanship. One recent example is the United Airlines crew who flew the DC-10 into Sioux City with engine and hydraulic failure. In addition to spectacular situations, most of us feel experienced pilots are also more effective in the thousands of simple little decisions occurring on every sortie.

But, we've also been troubled by the numerous examples of experienced pilots displaying very poor aviation skills — like the L-1011 crew who became so distracted with gear malfunction they permitted the aircraft to descend into the Everglades. Other experienced pilots have shut down good engines, drifted hundreds of miles off course, and attempted flamed-out landings in IMC. So what is the real story on experience?

Defining Experience

My interest in the subject started in 1986 when, as an F-4 Flight Safety Officer, I was disquieted by several F-4 mishaps. These involved pilots with more experience than I making poor decisions and paying with their lives. Since I hoped to live through my experienced years, I began to look at the mishap record of experienced and inexperienced pilots. This study led me to believe experience is a two-edged sword. While experience clearly makes us better at countless routine decisions, experience may also make us more at risk for a mishap.

I base this on a number of studies I have come across while examining the mishap records of USAF, Navy, and RAF pilots. The first of these studies examined Air Force mishaps of all types of aircraft. This study separated "out of control" and "non-out of control" mishaps. Because the authors considered the act of putting an aircraft out of control a problem only for *very* inexperienced pilots, they eliminated these mishaps from their calculations. The result indicates for non-out-of-control mishaps, experienced pilots are more at risk than less experienced pilots.

A second study continues this

continued

Experienced Pilots and Inexperienced Pilots

continued

theme. It combined both types of mishaps — out of control and non-out of control, and examined the mishap record of fighter-type aircraft. Again, a positive relationship exists between total hours and mishap rate.

A third study of RAF pilots also produced a finding that *experienced pilots* have a higher mishap rate than inexperienced pilots. This study of fighter-type aircraft compared total hours of the mishap pilots and the mishap rate.

The same study also looked at the experience with a particular aircraft. Using the hours the mishap pilot has flown the mishap aircraft as the measure of experience again correlated greater experience with a higher mishap rate.

The Navy also conducted a study considering flying experience for a given type of fighter aircraft. Again, the rate of mishaps increased for pilots with more than 300 hours in the mishap aircraft.

Finally, an Air Force study of fighter aircraft considered mishaps and duty title. Again, the older, more experienced the pilot (squadron commander, flight commander), the more accident prone.

Of course, some commanders cannot fly as often as other pilots. This lack of currency could explain the results although no study yet conducted has been able to prove a relationship exists between mishap rate and currency.

Who's at Risk?

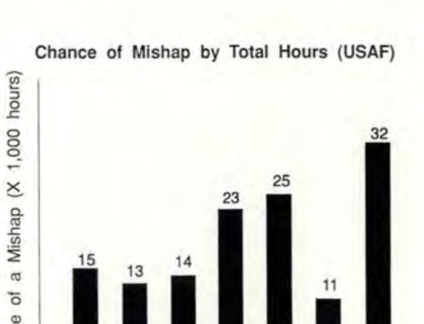
A lot of charts, a lot of numbers. What does it mean? To me, it means that past some point in our careers, the potential of being involved in a mishap increases. But why? Especially because it seems my day-to-day, routine decision making is getting easier, better, and also more effective.

Other articles have argued effectively, experienced pilots may suffer from overconfidence and complacency. While agreeing with these explanations, I would like to suggest there is yet another explanation for both the higher mishap rate and the sense of better routine decision making. This explanation? Experienced pilots perform somewhat poorly in "unique" types of emergencies. By "unique," we mean an extremely rare emergency not practiced or anticipated by the pilot.

To study routine and unique mishaps, we collected 156 fighter mishaps which started with a malfunction of the aircraft. Having been "placed" in these emergencies, pilots were forced to make decisions. We evaluated these decisions as good or bad.

We also evaluated the emergency situations as routine or unique. Routine emergencies are engine failures, flap problems, fuel transfer problems, and others with emergency procedures in the checklist. They are often practiced in the simulator and in flight.

Unique mishaps are the "once in a lifetime," never practiced, combination malfunctions such as a novel pitot system failure, flight control malfunction, or multiple hydraulic



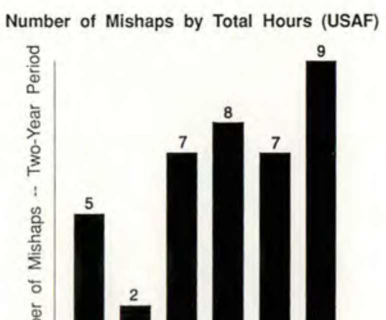
system failures. Some are impossible to simulate and are not practiced.

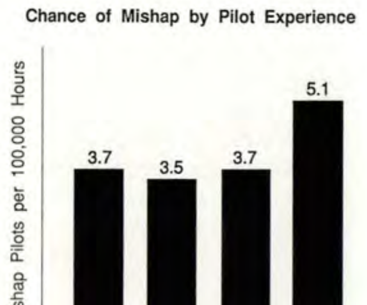
When we considered the type of emergency — routine or unique — and experience, we see with increased experience, the rate of mishaps in unique situations is higher, but in routine emergencies, the rate is lower.

So ... experienced pilots may suffer from a specific difficulty dealing with unique emergencies. We believe this may be due to experienced pilots not practicing the unusual. Unlike less-experienced pilots who often practice new (new to them) emergencies as they learn the aircraft, experienced pilots only practice the standard emergency procedures they have practiced over and over. So they may be losing the edge which helped them in younger years to deal with the unexpected.

In addition, with experience, we may be "spring loaded" to diagnose an emergency as a common, routine one we have seen before, rather than understand it to be unique. This seems to be the case in fighter-type flight control mishaps where experienced pilots often stay with an aircraft much longer than inexperienced pilots as they attempt to regain control.

Another reason for experienced pilots' problems in unique emergencies is experienced pilots may also not have the communication channels available to younger, inexperienced pilots. Everyone is willing to give the young pilot ideas, both during real emergencies and in the simulator. Fewer comments are made to experienced pilots. People may feel the experienced pilot has already thought of an idea, or he must know what he is doing.





Now, What Do I Do?

So what is the antidote? Practice the unlikely. Don't assume a malfunction is routine. Fight for communication. Invent safe, but difficult, scenarios to practice. Risk your own "failures" in the simulator by requesting "unrealistic" combination emergencies.

Don't diagnose an emergency as a "standard" EP. A pilot who read the 156 mishaps commented he was very surprised at how many "once in a lifetime" malfunctions occur.

Finally, fight for communication in the preflight brief. Set up an environment where your wingman or your copilot feels like that second set of eyes, ears, and observations are vital. Be an aircraft commander or flight lead who appreciates appropriate communication in flight. If this sounds a lot like CRM, you're right. It is. ■

BLACK-HOLE

CAPT BARRY SCHIFF (TWA)

Editor's note: Black-hole approaches posed a significant hazard to airlines during the 1970s. Since then, a number of advances — ground proximity warning systems, improved training, VASI and ILS systems installed on more runways, and head-up displays — have greatly reduced the incidence of black-hole approach mishaps among large jet aircraft. All pilots may benefit from this review of black-hole approaches — especially Capt Schiff's explanation of why pilots may be lured into flying into terrain or obstacles despite having the runway in sight throughout the approach.

■ During the 1940s, the bible for student pilots was the *Civil Pilot Training Manual*, published by the Civil Aeronautics Administration (predecessor of FAA). For its day, the CAA *Manual* was a no-nonsense book pulling few punches. It stated, for example, "night flights should not be made in single-engine airplanes unless all occupants are provided with parachutes."

This advice seems to imply bailing out is the preferred method of coping with an engine failure at night. Consider, however, this was written during an era when aircraft powerplants were no more reliable than a politician's promise. (Even today, however, an off-airport landing at night often requires more luck than skill.)

Despite claims to the contrary, night operations are still more hazardous for us than daylight flying. This is because the horizon is often not visible, optical illusions are more prevalent, and fatigue is often more of a factor. Also, obstructions and clouds may be difficult or impossible to see. Regarding this last point, consider hundreds — if not thousands — of pilots and passengers have collided with terrain which was never seen, even though visibility was unlimited.

Night Visibility

Such mishaps occur because night visibility is determined by the greatest distance at which prominent lighted objects can be seen and identified. Seeing a distant light, however, does not mean the pilot can see rising terrain directly in front of the aircraft on a moonless, overcast night.

Executing visual arrivals and departures over certain areas and under certain conditions is much like instrument flying and requires the same attention to minimum safe altitudes. Obviously, the crew is responsible for ensuring the aircraft is always at a high enough altitude to keep from flying headlong into unseen obstructions.

Avoiding obstructions, however, can be easier said than done, particularly during a long, straight-in approach to an airport at night. A subtle danger associated with some night visual approaches can lead airline crews to fly at dangerously (and sometimes fatally) low approach altitudes.

When descending toward an airport during the day, a pilot uses depth perception to estimate distance to and altitude above an airport. The pilot can fairly easily descend along an approximately 3-degree visual approach slot to a distant runway.

On a moonless or overcast night, however, the pilot has little or no

APPROACH

depth perception because the necessary visual cues (color variations, shadows, and topographical references) are absent. This lack of depth perception makes estimating altitude and distance difficult.

For example, a pilot flying 6 miles from and 2,000 feet above a runway which is 12,000 feet long and 300 feet wide sees the same "picture" through the windshield as when the aircraft is only 3 miles from and 1,000 feet above a runway that is only 6,000 feet long and 150 feet wide.

Approaches Over Water

The problem is exacerbated when straight-in approaches are made over water or dark, featureless terrain on an overcast or moonless night. The only visual stimuli are distant sources of light in the vicinity of the destination airport. Such situations are often referred to as "black hole" approaches.

The black hole refers not to the airport, but to the featureless darkness over which the approach is being conducted. Overwater approaches are notable examples.

Over the years, the black-hole approach has claimed many lives, but the cause was not understood until two Boeing Company engineers, Dr Conrad L. Kraft and Dr Charles L. Elworth, conducted an extensive study of the problem. The research program involved a specially developed visual night-approach simulator which a dozen of Boeing's senior pilot-instructors flew under various conditions. The results were published in a Boeing report entitled, "Flight Deck Work Load and Night Visual Approach Performance."

FIGURE 1

(See "Constant visual angles," next page.)

Constant Visual Angles

During the project, Kraft and Elworth had hypothesized and then confirmed that pilots executing black-hole approaches tend not to vary their descent profiles according to runway perspective as they normally do during conventional straight-in approaches (see figure 1).

Instead, the researchers discovered pilots maintain a constant visual angle while descending during such approaches. The visual angle is

continued

BLACK-HOLE APPROACH continued

the angle the destination airport (and surrounding lighting) occupies (or subtends) in a pilot's vertical field of vision.

Figure 2 shows an aircraft overflying an airport at a constant altitude. At position A, the pilot looks at the airport (and its surrounding lighting). Let's assume the airport occupies 5 degrees of the pilot's vertical field of vision. As the aircraft proceeds to position B, the airport fills a larger and larger portion of the pilot's field of vision. At position B, it occupies 10 degrees of visual angle. All of this is a fancy way of saying the airport seems to get bigger as the pilot gets closer.

Figure 3 shows what happens to the visual angle as an airplane descends vertically (assuming such a thing were possible in a fixed-wing aircraft) at some distance from the airport. At the higher altitude (position A), the airport occupies 10 degrees of a pilot's visual field. But as the aircraft descends, the visual angle becomes smaller. Finally, at position B, the visual angle is only 5 degrees. In other words, the visual angle decreases as altitude decreases.

Because the visual angle becomes larger as a pilot nears the airport and becomes smaller as the aircraft loses altitude, a pilot can descend toward an airport in such a way the resultant visual angle remains constant.

Not only can a pilot approach an airport in this manner, but this is exactly what pilots tend to do — without realizing it — while executing black-hole approaches. The problem is shown in figure 4. The flightpath during which the visual angle remains constant consists of the arc of a circle centered high above the light pattern toward which the pilot is descending.

Note that flying such an arc places the aircraft well below the 3-degree descent profile normally used when a pilot has better depth perception. Also, the circumference of this arc is sufficiently large that the pilot has no way of detecting he is flying along an arc instead of a straight line.

FIGURE 2

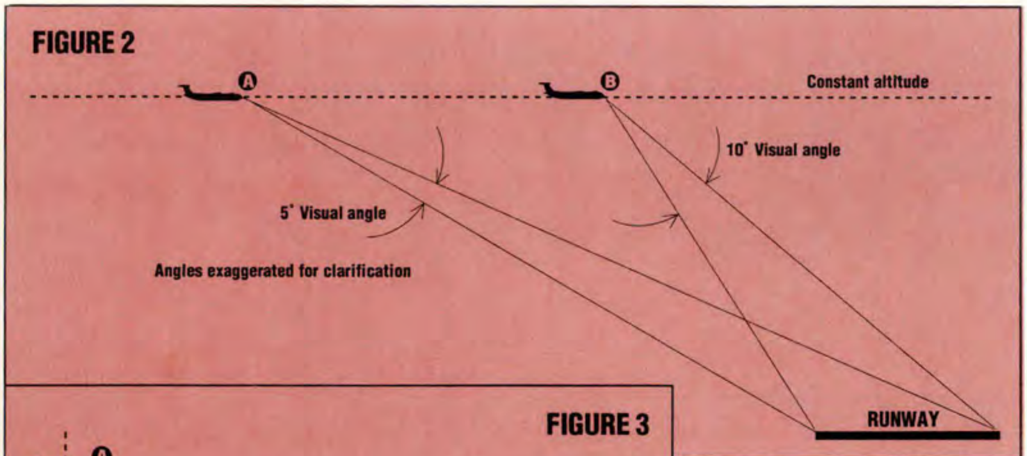


FIGURE 3

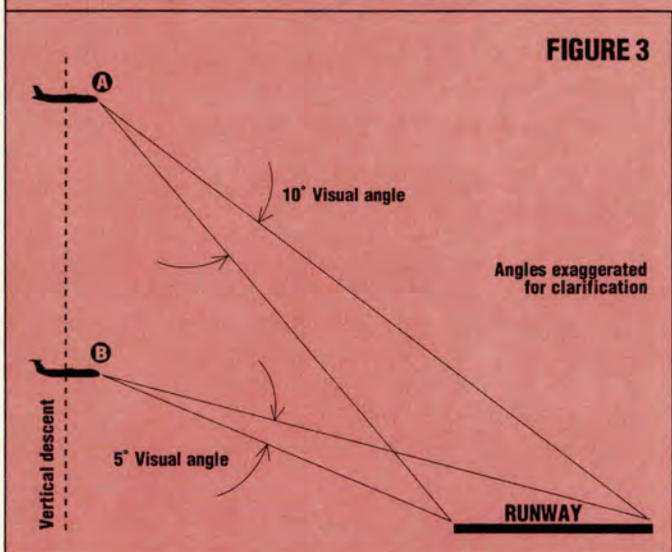
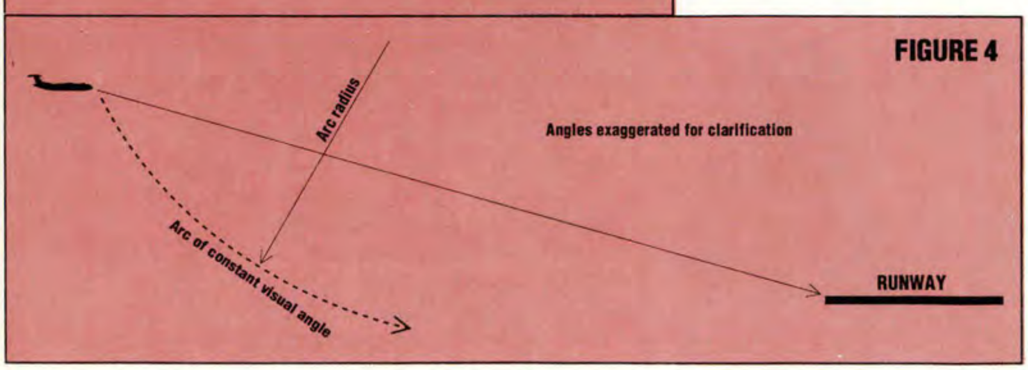


FIGURE 4



Low Approach Short of Runway

The pilot actually makes a low approach to a point about 2 or 3 miles from the runway. Upon arriving at this point, the error starts to become apparent and the pilot takes corrective action (unless the aircraft's striking an intervening obstruction interrupts the process).

Some may wonder how a pilot can possibly crash during a straight-in approach without first losing sight of the airport. A pilot about to collide with terrain or an obstruction does begin to lose sight of the airport, but this can occur after it is too late to effect a timely recovery.

Lights at Small Cities

The Boeing researchers also discovered that if the airport is at the edge of a small city, the additional lighting cues do not provide improved reference information to the pilot as long as the approach is made over dark terrain or water. Curiously, their experiments suggested adding lights around the airport caused greater and more dangerous approach deviations than when only the airport was visible in the distance.

Their report notes also "the complex (light) pattern of a city at night can replace to a large extent the normal daylight (visual) cues, and the experienced pilot can rely on them to get his bearings. However, an approach over water or unlighted terrain means the visual reference points are at a distance where altitude and sink rate would be more difficult to judge."

Kraft and Elworth conclude the problems associated with a black-hole approach appear to be aggravated by

- a long, straight-in approach to an airport located on the near side of a small city,
- a runway length/width combination that is unfamiliar to a pilot,
- an airport which is situated at a slightly lower elevation and on a different slope than the surrounding terrain,
- substandard runway and airport lighting, and
- a sprawling city with an irregular matrix of lights spread over various hillsides behind the airport.

Other factors, of course, may mislead pilots during night visual approaches. Among these are the following:

- Brightly lit runway-lighting displays appear to be closer than they really are and cause pilots to descend prematurely. This is easily demonstrated by requesting a tower controller to vary runway lighting intensity during your next lengthy, straight-in approach. As the lights dim, you will tend to flatten out the approach; as they brighten, you will tend to steepen the approach.
- Extremely clean air, such as often is found in the desert, also encourages early descents because lighted objects seem closer than they really are.
- When the horizon cannot be seen, scattered and distant ground lights can be mistaken for stars. These suggest to a pilot the aircraft's altitude is excessively nose high, which results in a tendency for the pilot to lower the nose and fly below the proper approach glidepath. A similar effect can be caused by the distant (upper) edge of city lights, which also can make the horizon seem lower than it is.
- Peering through a rain-soaked windshield can convince a pilot (because of refraction) the aircraft is too high and can result in an error of as much as 200 feet of altitude per nautical mile from the runway. (Refraction bends the visual approach path in the same way it "bends" the straw in a glass of water.)
- Viewing an airport through an intervening rain shower makes the runway lights seem bigger than they are, causing a pilot to believe the aircraft is too high.
- An upslope runway (and/or surrounding city lighting) — day or night — provides the illusion of being too high during a straight-in approach. This results in a strong tendency to descend prematurely. (Conversely, a downslope condition can lead to an overshoot.)

Glideslope Guidance

The best way to combat these often subtle and insidious factors is to avoid long, straight-in, visual approaches at night without glideslope guidance, especially when overflying the infamous black hole. Pilots seldom are victimized by illusions when the final approach is less than 2 or 3 miles long.

A pilot can use certain precautions to increase altitude and distance awareness during long, straight-in approaches at night when an ILS or VASI is unavailable for descent guidance. (Although a VASI may be visible for up to 30 miles at night, safe obstruction clearance is guaranteed only within 4 miles of the runway threshold.)

DME (if available and appropriate) can help to establish a safe descent profile using the principle a 3-degree descent profile can be maintained by being 300 feet above ground level (agl) for each nautical mile from the runway. (For example, an aircraft 3 miles from the runway should be at 900 feet agl.) A 4-degree descent is established by maintaining 400 feet per nautical mile, and so forth.

Always maintain a watchful eye on airspeed, altitude, and sink rate. An excessive sink rate (for the airspeed being flown) indicates either a strong tailwind or an abnormally steep descent profile. Remain alert.

Although stating this might seem silly, be certain you are descending toward an airport. Pilots have been deceived by highway lights or other parallel rows of lights that — from a distance — give the illusion of being runway lights.

Maintain a safe altitude until the airport and its associated lighting are distinctly visible and identifiable.

Like most people, pilots usually believe what they see. In black-hole approaches, however, pilots have compelling reasons not to do so. ■

Courtesy of *Airline Pilot*, Feb 93

Hangar Door Hazards

CMSGT ROBERT T. HOLRITZ
Technical Editor

■ During the past 10 years, there were over 200 reportable mishaps related to hangar doors. These mishaps resulted in the loss of hundreds of fingers, several lost limbs, and, regretfully, four fatalities. Statistically, operating hangar doors is one of the most hazardous maintenance operations.

Pushing and Pulling

It should not be too surprising, most injuries occur manually opening or closing hangar doors. Getting a 2-ton door to move is a task requiring more than one person, and once it gets moving, it is difficult for a single individual to bring it to a stop.

Too often a single individual tries to tackle the task alone and ends up with a back strain. Others make the mistake of trying to pull the door closed and end up having it roll over a foot or get parts of their body caught between doors.

Procedures

Reviewing the majority of mishaps, a common factor was either personnel failed to follow procedures or none were established. AFOSH Standard 127-66 and AFR 88-15 spell out the requirements for developing local procedures for hangar door operation. One of these requirements is to permit only persons who have been appropriately trained to be authorized to operate hangar doors. Improperly trained people were a factor in 90 percent of the mishaps and in all but one of the fatal occurrences.

Consider the unfortunate results

when an untrained maintainer attempted to close a set of powered doors. Without ensuring the tracks were clear, he pushed the CLOSE button. The door jumped 6 to 8 inches and rolled over his supervisor's foot. The mishap report does not mention the performance rating the nine-toed NCO gave his subordinate on his next report.

Fatal Error

Of the four fatalities, one NCO died when he was crushed by a falling hangar door which fell off the rails. The other three died of head injuries.

Tasked to wash an aircraft located in a hangar, a team of three maintenance personnel prepared the aircraft for towing to the flight line. All three proceeded to the center hangar doors. One team member opened the door about 1½ feet then leaned through the door with her hand on the door control. She then attempted to open the doors further but accidentally pushed the CLOSE button, pinning her head between the doors. She was pronounced dead on arrival at the hospital.

Except for the time and place, the circumstance of the other two fatal mishaps are almost identical.

The victims placed their heads between the narrow opening of the doors.

The buttons were either not marked or poorly marked. As a result, the person inadvertently pushed the CLOSE button.

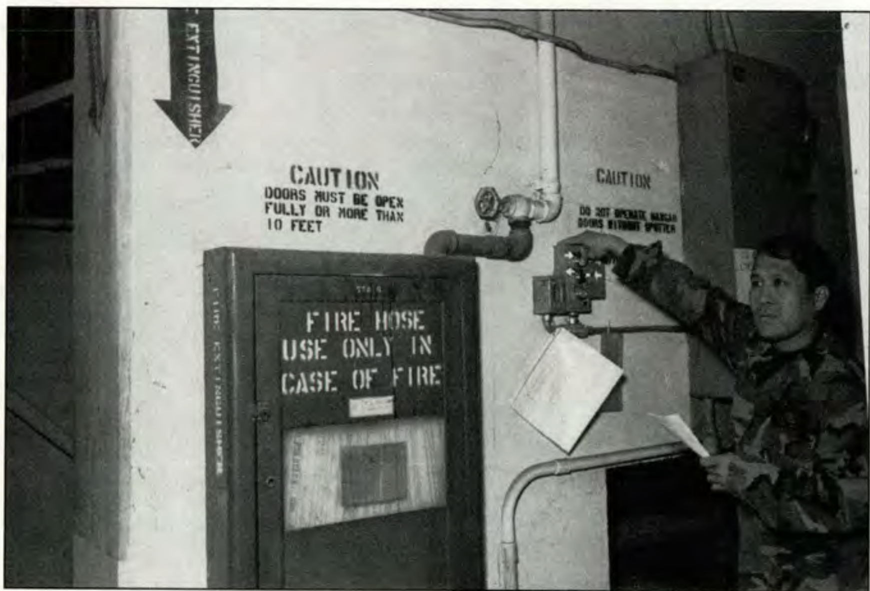
Procedures were written but not followed.

Had the requirements outlined in AFOSH Standard 127-66 and AFR 88-15 been followed, the mishaps would not have occurred.

For one thing, AFOSH Standard 127-66 prohibits opening hangar doors to a width of less than 10 feet. This is to allow time for the operator to react if the wrong button is pushed or if the system malfunctions. In fact, many units require hangar doors to be either fully opened or closed to ensure sufficient clearance for aircraft during towing operations.

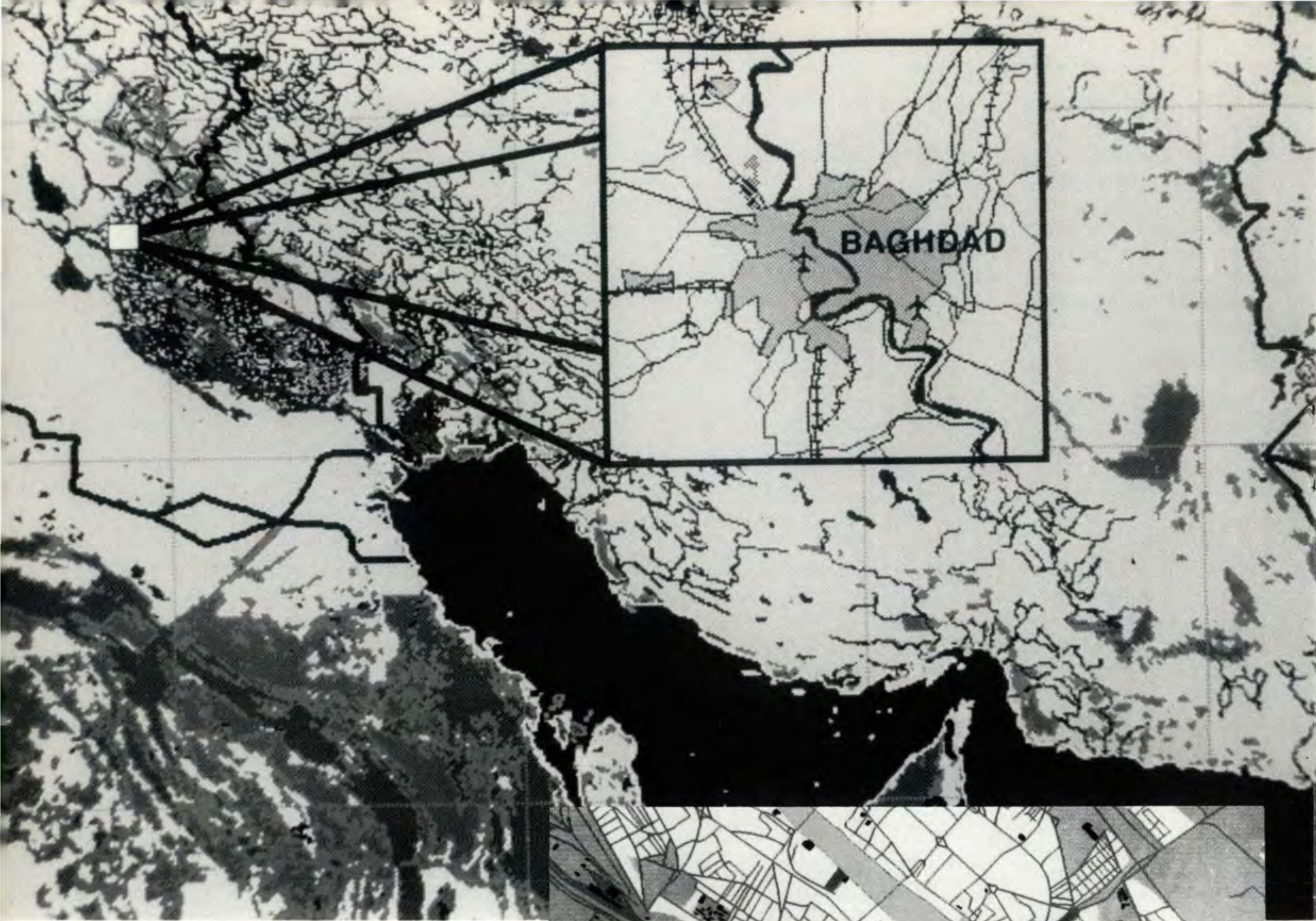
For another, had a spring-loaded cover or hood been installed on the CLOSE button as required by AFM 88-15, the victims may not have mistakenly pushed the CLOSE button.

In addition to the three fatalities, there have been 26 people who received head injuries in the same scenario. Only sheer luck has kept the fatality rate down to three. If the stats hold, the Air Force will experience another fatality by the end of the year. A periodic briefing of these mishaps and the hazards of hangar door operations to *all* flight line folks can help stop the dangerous trend. ■



Written procedures for operating hangar doors should be established and strictly adhered to.

Hangar doors should never be opened to a width less than 10 feet. A spotter should always be used to ensure personnel and equipment are clear of doors.



HOT NEW MAPS!

THE DETAIL, SOPHISTICATION, AND QUALITY OF THIS MAP DEPICTING BAGHDAD CAN BE PRODUCED TODAY WITH ONLY A FEW TOUCHES TO A COMPUTER. THE TECHNOLOGY IS AVAILABLE!

During the Middle East crisis, this "hot" new form of computing called GIS provided vital support for the mapping needs of Operation Desert Shield and Operation Desert Storm. This support represented the first time GIS technology had been used in an important role during an actual conflict.

PEGGY E. HODGE
Assistant Editor

Photos Courtesy ESRI

The high-tech mapping capability shown here is invaluable to both the military and civilian environments. Maps like these and the supporting technology helped us during Operation Desert Storm with targeting and planning. As you practiced flying over Baghdad in the simulator, did you wonder where the real-life, very detailed map of airways into Baghdad came from?

I was very fortunate to talk to the people with the top reputation for producing the computer programs which afford us this technology. You will be impressed, as I was, with the capability and versatility of their product. — Ed.

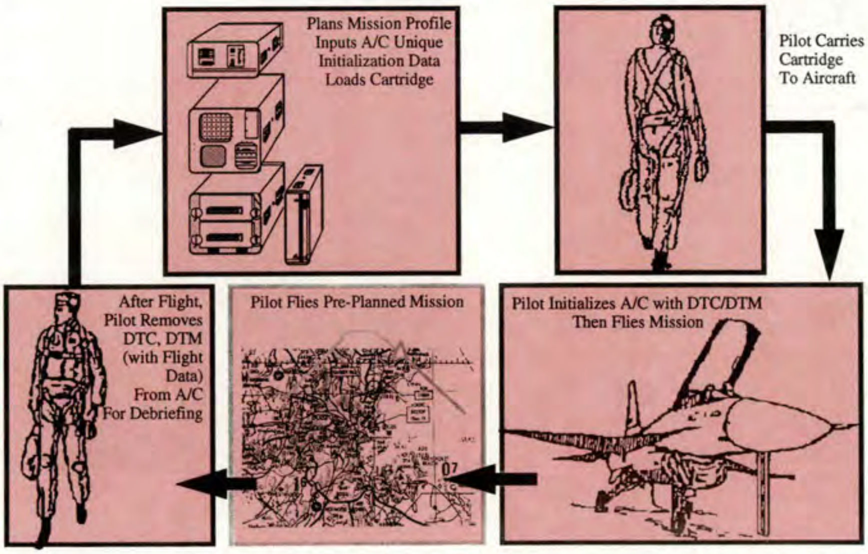
■ How many times have you said, "I wish I had known that," or "It's too bad we couldn't have seen that coming," or "Think of the lives we could have saved had we been able to predict that."

The world is full of many complex problems and challenges. The more information we have available and can put to use, the better we can plan, make more sound decisions, and accomplish tasks faster, easier, safer, and more efficiently.

An internationally known company headquartered in Redlands, California, Environmental Systems Research Institute, Inc. — ESRI — has already solved many problems related to information handling. One of their solutions, a computer software program, has been referred to as a technology which can literally "save our planet."

GIS allows us to efficiently store, update, analyze, and display data that has been geographically referenced. The program allows us to store layers of data, as well as a set of programmed operations for working with and displaying the data in the form of an electronic map.

Concept Of Operations



This concept of operation shows how our Air Force aircrews are using GIS technology. This program provides the necessary quick turnaround we need.

ESRI's Background

ESRI is recognized as the world leader in the rapidly expanding field of geographic information systems — GIS — the computer programs used to produce the "hot new maps" you see here.

Founded in 1969, ESRI pioneered the development and application of a number of products and services for organizations interested in geographic analysis and mapping.

Early research and development in cartographic data structures, specialized GIS software tools, and creative applications of these systems set the stage for the revolution in automated mapping.

A high-tech mapping program, called ARC/INFO, provides valuable information for our respective uses. It is used in private industry, university teaching and research, and government agencies. It can be used for geographic data management, map production, and operational decision making. Our examples of GIS products on pages 14 and 15 demonstrate this wide spectrum of capabilities.

ARC/INFO is now the leading automated mapping and spatial database management system (DBMS) in the industry. ARC/INFO software is unique because it combines the cartographic capabilities of traditional computer mapping systems with a strong analysis system built around a relational DBMS.

continued

HOT NEW MAPS!

continued

These systems together provide a state-of-the-art system able to display, analyze, and manage all forms of spatial data.

The Software Program

As one of the fastest growing branches of computing, GIS is the basis for making these "hot new maps." This program allows us to efficiently store, update, analyze, and display data that has been geographically referenced. The program allows us to store layers of data, as well as a set of programmed operations for working with and displaying the data in the form of an electronic map.

GIS combines map information with database information and allows us to view and analyze more than either set of data could provide alone. Information can cover anything which can be referenced on a map.

Once the desired information is installed in the database, an operator can retrieve a color-coded map displaying the desired portion of the information. Other user commands allow manipulation of this displayed data to show the information from another angle, or with other highlights.

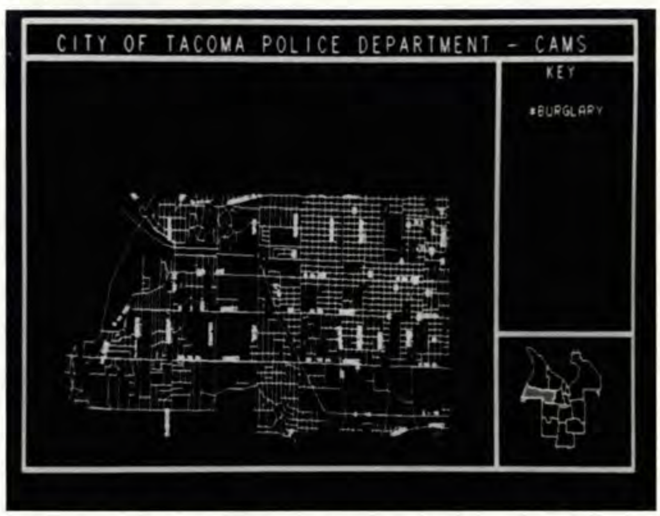
Unlike paper maps designed for specific tasks and users (e.g., road maps, weather maps, or vegetation maps), GISs allow the storage of many types of data.

How It Works

Some examples of how the Department of Defense (DOD) is using this technology provide a good understanding of how GIS is working.

Department of Defense GIS and digital mapping communities in DOD provided vital support for the mapping needs of Operation Desert Shield and Operation Desert Storm. Mappers and system specialists and analysts worked 24 hours a day, 7 days a week to process the requests for cartographic products, digital spatial data, system support, and analytical and interpretative services. Hard copy maps were still the staple product but the military services relied heavily on technology to analyze and interpret data.

Flights can be planned on digitized maps and charts, threats identified, targets studied, tactics developed, and strip maps and target photos printed in the time it takes to refuel and reload weapons.



GIS is also invaluable to the civilian community. Shown here is a map depicting burglaries that have occurred in the Tacoma area. Although fictitious, you can see the predictive value of analyzing crime trends and the efficient distribution of police officers.

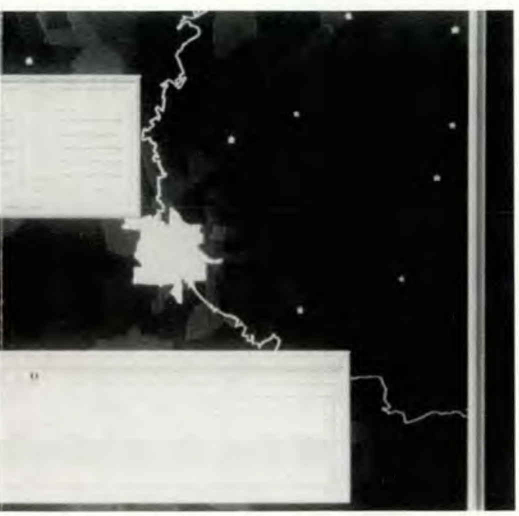
An example of this marke
tion for a department store
population. This type of inf

Air Force To make Global Power/Global Reach more than a catch phrase, the Air Force must be prepared to respond within hours to a wide range of contingencies, emergencies, and humanitarian crises anywhere in the world. Aircrews must plan and be ready to go as quickly as aircraft are ready. They can't spend days cutting up maps and using slide rules and pencils for flight planning. In a combat environment, aircrews must "turn" as quickly as their aircraft to meet demanding sorties.

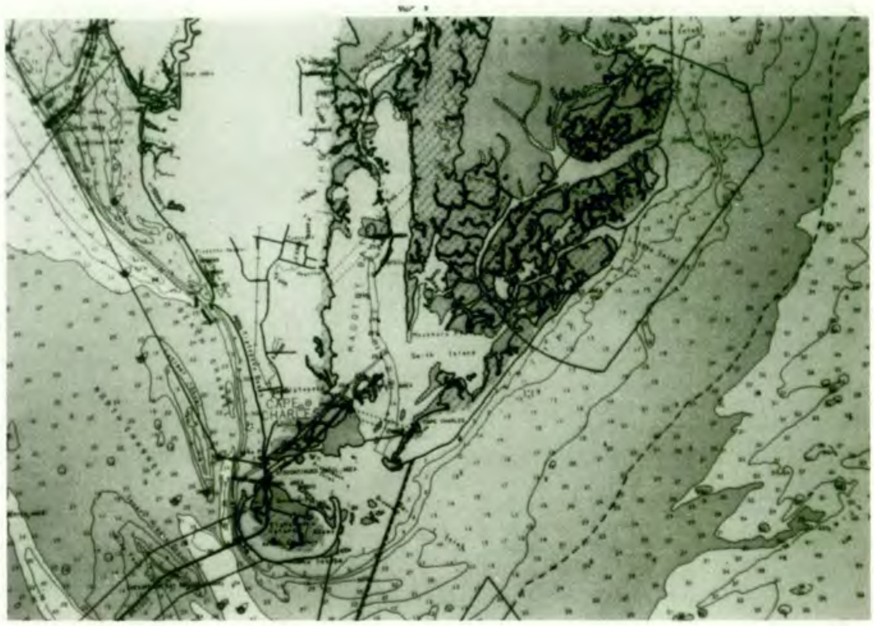
Computer technology is making this possible as well as affordable. Our flights can be planned on digitized maps and charts, threats identified, targets studied, tactics developed, and strip maps and target photos printed in the time it takes to refuel and reload weapons. The computers will go with the aircrews along with other essential support

The four images above are of Mount St. Helens, Washington, and were derived from a USGS digital elevation model. These images were created using GRID Map Algebra that allows for generation of shaded relief images.

The map above shows the areas of risk in the Arabian oil spill. Information could be used by Naval operations and air/sea rescue.



ting application of GIS can pinpoint the most ideal loca- with regard to a variety of factors to include income and ormation would be invaluable to marketing professionals.



The Digital Nautical Chart project has the potential to change ocean navigation forever. The database used to formulate this map contains approximately 14 layers of information including the latest data on the areas' port facilities, aids to navigation, limits, obstructions, and hydrography.

gear when they deploy. (See the diagram of "Concept of Operations.")

Navy The Navy uses the high-end viewing and analysis capabilities (allowing fine detail) of a full GIS for presenting navigational data — such as an area's port facilities or underwater obstructions. The data is stored on a compact disk and retrieved and viewed with onboard computers.

The information in the database is the same found on paper charts. However, because of its organization and underlying technology, it can be used for spatial analysis.

For example, an operator might ask the program to show ocean depths greater than 30 meters which are also within a 500-foot radius of a certain position. Those locations would be highlighted on the computer display along with any related attribute information in the database. The operator could then change the parameters of the question to look at other alternatives. This database will modernize the Navy's navigational capabilities.

Hot New Maps!

This technology is invaluable to all of us! Among **many** other benefits, GIS increases our training effectiveness, it allows our aircrews to fly safer and more efficiently, and for the first time, this technology was used in an important role during an actual conflict. ■

Bob Patterson of Redlands Aviation holds one of the 87 GPS units the company installed in its fleet of light aircraft.

GPS: Revolution in Navigation

CMSGT ROBERT T. HOLRITZ
Technical Editor

■ For more than a decade now, the FAA has authorized general aviation to use Long Range Navigation (LORAN). Today, nearly half of the general aviation fleet is equipped with some form of LORAN equipment. The advantage of LORAN over VOR is it allows the pilot to fly a direct route from point A to point B, avoiding the need to dogleg via the often crowded federal airways.

However, LORAN has some significant disadvantages. Although LORAN coverage is now available across the North American continent, it is not available everywhere. There are only 22 LORAN chains worldwide, and 12 of them are in the US and Canada, leaving 10 for the rest of the globe. Also, its low broadcast frequency of 100kHz is adversely affected by static electricity generated by the aircraft in flight, thunderstorms, and even sunspots.

In spite of its drawbacks, a few years ago the FAA chose LORAN as the nav-aid of the future. Improved technology persuaded the FAA to install additional LORAN chains (transmitters) and establish LORAN nonprecision approaches — which furnish position information to pilots but no descent guidance — at many airfields. That was before the Global Positioning System (GPS) came along.

GPS

As with LORAN, which was a product of WW II, GPS was developed by the military, for the military. Unlike LORAN, which relies on a series of ground-based transmitters, GPS gets its information from a group of 21 military satellites in orbit nearly 11,000 miles above the earth. Because these satellites transmit on extremely high frequencies (1575.2 and 1227.6MHz), they are virtually immune to static interference.

The GPS concept is surprisingly simple. Each satellite contains an amazingly accurate atomic clock. A computer in each satellite knows its altitude, speed, and direction. Since these are predictable, the computer uses the clock to determine the position of the satellite at any time. The exact position of the satellite is updated by fixed base ground stations at least once every orbit, and the update is transmitted to the satellite's computer.

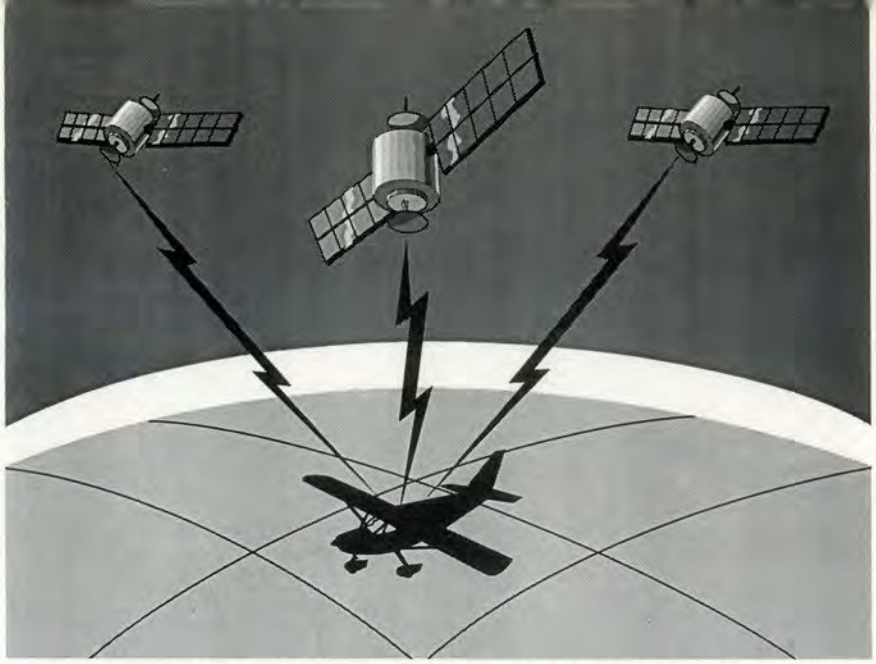
The GPS receiver also has a clock and a computer, which contains an almanac data base telling it where each satellite is scheduled to be at any given time. The receiver locks on to several satellites, each transmit their position and, as with LORAN, the receiver computes its own position.

The more satellites the receiver tracks, the more accurate the position. Most of the units on the market are "3-D" capable. That is, they can calculate latitude, longitude, and altitude. To provide 3-D information, GPS must track at least four satellites. Should only three be available, GPS will provide only "2-D" information — latitude and longitude. With less than three satellites available, however, GPS is unable to provide any position information. Typically, LORAN is accurate to about 100 meters and cannot provide altitude. On the other hand, GPS can pinpoint a location to within 18 meters and altitude to within about 30 meters.

As I mentioned before, GPS is a Department of Defense program. To be sure, any future enemy will definitely be equipped with some form of GPS navigation device. The former Soviet Union's program is called GLONASS (a Russian acronym). For security reasons, the Pentagon has the capability, through a concept called *selective availability (SA)*, to degrade the system for civilian use while maintaining its own ability to function with peak accuracy. But even in the degraded mode, GPS still performs with an accuracy comparable to LORAN.

Differential GPS

In the degraded mode, with the addition of fixed ground reference transmitters, GPS can provide accuracies of 1 to 5 meters. This system, known as differential GPS (DGPS), is being looked at by the FAA to possibly replace LORAN for nonprecision approach at many of the nation's airfields. The Coast Guard has already begun a program to provide a network of stations along the Nation's coastline to provide DGPS capability for ships operating within 300 miles offshore.


By receiving signals from three satellites, position can be determined within 3 feet.

Two companies, Magnavox and CUE Network, have joined to provide a low-cost DGPS system which will cover the US and Canada. For a small fee, subscribers can access data (via a pager already available) which, when plugged into a DGPS-capable receiver, will provide a fixed transmitter for the system.

Data Base Smart

Although they could function equally well in aircraft, the first GPS receivers were designed primarily for boating enthusiasts. However, as they did with LORAN, the general aviation folks quickly discovered the value of GPS as a navigational aid for aircraft.

As the use of GPS became fairly common in aircraft, the manufacturers designed GPS units specifically with aviation in mind. Many state-of-the-art units contain a built-in data base which can provide an unbelievable volume of information. This includes the length, instrument approach type and frequency, and ATIS, ground, approach, departure, ground, Unicom, and Common Traffic Advisory frequencies of nearly 10,000 airfields throughout North America. They can also provide the location and heading of the nearest runway, something which is nice to know in an emergency. In addition, some data bases also provide all victor airways with MEAs. All of this is available to the pilot from a unit weighing less than a pound.

Cost

When they first came out only 20 years ago, pocket calculators cost the equivalent of about $100 and were about the size of a paperback book. Today, one can be purchased for about $8 and can be as small as a credit card. This type of evolution has accelerated in GPS development. The first units weighed a few pounds and cost over $2,000. The state-of-the-art units weigh less than a pound, and the cost is now less than many LORAN units. In fact, one company offers a hand-held unit with a data base and computer port for less than $850!

Here to Stay

GPS provides the pilot with an economical and user-friendly way to navigate. Even the renter pilot can purchase a personal unit, program each at the kitchen table, and bring it along from aircraft to aircraft.

Although GPS is presently approved only for VFR flight, the FAA is looking, more than favorably, at GPS to replace LORAN, in spite of the money it has already invested in the country's LORAN network. In fact, it has stopped certifying airfields for LORAN nonprecision approaches. It may even make the state-of-the-art microwave landing system obsolete before it is fully developed. For this reason, GPS will be an inexpensive and wise investment for the serious pilot. ■

GCAS for HEAVIES

Sunstrand's Beech King Air is modified to simulate the flight characteristics of a C-130 cargo plane in order to provide a realistic demonstration.

CMSGT ROBERT T. HOLRITZ
Technical Editor

■ Many people consider spatial disorientation and loss of situational awareness strictly a problem for the fighter community. Yet, in the past 10 years, nearly a dozen Air Force heavy aircraft have been destroyed as a result of controlled flight into the ground. And, although this number is considerably lower than fighters, the number of lives lost exceeds that of fighter mishaps. With all of the hype over the Air Force's research for a ground collision avoidance system (GCAS) for fighter aircraft, the development of a ground collision avoidance system for transport aircraft has almost gone unnoticed.

System Development

Flying Safety and other AFSA members had a chance to examine one system developed by Sunstrand Aerospace. It provides flightcrews with ground collision, windshear, and stall warning through both visual and aural cues simultaneously. According to Brad Deacon, Senior Marketing Administrator for Sunstrand, their GCAS system has been under development continuously since 1967, and they have invested more than $35 million to date. Their research included studies of cockpit voice tapes and mishap reports of ground collisions. They also used computer simulations of actual mishaps to provide a complex, yet reliable, algorithm for the system's computer.

Sunstrand pilot, Mark Johnson, points to the MK VII computer. Weighing 6 pounds, it is the brain of the ground collision warning system.

Mark VII Computer

The brain of the system is the warning computer. Weighing 6 pounds and only about the size of a desk dictionary, the computer uses inputs from aircraft instruments such as the radar and barometric altimeters, rate of climb indicators, ILS and airspeed indicators, along with gear and flap positions to detect hazardous flight conditions. For example, without the gear down, the system will squawk "Too Low Gear" at a predetermined altitude. The system also compares inputs from the radar altimeter with the barometric altimeter to detect rising terrain indicating possible collision with a hill or mountain. And while it is not included in the C-130 package, the warning computer also has the capability to detect any windshear conditions.

Demonstration

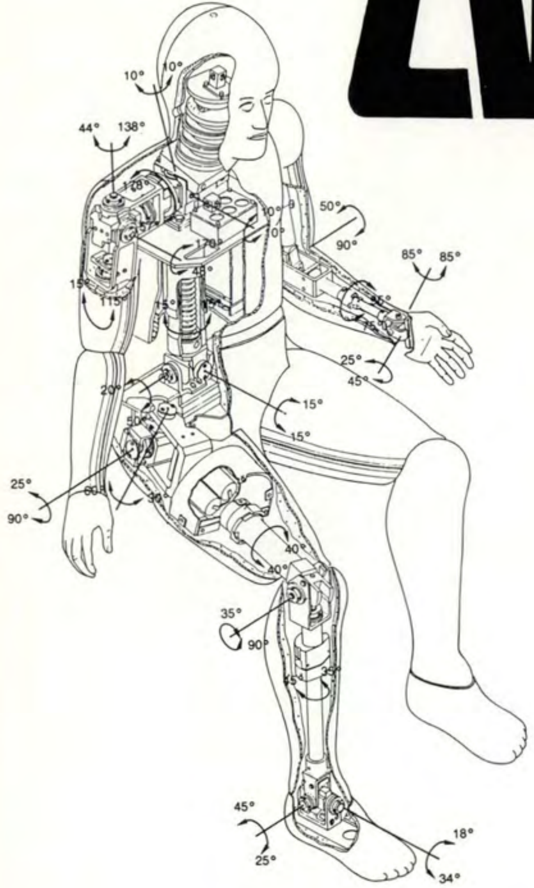
To demonstrate their system, the Sunstrand company has configured a Beech King Air to simulate C-130 flight characteristics. When installed in the King, the computer uses its C-130 program to provide warnings of potential collision with the terrain. Sunstrand flew the King Air to Norton AFB to demonstrate their GCAS system to members of the Air Force Safety Agency. Parked on the ramp, the King Air looked like a standard twin-engine aircraft. In fact, the only visible difference was the Mark VII mounted in the avionics equipment compartment just forward of the left wing and a few extra lights and gauges in the cockpit. When pilot Mark Johnson, who has been testing and demonstrating the system for more than 5 years, invited Colonel Dave Skakal, AFSA Chief of Flight Safety, and me on a demonstration flight, we eagerly accepted. During the flight, Johnson demonstrated how the system reacted to unsafe flight characteristics such as insufficient takeoff climb performance and closure rate with the terrain.

Throughout the flight, the system performed flawlessly. Over California's Salton Sea, Johnson demonstrated the bank, low level gear, and flap warnings. The system was so smart it virtually defied a pilot to get into a hazardous situation without being warned. I was most impressed near the end of the flight when Johnson headed straight for the side of a 2,800-foot mountain. As we approached the mountain at 200 KIAS, I began to think I should have stayed on the ramp. Just as I was about to panic, the warning light illuminated, and the annunciator told the pilot to "Pull up, Pull up".

Air Force Testing

The Air Force began testing the Mark VII [AN/AS 156(V)] in 1990 and completed C-130 testing (which did not include windshear warning) in 1991. According to Brad Dean, the Air Force will include GCAS as part of C-130 and C-141 autopilot mods, and it is looking to install it in the C/KC-135 and C-17 fleets. With a mean time between failure of 7,500 hours, and at a cost of only $20,000 per unit, if it prevents only one Class A mishap, GCAS for heavies will be a bargain. ■

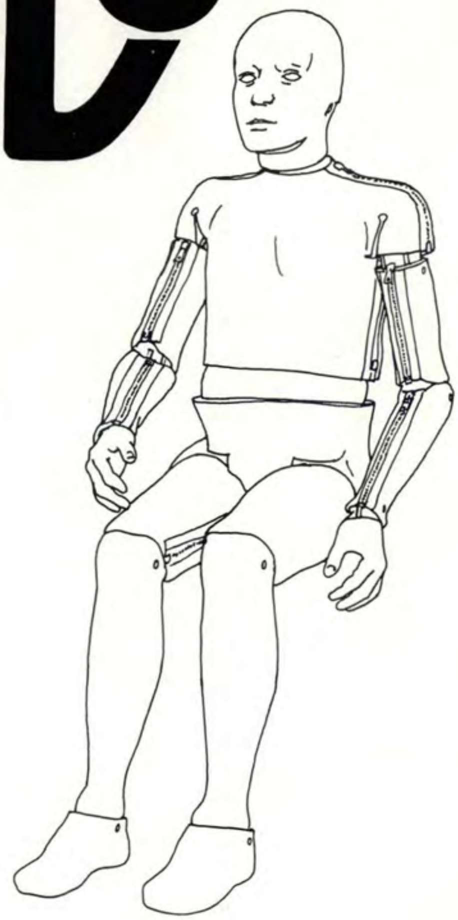
ADAM



CMSGT ROBERT T. HOLRITZ
Technical Editor

■ For more than 35 years, researchers used simple manikins to study the physical effects of various escape systems on aircrews. However, as aircraft became faster, and the envelope in which escape systems had to operate increased dramatically, researchers needed a more advanced technology manikin to study human physical response during high-speed ejection from military aircraft.

In 1984, the Crew Escape Technology (CREST) Office of the Air Force Systems Command set out to design a fully instrumented manikin which could replicate both static and dynamic physical characteristics of the human anatomy. In 1990, CREST



ADAM in the hotseat during a high-speed ejection test.

A mechanically correct manikin, ADAM helps researchers study human responses during ejection tests.

took delivery of the Advanced Dynamic Anthropomorphic Manikin, appropriately dubbed ADAM.

ADAM's Anatomy

Structurally, ADAM is designed to accurately simulate the human skeleton. ADAM's torso is constructed of aluminum alloy, and his limbs are fabricated of stainless steel. According to Stephen Mehaffie, CREST Deputy Program Manager, "Each of ADAM's 39 joints match those of a human's in terms of rotation and actual ability to move. He can move any way a human can, but he can't move any way a human can't move."

ADAM's spine also accurately duplicates that of a human. In the vertical direction, it replicates the spine's elasticity. In the Z-axis (twisting or turning), a mechanical spring/damper provides spine response qualities.

Unlike past research manikins, ADAM has simulated skin and flesh. A heat-cured vinyl plastisol provides the proper outside flesh-covered body contours which also represents the characteristics of human flesh.

He's Smart

ADAM is the first research manikin to incorporate an on-board, computer-controlled instrumentation system. Located in his body cavity and mounted on his spine, the instrument package contains signal conditioning hardware and a lithium battery-powered microprocessor. Wires are routed to sensors in the head, neck, spine, and to 31 transducers in the joints.

During tests, ADAM transmits sensor information via a conventional antenna and also stores it in the microprocessor's memory. When a test is complete, the information can be downloaded from a high-speed data port to a data retrieval and storage system for detailed analysis.

Other Applications

Although the Air Force uses ADAM primarily to study human physical response during high-speed ejection from military aircraft, ADAM has other applications including tracked vehicle severe ride, helicopter seat crashworthiness, and consumer vehicle crashworthiness tests. ADAM is now helping researchers study parachute opening forces and deceleration effects on pilots and crewmembers. During these tests, ADAM and sky diver Mike Spurgeon have logged 34 jumps from a Beechcraft E-18 flying at 10,000 feet.

Eve?

The Air Force has 12 of the ADAM manikins, and they are kept busy. The manikins were manufactured in two sizes. The large model weighs 217 pounds and is 74 inches tall. The small model stands 66 inches and weighs 142 pounds. According to Steve Mehaffie, because both models are capable of measuring the effects of ejection forces on both men and women, there is no need for an EVE. ■

With a little help even a dummy can skydive.

FSO's CORNER

Keeping Tabs on Low Level Routes

MAJOR DALE PIERCE
919th Special Operations Wing
Duke Field, Florida

Shark Attack

■ One constant of the flight safety business is keeping up with your local low level routes. Often, it seems just when you thought it was safe to go back in the water, another shark shows up. When it comes to low level routes, shark species are nearly as diverse as those in the ocean, and some are even more likely than those in the ocean to take a bite out of your unit's hide.

Among others, low level route shark species include changes in civilian air traffic, cultural development, changes in unit mission and aircraft, and ever-changing FAA-controlled airspace.

Civilian Air Traffic

Civilian air traffic is as varied as the models of aircraft and the pilots who fly them. Commercial air routes are generally predictable, and changes to approaches to major airports are well published. Keeping up with these is a fairly simple matter.

However, keeping up with Joe Blow's new VFR-only grass strip located in the middle of IR-555 can be a more formidable task. If Joe plans to do some crop dusting from a dirt strip for less than 30 days, in most states, there is no requirement for Joe to obtain FAA certification

It's surprising how often radio transmission towers are erected across the country. In many cases, it's not only the number of towers, but the height which could pose new hazards to old low level routes.

Although these long, low buildings don't appear to be a hazard, the chicken farmer's concerns will likely force a change in the low level route and exposure to new hazards.

for the strip. Therefore, it's entirely possible for no one to know about the strip except a few local folks. Longer-term strips must be FAA certified, and information on these can be obtained by checking with the FAA Servicing Airport District Office for your region.

Cultural Development

Cultural development may include new towers, new residential subdivisions, or mining operations requiring modified altitude restrictions. Because of FAA certification requirements, tower information can usually be found in the Chart Updating Manual. That is, unless Joe Blow puts up a temporary tower and doesn't bother with certification. Keeping up with residential development can be accomplished easily by making occasional survey flights.

An ex-Wild Weasel operations officer told me he learned from experience to watch out for mining operations employing explosives — keeping a watchful eye on any new activity on "dormant" mines. Overflying such an area at the wrong time can ruin your whole day.

Changes in Mission Tasking

Changes in mission tasking may require more extensive use of low level routes shared with other units. For example, a couple of years ago, we added our aircraft to low level routes in use by other Eglin-area units. In the Eglin area, central scheduling is essential to avoid having two aircraft try to share the same airspace at the same time.

Changes in Military Traffic

Changes in local military aircraft density may result from force consolidation. For example, plans are being formulated to consolidate Army, Air Force, and Navy undergraduate helicopter training (UHT) at Fort Rucker, Alabama. If implemented, this change will shift Navy UHT traffic from the Whiting Field, Florida, area to the Fort Rucker area. Anyone flying low level routes in the Fort Rucker training area will be exposed to increased UHT student traffic.

Changes in FAA-Controlled Airspace

Changes in FAA-controlled airspace are a constant in aviation. The redesignation of airspace categories is but one change. The adding and expanding of restricted areas are a constant problem. Fortunately, the FAA is good about advertising these changes, so checking NOTAMs will help a lot. Checking sectionals for ARSAs (soon to be Class C airspace) will also help to avoid being violated.

Identification and Deconfliction

Identification and deconfliction are just some of the potential problems along low level routes needing identification and deconfliction. You can identify some by making a telephone call, others by cracking the books, and some by having aircrews make each mission a minisurvey flight. Deconflicting your routes will take good staff work and also some creativity.

Once you've identified and deconflicted the threats along your low level route, make sure your low level route abort procedures also take the threats into consideration.

If you have a real-world, low level route horror story, I would love to hear it so I can pass it on to other Air Force FSOs. Call me at DSN 872-5378 or 872-5212 (USAFAWC). I look forward to hearing from you. ■

BRAVELY INTO CLASS

LT COL ROY A. POOLE
Editor

■ Last month, we began a review of the coming airspace classifications. By September 16, we will need to know not only the classifications, but also what kind of restrictions apply. This month, we go bravely into Class B airspace.

Bravery and Class B are more than alliteration. Class B used to go by the name Terminal Control Area (TCA). TCAs were arguably the most restrictive environments for any pilot to enter. Nothing is very different with the name change to Class B.

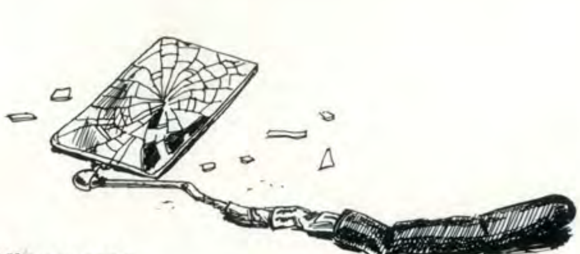
Class B airspace is used for some of the most crowded and dangerous skies in our country. Class B airspace attempts to provide added safety for operations into major air terminals like Los Angeles International, Dallas-Fort Worth, and Chicago-O'Hare.

Like its predecessor, the TCA, Class B airspace requires a working radio in order to receive permission to enter. Pilots may be operating IFR or VFR while in Class B airspace. In either case, Air Traffic Control will provide aircraft separation from all other aircraft. (However, the potential for unauthorized entry into Class B airspace is just as high as we've seen in the older TCA system — don't stop looking outside the cockpit!)

Those aircraft operating VFR must have at least 3 miles visibility and remain clear of clouds. Just because Air Traffic Control has given you a vector doesn't mean you are cleared to violate these cloud clearances.

For many pilots, Class B will remain an area where no one bravely wants to go. But, if you've **b**riefed your crew, **b**ought your life insurance, and **b**eware of other airplanes, you may**b**e will make it safely through Class **B** airspace. ■

MAINTENANCE MATTERS



Mirror error

■ The engine was received from the jet shop and installed on the test stand for an ops check. A tool inventory was accomplished by the 7-level supervisor prior to the engine run, but the supervisor left an inspection mirror and a flashlight in the intake for use by a 5-level who was to perform the final inspection for training.

The trainer completed his inspection and reported no discrepancies. During engine start, when the engine reached 62 percent, sparks and a ball of fire exited the engine. The crew immediately shut the engine down and returned it to the jet shop for inspection.

During the inspection, the JEIM folks found extensive damage to the engine compressor blades and stator vanes. When the turbine section was removed, they found severe damage and the remains of a telescopic inspection mirror.

The lesson to be learned is simple. A thorough tool inventory should be conducted just prior to engine start. ■

"NO STEP"

■ After an uneventful training flight, the F-111's crew chief discovered 60 percent of the right overwing fairing was missing. Further inspection revealed damage to the right horizontal stabilizer rudder and punctures in the right flap spoiler and aft fuel tank.

An investigation by Quality Assurance folks showed the upper wing side seal had been repaired locally with an authorized patch. However, when the corrosion folks painted the repaired area, they did not stencil the "NO STEP" markings as required by the TO.

Because there were scuff marks around the damaged area, it is believed the failure of the fairing was due to maintenance personnel stepping on the "NO STEP" area. An inspection of the unit's fleet revealed numerous aircraft were not properly marked to indicate "NO STEP" areas. A survey of the unit's maintainers showed they were generally unfamiliar with the "NO STEP" areas of the F-111. This is the second failure of an F-111 over the wing fairing in the past 10 months.

WATCH YOUR STEP! ■

Wing Loss

■ During a postflight inspection, the Eagle's crew chief discovered a wing missing from the AIM-7 *Sparrow* missile loaded on a forward launcher. A closer look also revealed minor damage to the aircraft fuselage. A team of maintainers concluded the missile's wing had not been properly installed by the weapons loading team.

According to the Air Force Safety Agency, during the past 11 years, there have been 20 AIM-7 fins lost in flight. The majority of these mishaps were caused by failure of the load crew to ensure the fin was properly installed. Some loaders are under the misconception an audible click indicates the wing is secured and locked. However, tests have shown this is not the case.

In fact, the only way to be sure the wing is properly attached to the missile is by a "Shake/ Pull" test. A vigorous tug during postload and preflight checks will prevent the hazard and embarrassment of losing an AIM-7 wing in flight. ■

OPS TOPICS

Hear and Avoid

■ Stacks of Hazardous Air Traffic Reports (HATR) include the phrase, "See and Avoid" in the analysis of what went wrong and why two airplanes got too close together. In fact, a crew might think the only way to avoid another airplane without the help of radar is with a pair of Mk I, 20/20 eyeballs. However, since the eyes only occupy one side of your helmet, don't bet your life on them.

A formation of B-52Hs recently began a letdown for entry into a low level route. The lead aircraft in this three ship overheard Center clear another much faster bomber onto the route just 2 minutes behind the last B-52. Not wanting his wingman to receive a tailstrike, lead called the Lancer and told it a formation of heavy metal was already on the route, only a few miles ahead. The Lancer remained at high level and clear of the route.

Scheduling problems caused the mishap in the first place, but that's not the issue here. What matters is the use of radios and attentive ears. Many times, we've seen near midair reports which cited the primary means of avoidance was the radio calls which showed two aircraft were on their way to the same spot in the sky.

You may not see much about it, but Hear and Avoid works — try it and see. ■

No, Not You, the "Other" You

■ Sometimes in the course of keeping radio transmissions brief in our crowded skies we all tend to clip off portions of our radio calls. Depending on which items you don't transmit, the airwaves will remain clear and efficient. However, leave out the wrong items, and life gets very messy.

The training jet was cleared for a closed traffic pattern with a tanker approaching 6-mile final. During the closed pullup, the small jet took a bird down the right engine. Established on the closed downwind, the crew shut down the damaged engine and declared an emergency with tower. The crew then advised tower of the need to extend the downwind leg slightly.

Recognizing this would likely bring their aircraft into conflict with the emergency aircraft, the crew of the tanker offered tower an option. They said they could break off the pattern to the right, so "he" could land without turbulence. However, "they" didn't use their call sign during the transmission.

Tower, believing they had just heard transmission from the emergency aircraft, cleared "them" to break out and reenter a 2-mile initial.

As a result, the tanker continued the approach, and the trainer (understanding tower's call was in response to the tanker transmission) began a turn to final. The two aircraft came within 150 feet of one another, and the trainer still had to fly through a portion of the tanker's wake turbulence. The

OPS TOPICS

tanker broke off the approach and the trainer landed without incident.

While there were a number of links in the chain to this near miss, the weakest, and yet the biggest, was the failure to use and verify call signs. As each transmission was made without a clearly identifying call sign, confusion continued to build. Although expediency seemed to be required due to the emergency, it's clear there were some things which should not have been left unsaid. ■

pro fi' cient

■ adjective 1. well-advanced or expert; skilled. 2. adept, competent, experienced, able.

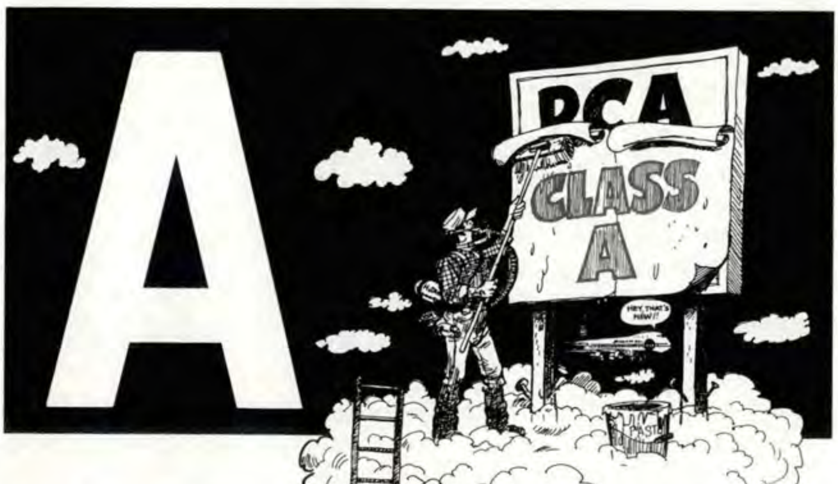
When is a pilot proficient? When the landings are smooth? When the approach is flawless? When the bombs are all shacks? Or does proficiency come as the hours add up?

Often, it's the little things which mark proficiency. Even something as little as a newer style switch in the cockpit. A single-engine fighter pilot recently experienced the effects of limited proficiency.

By his own admission, the pilot's proficiency was not where it should be. All flights were flown with an instructor nearby. During preparation for a refueling, the pilot inadvertently moved the fuel shutoff switch, rather than the switch for the air refueling door due to a lack of proficiency.

The switch was a newer, bulkier type than before. In this particular case, the pilot lacked the proficiency to recognize his error or to correct it before a flameout landing was required.

How do you measure your own proficiency? In an environment as complex as Air Force aviation, every pilot needs to find honest answers to their proficiency levels as missions and aircraft keep changing. Simply meeting the minimum requirements on your last day of currency may not be enough. ■



Remember us? We're not going away and neither is the September 16th change in airspace classifications. Don't miss Class B on page 24.


CAPTAIN
Craig E. Brown

FIRST LIEUTENANT
Jeffrey M. Zeller

48th Fighter Wing
RAF Lakenheath, United Kingdom

■ On the night of 29 October 1991, Captain Brown and First Lieutenant Zeller were flying their F-111F on a terrain-following radar mission in the weather over the Scottish Highlands. While on their IP-to-target run at 540 knots, the left engine compressor section exploded causing a massive fire that lit up the entire left side of the aircraft. The left engine fire light illuminated and the left engine seized.

Captain Brown climbed the aircraft, trading airspeed for altitude, and prepared to eject while Lieutenant Zeller switched the radio to guard and called "MAYDAY." In the climb, the crew applied engine fire emergency procedures, and the visible indications of the fire began to diminish. Captain Brown called a "Knock It Off" and informed his wingman, who was 8 miles in trail, of his situation as he turned the aircraft toward the nearest divert base.

The wingman rejoined and confirmed the fire was out. Lieutenant Zeller completed all required checklists while Captain Brown flew a seized single-engine, straight-in approach. They attempted to engage the approach end cable. However, a hook skip frayed the cable. The crew, using proper braking procedures, was able to stop the aircraft on the runway without further incident.

After emergency ground egress, the crew discovered the extent of damage to the aircraft. The left side of the aircraft had a 6-foot by 2-foot hole, and the tail of the aircraft had numerous holes and fire damage. Furthermore, the left engine casing was gone, exposing the compressor section, and the left stabilator had shrapnel damage.

Despite the severe damage to the aircraft, the crew handled the emergency flawlessly, preventing the loss of a very valuable aircraft.

WELL DONE! ■

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UNITED STATES AIR FORCE

Well Done Award

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

CAPTAIN

Roger W. Mostar

95th Reconnaissance Squadron
RAF Alconbury, United Kingdom

■ On 16 July 1991, Captain Roger Mostar was flying a reconnaissance mission above FL 600 in a TR-1A. Shortly after beginning an autopilot-initiated turn, the aircraft pitched up abruptly accompanied by severe stall buffet. Struggling to regain control, Captain Mostar accomplished emergency procedures. After a few tense moments, he stabilized the aircraft.

A hydraulic selector had failed when the autopilot was trimming in the turn, resulting in full nose-up trim and subsequent loss of all hydraulic system pressure.

Both arms were needed to hold the yoke forward to stabilize the aircraft. Unable to hold the yoke forward for very long using only his arms, he moved his knees in front of the yoke to apply forward pressure. Adjusting the electric seat up and down varied the amount of forward knee pressure and thereby controlled the pitch.

With the loss of all hydraulics, the landing gear provided the only drag for the 1 1/2-hour long descent. A no-flap, straight-in approach was flown to a runway only 8,030 feet long. (A no-flap approach and landing in the TR-1 must be flown so as to arrive over the threshold at approximately 5 feet and just a few knots above stall speed.)

Captain Mostar was unable to slow the aircraft for a safe landing on his first attempt and wisely chose to go around despite his fatigue. On the second attempt, he crossed the threshold on speed, deployed the emergency lift spoilers, and landed approximately 1,500 feet down the runway. He shut down the engine during the rollout, applied the emergency brakes, and stopped the aircraft on the runway.

Captain Mostar's superb airmanship and professional handling of a difficult emergency prevented the loss of a valuable mission aircraft.

WELL DONE! ■


COMING SOON
TO A MOUNTAIN PASS NEAR YOU
WATCH FOR IT!
THE CLOUDS
★ "TWO THUMBS DOWN" ... Cisco and Heavup
★ "HORROR AND SUSPENSE PERSONIFIED" ... Flying Safety
★ "A WHITE KNUCKLE THRILLER" ... USA Everyday
★ "TELL ALL YOUR FRIENDS ABOUT THE BAD ENDING" ... Newsweak
★ "AN UNFORGETTABLE EXPERIENCE" ... Stymie Magazine
★ "DON'T TAKE THE KIDS ALONG" ... Rex Riley