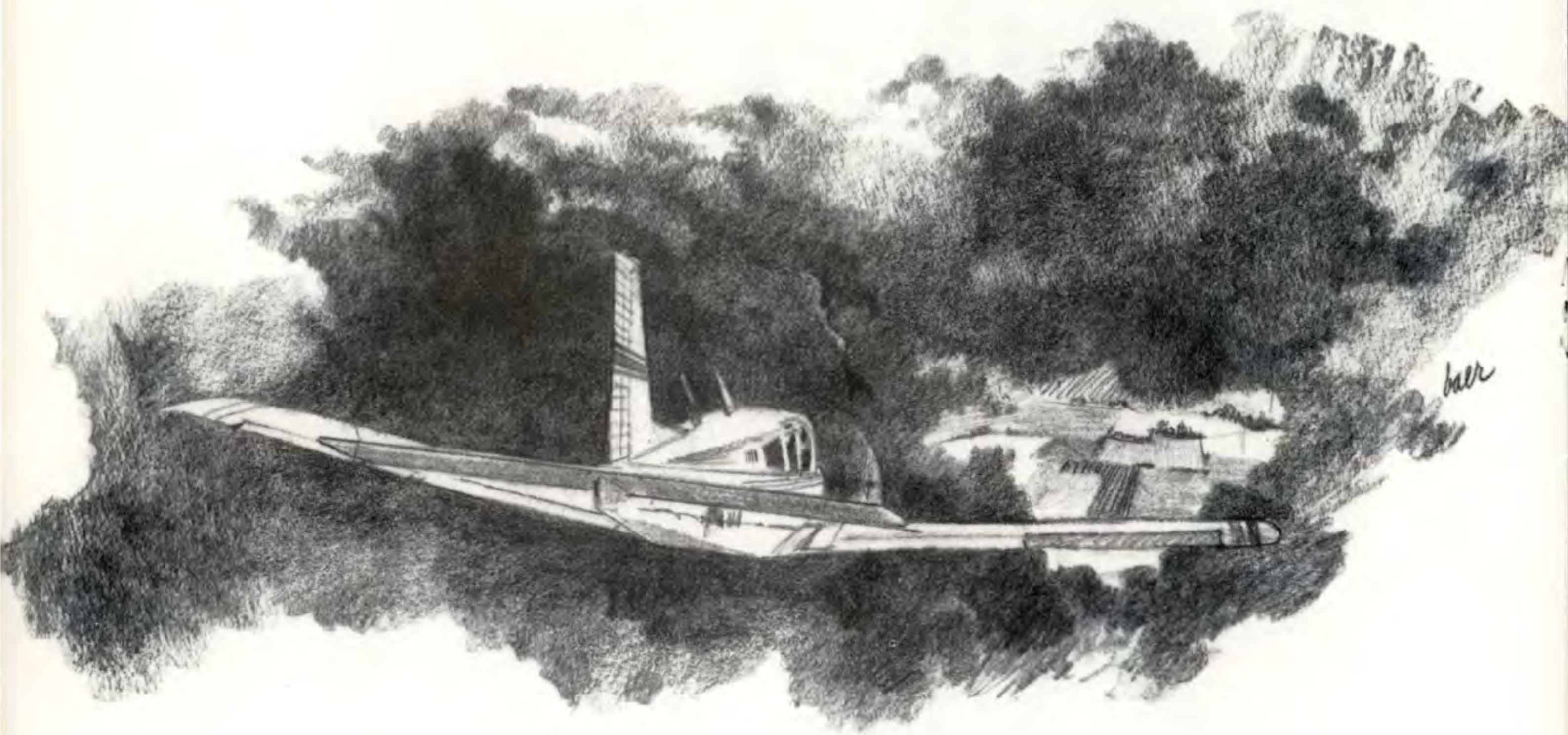
# Flying SAFETY



JULY 1993

# Our Past is Present



# THERE I WAS

■ With my wife and two children aboard, I departed in a PA-28 *Arrow* at 0840 hours local time. The weather was bright and sunny. The forecast weather for the area included a cloud base of 2,000 feet and 5 miles visibility.

As we arrived, I could see the weather seemed to be closing in a couple of miles further south. I called another aircraft which was returning from an aborted attempt to fly to a nearby area, and the pilot advised the weather was unsuitable for VFR.

I called the radar advisory service and told them I would turn around and return to an airport not far away. We sat on the ground there for about 2 hours and talked to the crew of another Arrow and to the local instructor. We departed at 0950 and, upon arrival at our destination, found a 2,000-foot cloud base with 3 nm visibility. I called radar and requested an updated weather for my route but this was unavailable. I advised the service I would continue as the weather appeared to be okay for VFR.

But before long, I had to call radar and advise the weather ahead seemed to be closing in and I would return to the former locality. While clear of cloud, I turned left onto a reciprocal heading. Soon after completing the turn, we were flying in cloud. I called radar and requested guidance from my present position. Visibility was poor and deteriorating. They told me to squawk code 4101. Then, they requested my altitude and confirmation I was still VFR. I replied, "Visibility nil, altitude 1,700. Please provide radar vectoring to destination and clearance to climb."

Radar continued to question me rather than provide vectors and a clearance. Communications then became garbled, and I was unable to understand any more transmissions. I was becoming most uneasy and was considering climbing, even without a clearance, and risking penetrating controlled airspace. I remember saying to my wife, "Better try and slow this thing down," but I have no memory of placing the aircraft into a precautionary mode.

continued

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## SPECIAL FEATURES



## REGULAR FEATURES



### CONTRIBUTIONS

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# THERE I WAS continued

of sighting the ground out of the left window. The aircraft may not have been flying wings level. I may have attempted to level the wings and may have pulled back hard on the yoke.

At 1010, the aircraft struck the ground in a nose-high, left-wing-low attitude at a speed of 80 knots. (The speed was obtained from radar information.) The engine and left wing were torn from the aircraft which skidded along the ground before coming to rest inverted. The engine continued for about another 150 feet beyond the aircraft. Fortunately, there was no fire.

The cloud was down to ground level in the mishap area.

Although I do not remember it, my wife told me I crawled out of the aircraft and then helped the children to get out. I heard a car on the other side of a nearby hill and instructed the children to put on their jackets, take a flashlight, and walk over the hill to where I hoped they would find a road. I told them to try to wave down a car but to stay off the road to ensure they were not hit.

My wife was trapped inside the wreckage for 2 hours. Cutting equipment was needed to rescue her.

In hindsight I have concluded:

■ I should never have allowed radio work to interfere with flying the aircraft.

■ The autopilot should be used in cloud to help maintain straight and level flight. Disorientation can occur all too easily if you are distracted.

■ I had been concentrating on the worsening weather ahead and may not have kept a lookout for the conditions behind. Although I was clear of cloud and had reasonable visibility throughout the turn, there may have been no gaps in the cloud behind. Always ensure you have an escape route.

■ Weather conditions along that route are known for rapid change. On some occasions, it might be wise to plan a route around this area to reduce risk, even if it adds a little time.

Weather forecasts are very valuable but cannot be taken as gospel. A pilot should always have an alternative course of action in mind should the weather present problems along the planned route.

■ Doing the correct thing by avoiding penetrating controlled airspace without a clearance may not be the most appropriate action in all circumstances. On reflection, I feel I should have climbed to a safe altitude before becoming embroiled in a lengthy, radio discussion.

**Editor's note:** Obviously, violations of controlled airspace are illegal and can pose serious danger to traffic operating in the airspace. Nonetheless, emergencies such as the one described above require the pilot to remain in control and carry out an effective escape plan. Remember: AVIATE, NAVIGATE, and COMMUNICATE. ■

# Under Arrest

**CMSGT ROBERT T. HOLRITZ**
Technical Editor

■ As jet aircraft began to replace piston aircraft, the need for a method to arrest heavier and faster aircraft was first recognized by the Navy. As early as 1948, the Naval Air Test Center at Patuxent River, Maryland, began testing a simple, yet effective, emergency arresting system to support its new F7U high-speed carrier jet fighters.

The system consisted of a cable connected to 1,500 feet of surplus anchor chain connected to wire pendants which engaged the hook of the aircraft. As the jet moved down the runway, it dragged increasing lengths of chain behind it which brought it to a relatively smooth stop.

By the end of WW II, the Air Force already had several high-speed jets on the ramp. The F-84, the Air Force's first post-war production fighter, began rolling off the production lines in 1947, and the F-86 made its first flight in May 1948. Because this new generation of aircraft was much faster and heavier than its predecessors, the Air Force, too, saw the need to develop some kind of system to arrest jet aircraft with high landing speeds.

The Aeronautical Systems Division at Wright-Patterson Air Force Base, Ohio, developed the MA-1A arresting system which was basically a refined version of the Navy's system. Since the early Air Force jets did not have tailhooks, the MA-1A barrier consisted of a nylon webbing which, when engaged by the aircraft's nose wheel, throws an arresting cable upward to engage the aircraft's main landing gear.

The MA-1A was used extensively

continued

Because the post World War II generation of aircraft was much faster and heavier than its predecessors, the Air Force saw the need to develop some kind of system to arrest jet aircraft.

A T-38A takes an MA-1A barrier during early tests at Edwards AFB CA. The MA-1A's webbing engages the aircraft and then drags a length of heavy chain to stop the aircraft.

# UNDER ARREST

continued

during the Korean War. While the system saved many aircraft and crewmembers, it was only about 60 percent reliable and usually caused some damage to the aircraft.

### Tailhooks

In 1953, the first of the century fighters, the F-100, entered the Air Force inventory. Weighing nearly twice as much as the F-86, the F-100 proved too much for the MA-1A. It wasn't until 1959, on the recommendation of the Aeronautical System Division, the Air Force decided to equip the century fighters with tailhooks. These hooks were designed for emergency arrestment only. And, unlike the Navy fighters, the pilot could not retract the hook.

The Air Force used two types of hooks on the century fighters. One had a stiff shank hook with air oil dampers. Commonly referred to as the Navy type, these hooks were installed on the F-102, F-104, and the F-105. The other was simply a long, flat spring attached to the fuselage with a Navy hook shoe on the end. These were installed on the F-100, F-101, and the F-106.

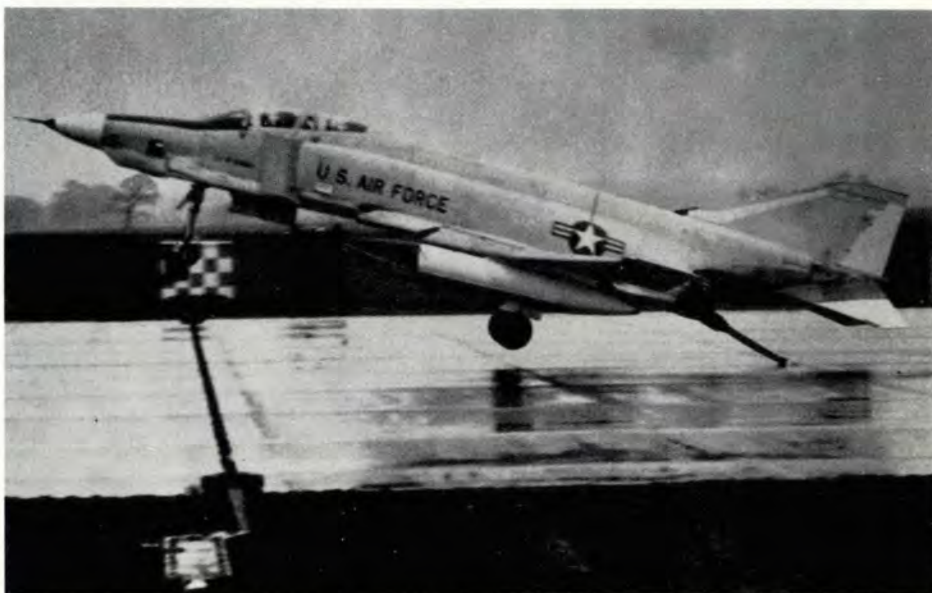
To accommodate the tailhooks, the Air Force procured an arresting system which used water pressure to absorb as much as 50,000,000 foot-pounds of energy. Named the BAK-6, these "water squeezers" were installed at Air Defense Command bases around the country.

Although they were generally reliable and rugged, they had several drawbacks. For one, they had an engagement limit of 160 knots which was too low for the newer aircraft. For another, they were slow to retrieve, and could not, therefore, handle multiple emergencies.

### BAK-9

The BAK-9 arresting system was a joint Navy/Air Force project. The BAK-9 has several advantages over the BAK-6. It uses a rotary friction energy absorber which costs less than one-third of the BAK-6 water squeezer. It can also be reset in less than 4 minutes, can engage an aircraft traveling at 190 knots, and

The aircraft should have all the wheels on the ground when the tailhook engages the barrier. Otherwise damage to the aircraft can occur.




bring it to a stop within 1,000 feet.

### BAK-12

The BAK-12 was developed in the mid '60s and is the system of choice for bases with heavy aircraft. It is a rotary friction system similar to the BAK-9 except there are two separate units placed symmetrically on each side of the runway. The BAK-12 is also available as a deployable system. In this configuration, it is designated the BAK-13 mobile aircraft arresting system (MAAS).

The BAK 12 is the most successful barrier yet developed.

The BAK-13 is a rapidly installed and relocatable arresting system for use at bases in high-threat areas where runways are subject to damage from enemy attack. The BAK-12 energy absorbers are mounted on trailers which can be rapidly anchored in place. The BAK-13 is available at many overseas installations.

### The Approach End

Although departure end arresting systems have been used by the Air Force since the early 1950's, it wasn't until the mid 1960's the Air Force began development of approach engagement systems. The work began in 1964 when a small group of engineers at Edwards Air Force Base, California, conducted a series of tests with an F-100. They concluded approach engagements would be used only for emergencies such as blown tires or unsafe gear.

An approach end engagement has several advantages over the departure type. The primary advantage is the barrier will maintain directional control of the aircraft. Other advantages are a short ground run (1,000 feet) and placing of the crash vehicles because of the known stopping distance. Further, ground crews could quickly foam the runway area just past the barrier (a common practice in the '60s).

Today, both departure and approach engagements are common. The key to a successful engagement is not only training but also a knowledge of the type of arrestment equipment you may encounter. A review of your aircraft Dash-1 and the "Worldwide Aircraft Arresting System Summary" prepared by the Defense Mapping Agency Aerospace Center, which lists just about every airfield with an aircraft arresting system worldwide, can make a barrier engagement safer. ■

F-111 engages BAK 12 during tests in the early '60s.

The BAK 13 mobile system can be rapidly set in combat areas.

## Safety Warrior

# Our Past Pays Off

**PEGGY E. HODGE**
Assistant Editor

■ In the old days, we relied heavily on the flight service station attendant for flying safety. They were great for shooing stray cattle off of the airstrip when necessary, stowing the mail, and seeing to supplies. When you faced a landing in darkness or poor visibility, they would be there to light the airfield with the best means at hand — automobile headlights, oil drums, flares, etc.

But as aviation progressed, his well-intentioned, but crude, operation left safety too much to chance. Aviation has come a long way from those early-day safety measures with significant advances in escape systems, runway lighting, cockpit aids, and system design. Today's safety advances leave little to chance — but getting to this stage was a difficult and often risky process. Here are just a few of the ways we got where we are today.

### Ejection Seats

The Germans first experimented with ejection seats in 1938. They used a bucket mounted on four rollers which moved in two channels. In 1942, Sweden installed an ejection seat in their attack bomber. By 1946, the British had designed and tested its first ejection seat, the Martin-Baker seat. At the end of the war, the United States acquired several of the German seats and catapults which were evaluated for possible application to the F-80 aircraft. However, the German seat was inadequate for the F-80 since the catapult speed was insufficient for safe ejection at the F-80's maximum operating speed. A new ejection seat, patterned after the German seat, was designed in 1945.

The first human ejection test in the United States occurred at Wright-Patterson Air Force Base, Ohio, from a P-61B test aircraft on 17 August 1946. The first emergency ejection from a USAF aircraft occurred from an F-86 on 29 August 1949. Most notably — it was successful!

The primary technical problem addressed in the design of these early ejection seats was clearance of the tail. Since speeds and altitudes were relatively low by today's standards, the main problem was spinal injuries caused by the force of the ejection.

However, as the speed and altitude envelopes expanded, ejection seat design engineers faced new problems. The wind forces encountered at high airspeeds also created problems. Helmets and oxygen masks were being ripped off, and body extremities were being injured due to the high aerodynamic forces.

As speeds and altitudes increased still further, more catapult thrust was required to provide tail clearance. The rate of spinal injuries kept rising as a result of this increased catapult acceleration. Then the rocket catapult was developed — it provided additional tail clearance while decreasing the acceleration level.

To eliminate, or at least reduce, the severity of egress system deficiencies, the Air Force initiated a program in 1967 to develop an advanced concept ejection seat. The seat was to be a rugged, light-weight, easy-to-maintain system with advanced technology subsystems.

The Air Force's ejection survival rate for fiscal year 1992 was 78 percent. There were 57 crewmembers involved in escape system-equipped aircraft mishaps; 32 attempted ejection and 25 of them survived. The most the Air Force ever had in one year was 262 in 1959. Historically, the primary cause of ejection fatalities has been initiation outside the envelope.

Recently, the Air Force initiated a program to develop a new generation escape system. With its Crew Escape Technologies (CREST) Advanced Development Program, a number of technologies will be developed to upgrade current systems which the Air Force plans to retrofit on the current ACES II seat.

**Runway Lighting**

Many advancements have been made in the methods used to light runways. A new generation of approach lighting aids is rapidly being developed to improve visual characteristics, reliability, and to reduce cost.

Some of these systems are already operational, others are undergoing testing, and still others are being refined in the laboratory. The precision approach path indicator (PAPI), the pulse light approach slope indicator (PLASI), and electroluminescent and radioluminescent lighting sources are important aids in runway lighting discussed here.

Developed in England, PAPI is designed to provide sharper and more specific indicators for glideslope position than the visual approach slope indicator. The PAPI display provides five different combinations of light to the pilot, each representing a specific indication of approach position.

The second generation approach aid is the PLASI. PLASI is a single-source unit that uses a pulsing light to provide glidepath information. Deviation below glidepath results in the pilot seeing a pulsing red light, and above glidepath, a pulsing white light. When the correct approach path is flown, the pilot views a steady white light.

Two new technologies have been undergoing research and development and offer promise in augmenting incandescent sources that have been the mainstay of aviation lighting. These are electroluminescent and radioluminescent lighting.

Electroluminescent lights use phosphors sandwiched between two electrodes, one of which is translucent to allow for any light transmission.

The second of the new lighting technologies is radioluminescent lighting. Existing airfield lighting systems require a great deal of energy to operate an airfield. Radioluminescent lighting is totally self-sufficient, requiring no externally provided power source. Light is produced by phosphors activated by radioisotopes.

**Cockpit Aids**

Still in the experimental stages is

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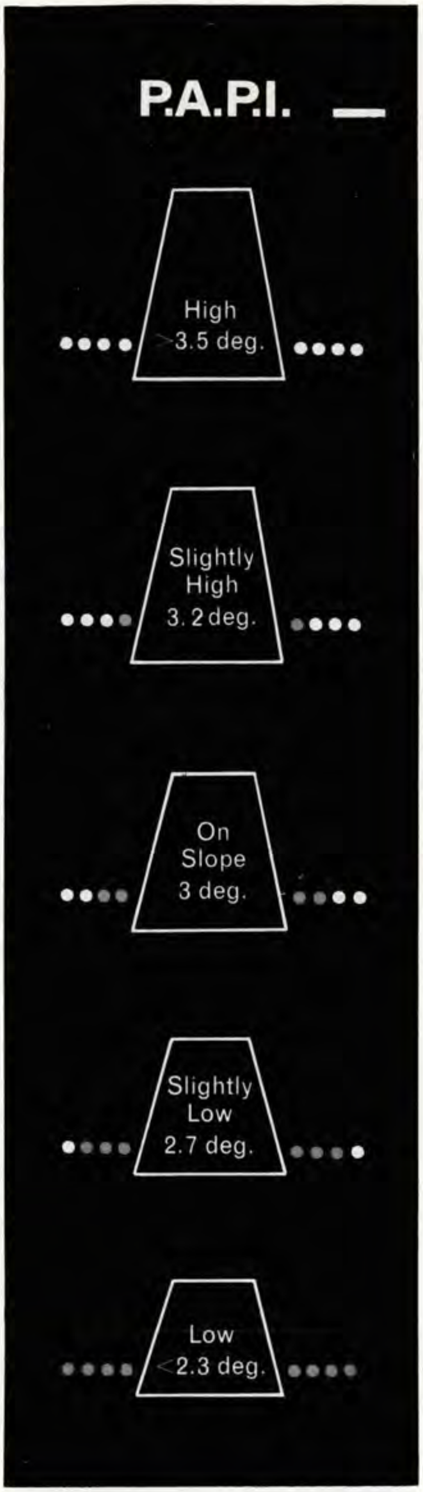
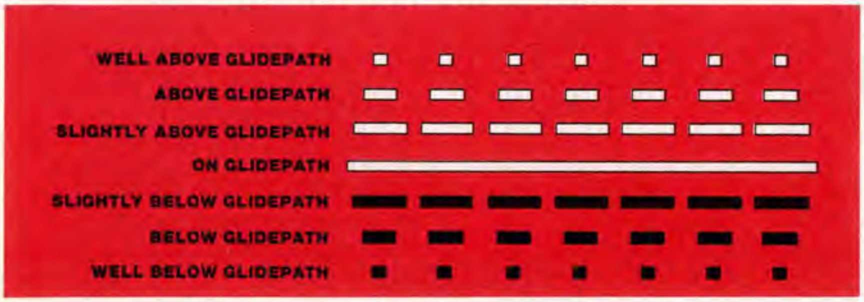



The PAPI uses five different combinations of red and white lights to more accurately display the aircraft's approach angle. The colors transition from all white for a very steep approach to all red for a very shallow approach.

**PLASI LIGHT INDICATIONS**




With the PLASI, the pilot would see a steady white light when on the glidepath. A steep approach would be indicated by pulsing white lights, and a shallow approach would result in pulsing red lights.

the concept of flying by pictures and color coding. The Flight Dynamics Laboratory at Wright-Patterson Air Force Base is working on several programs which gives pilots advanced displays using pictures of flight information and mission status.

Because a person is able to interpret information more easily from pictures than letters and numbers, the Air Force would like to give the pilot pictures to fly by as much as possible. Color coding makes the pictures even more meaningful. For example, enemy threats could be one color — friendly forces, another color.

One specialized adaptation of the fly-by-picture concept is an electronic terrain map. The main display would give airborne pilots perspective views of terrain with both natural and manmade features added. The map would permit pilots to see what's ahead and below despite weather and darkness.

### System Design

There have also been significant advances in aircraft system safety over the years. System safety strives to ensure critical failure modes are eliminated during the design stage of our systems. The Air Force has been a primary participant in the development and implementation of system safety within the military services.

This important role began with the introduction of system safety engineering programs into ballistic missile systems development in the early 1960s. Later, the role expanded into application to aircraft and other systems.

In 1969, the Department of Defense approved Military Standard 882, System Safety Program Requirements, for all Department of Defense agencies and departments to use in developing system safety programs. This was the first military standard issued for system safety.

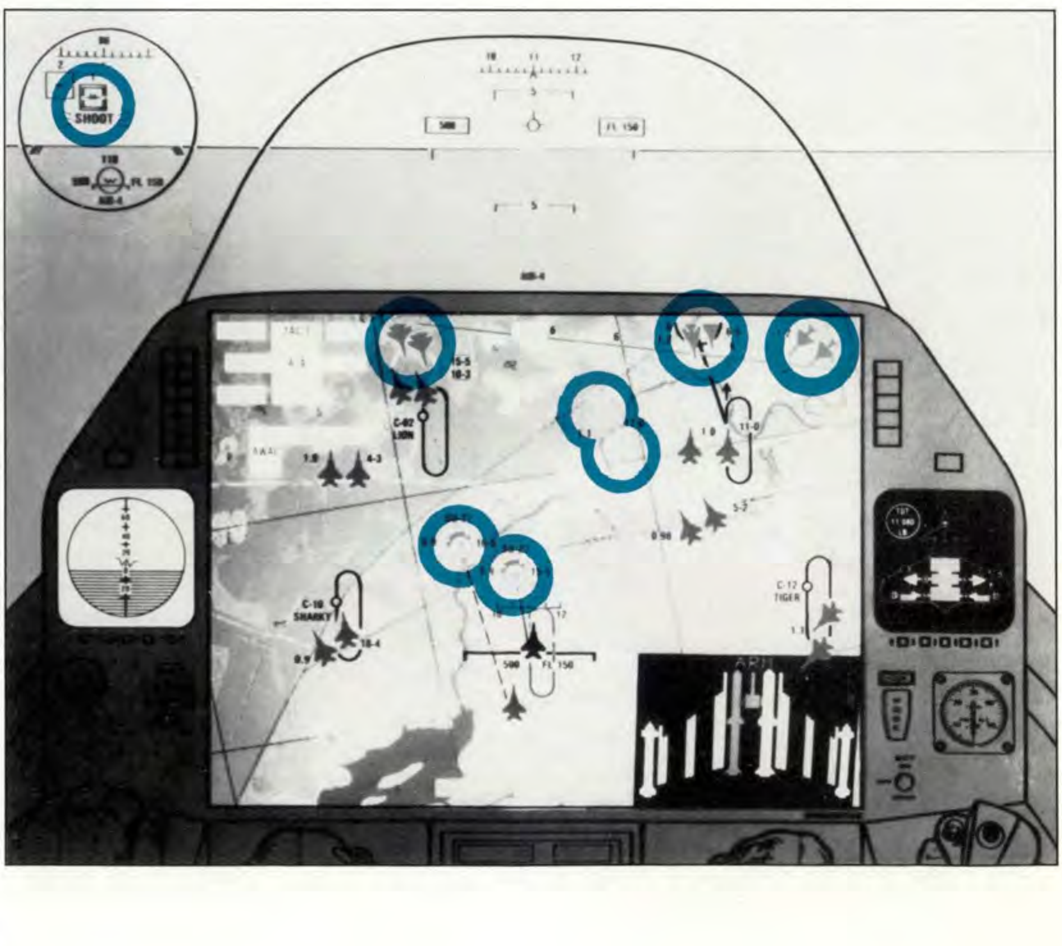
Air Force support of system safety in weapon system development and their activities has been largely responsible for the establishment of the system safety discipline.

### Our Past Pays Off

The bleakest year in flight safety is considered to have been 1943. But only 48 years later in FY91, the Air Force recorded its best year in flight safety. These technological improvements contributed significantly to allow the Air Force to have come so far in safety.

Air Force flight safety has progressed in its programs, practices, and system and technological designs. Continued dedication to this program by the Air Force and its people will ensure safety in the skies. ■

Pilots of the future may control aircraft with voice commands based on information presented to them on TV-like screens.



# I *Think* We're Over Pulaski

MAJOR CHARLES H. McCONNELL

This Safety Warrior article was written in 1948. Even though our equipment and ATC procedures have improved tremendously since then, there are still some good lessons to be learned. We see some of the same problems today such as complacency, failure to properly identify navigation aids, get-home-itis, etc. I'm sure you can see some applicable safety lessons. — Ed.

■ I had just been called back on active duty. The "outside" had been kind enough to me, but like many other World War II pilots, the little flying I did in the Reserve served only to whet my appetite to get back in the big leagues. As I said before, the outside world had been kind to me. A good job, a house, a new car, and the finest wife in the world. I gave up the job, sold the house, kept the car and the wife, and reported as per telegram to Mitchel Field, New York.

At Mitchel, the men in white gave me everything but a saliva test.

"For an old man (I'll be 30 this month), you're in fair to middlin' shape," they said.

Two weeks later I found a home. My boss, a lieutenant colonel, introduced me to the "mahogany bomber" which I was to "fly" 8 hours a day, 5 days a week.

"This," I said to myself, "is not for me."

I walked into the colonel's office like a lion for what turned out to be a heart-to-heart talk. He did the talking, and I did the listening. I came out like a sheep — which had been fleeced.

I guess he felt sorry for me, because 5 minutes after our (or should I say his) talk, he came out to my desk and told me there was a trip to the west coast, and if I wanted to go as copilot, I could.

In less time than it takes to dump the contents of those "in" and "out" baskets into that big double drawer on the lower right side of the mahogany bomber, I was gone.

The flight to the coast was just another trip to the pilot. He was bored stiff. But to me it was as thrilling as my first solo on a PT-19. I even got a big kick out of making position reports. My navigation was, at the start of the trip, a wee bit ragged. By the time we passed the Mississippi, I started to get the hang of the E6B and began hitting the ETAs on the head.

The thought passed through my mind this was a much nicer way to make a living than peddling insurance policies from door to door.

A few minutes later, I began to wish I was back on the ground policy peddling — or, for that matter,

continued

# I *Think* We're Over Pulaski continued

peddling anything — just so long as it was on the ground. We went full bore into the granddaddy of all thunderstorms. Don't ask me why. We had seen this one from about 30 miles back. I guess I figured we would go around it. Still feeling like a kid with a new toy, and for some reason a bit reluctant, I just sat there and never said a word.

Two minutes through the roll cloud I really became a roving commentator.

"Say, maybe it's none of my business, but aren't we on an IFR clearance?" "VFR" was the reply.

That made me mad. "VFR or CFR," I retorted, "I'm getting a change in flight plan."

"We'll be out of this in a few minutes. Keep your shirt on," he replied. And sure enough, in a few minutes we broke out into the clear again.

This fellow, we'll call him Captain Smith, was reported to be a good pilot. I had checked before we left home. But he was careless. I had felt this all the way along the route. There were the little mistakes he made on the flight plan, the fast taxiing, and the hasty pretakeoff check, the low turn out of traffic, and now the flight through the cumulobumpus on a VFR clearance.

This boy, I thought to myself, will stand some watching.

That night we RON'd at Barksdale. We got a room together in the BOQ and shot the breeze for a while. Smith was really a character. I wanted to get on the subject of flying IFR on a VFR but found myself to be just a good listener. And Smith could really tell a story.

The remainder of the trip to the coast was uneventful.

"Coast to coast in 2 days sure does beat house to house for life," I mused to myself as we taxied to the ramp at March AFB.

Coming back, we flew direct to Fort Worth. Flight Service recommended we return to Mitchel via Tulsa, St Louis, Dayton, and Washington because of a terrific squall line lying between Dallas and Shreveport. One look at the pilot reports and we decided we hadn't lost anything at Shreveport, so it was off to Scott via Tulsa.

The trip to Scott was VFR.

The forecaster at Scott was very pessimistic about the weather into Washington. Since we were both tired, I recommended a sack in the BOQ.

"No guts?" was Smitty's reply to my recommendation.

"If you want to go all the way to Mitchel," I replied, "it's okay with me."

We started down the runway just as the sun was dropping behind the horizon.

I made a position report to Wright-Patterson Airways. They advised scattered thunderstorms with most of the area en route covered with stratocumulus clouds. We changed to IFR. We were given 9,000 feet by ATC. For 1 hour after passing Dayton, we were in and out of cumulus clouds.

The radio compass needle was very erratic. Static made the identification of any station absolutely impossible. We tried to work an aural null but could not identify the station because of static. We flew several different headings which led me to believe Smitty wasn't too sure of where we were — other than over North America.

Then it happened. Smith had been trying to locate a station on the compass. The needle settled down and held to 45° on the radio compass indicator. I looked at the magnetic compass. It read 180°. I switched my jackbox to compass position and heard nothing but static.

In a very few minutes, the needle swung around indicating we had passed over the station. Smitty picked up the mike and called Pulaski Radio. I began to feel a little easier about the whole thing when I switched to VHF and listened to Smith's position report.

As he hung up the mike and started to descend to 3,000 feet as instructed by ATC, I reached across and switched him over to the interphone.

"You've got a good set of ears," I said. "I couldn't make out that station identification to save my hide."

"Neither could I," he replied, "but I think we're over Pulaski."

"You think!" I screamed.

That was all I needed. I picked up the mike and called Pulaski. I told them we were uncertain of our position and requested permission to remain at 9,000 until we reached Richmond.

By the time we got back to 9,000, Pulaski informed us we could stay at 9,000. They had no other aircraft reported in the area.

Smith had given our estimated time en route from Pulaski to Richmond as 1:10. Two hours and five minutes later, we reached Richmond. We had been holding a heading of 100° from what Smith had assumed to be Pulaski. From Richmond on into Mitchel, the weather was VFR.

When we landed, I retraced our flightpath from Richmond on the reciprocal of 100° and found we had been over Huntington, West Virginia, at the time Smith started his descent to 3,000 feet. Pulaski is 180 miles from Richmond. Huntington is 300 miles west of Richmond, and Richmond is about 100 miles east of the mountains. If we had descended to 3,000 feet at Huntington, we would have flown most of that 300 miles 2,000 feet underground. ■

## Safety Warrior

# The Early Days

LT COL JIMMIE D. MARTIN (RET)

**Army aviation got off to a slow start. It took the Wright brothers from January 1905 to December 1907 to convince the government they had invented a flyable aircraft.**

Then, Signal Corps Airplane No. 1 was formally accepted on 2 August 1909. But, after all these hurdles were passed, Army aviation was off to a flying start and received enthusiastic support from everyone. Well ... that's not quite how things happened.

General Allen, Chief Signal Officer, asked for appropriations of $200,000 per year through 1910 for aeronautics. He got nothing. One member of Congress reportedly said, "Why all this fuss about airplanes for the Army — I thought we already had one." (Hmmm, sounds like a few years back in my own career when a prominent member of government decided we should build one multipurpose airplane for all the different commands and services to use.)

One of the provisions in the Wright brothers' contract was to train two pilots. General Allen chose Lieutenants Frank P. Lahm and Benjamin D. Foulois. But, before instruction could start, Lt Foulois was sent to France as the US delegate to the International Congress of Aeronautics. Lt Frederic E. Humphreys of the Corps of Engineers took his place as a student pilot.

Wilbur Wright began instructing the lieutenants on 8 October 1909. Lahm got the first lesson, but Humphreys soloed first. On 26 October, with a grand total of 3 hours, 4 minutes, and 7 seconds of instruction, Lt Humphreys made his first solo. Lt Lahm followed a few minutes later with his first solo flight after a total of 3 hours, 7 minutes, and 38 seconds of training.

Lt Foulois returned from France late in October and got three flights with Wilbur, and then Lt Humphreys took over his instruction. Foulois received 3 hours and 2 minutes of instruction, but didn't solo. On 5 November, Lts Lahm and Humphreys were flying together and hit the wingtip on the ground during a low turn. They were unhurt, but the aircraft was so badly damaged new parts had to be ordered from the factory.

While waiting for parts to repair the fleet, the Aeronautical Division

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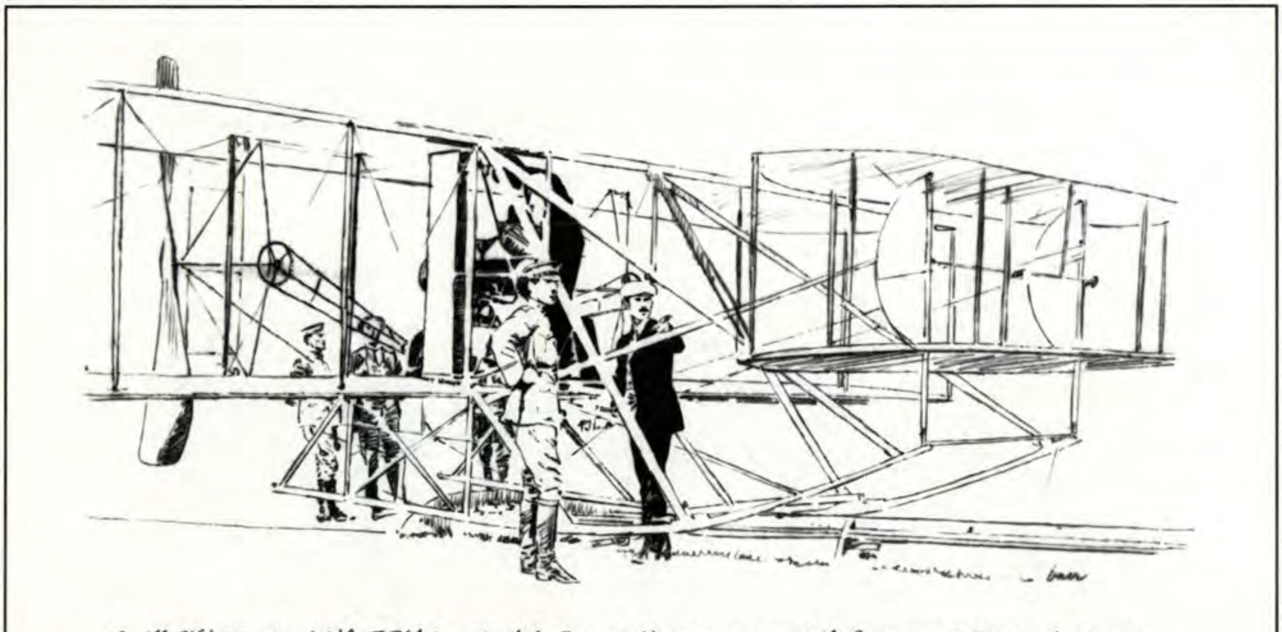


*Orville Wright talks with Lt F.P. Lahm about the Army's first aircraft with Lt. Benjamin D. Foulois looking on.*

Lt. Benjamin D. Foulois and Phil Parmalee sit in the Collier Wright Flyer at Ft. Sam Houston, Texas — March 1911

## Safety Warrior — THE EARLY DAYS continued

suffered its next setback. Lt Lahm was forced to return to the Cavalry because he had been detached for 4 years, the maximum allowed under regulations. Lt Humphreys, who had been assigned only temporarily to the division, was returned to the engineers. That left only one pilot, Lt Foulois, who had a little over 3 hours of flying time but had not soloed.

Winter in Maryland was no place to be flying in an open aircraft with no protection from the cold. So the Army decided to move the airplane to Fort Sam Houston in San Antonio, Texas. General Allen told Lt Foulois, "Just take plenty of spare parts and teach yourself to fly." By the end of February 1910, everything was ready for him to resume his flying. Since he had no instructor, Foulois received instruction by mail from the Wrights. Thus, he became the first correspondence-course pilot in history. He made his first solo flight on 2 March, and by September had amassed a total of 9 hours in 61 practice flights.

Since the Signal Corps didn't get an appropriation from Congress to buy more aircraft or to maintain the one they had, they were only able to give Lt Foulois $150 per year for gasoline, oil, and repairs. Since this was far too little, he was forced to use his own money for essential supplies and equipment. By 1911, in spite of Lt Foulois' best efforts, the plane was in poor condition. Help came from the press.

No, they didn't start a media campaign to force Congress to allot more funds. The help came from Robert F. Collier, owner of *Collier's* magazine. He purchased one of the new 1910 Wright Type B airplanes and rented it to the Army for $1.00 per month. The Wrights even sent along one of their pilots to train Lt Foulois in the new plane since it had a different control system from the one he was used to.

On 3 March 1911, Congress made its first appropriation for Army aeronautics — $125,000 for the year 1912. With $25,000 of the appropriation made available immediately, the Signal Corps ordered five planes at a cost of $5,000 each. Three of the aircraft were Wright Type B's and the other two were Curtiss planes. Signal Corps Airplane No. 1 was in poor condition and completely outmoded by design improvements in the new aircraft, so the War Department donated it to the Smithsonian.

Since the War Department now had planes of its own, it returned the Collier plane in May of 1911. Both the Curtiss and Wright companies sent instructors with the new aircraft, and the Army began to train

The Curtiss IV Model D – Army Signal Corps #2 - 1911

**Air Force fixed-wing pilots fall into two classes — tanker/transport/bomber or fighter/attack/reconnaissance. The first Army pilots also fell into two classes — left seat or right seat pilot.**

new pilots. There were 18 volunteers for aviation duty when the new aircraft arrived at Fort Sam Houston. The young officers were not relieved of their regular duties but had to learn to fly in their spare time. After studying both the Wright and Curtiss planes, the student pilots were allowed to choose which one they wanted to fly.

As you might expect, their safety record was not very good, and there were several crackups. The most serious occurred on 10 May 1911, when Lt G. E. M. Kelly took off on his primary pilot qualification flight in Signal Corps Airplane No. 2, the Type IV Model D Curtiss plane.

The aircraft crashed during landing, and Lt Kelly died a few hours later due to a skull fracture. The commanding general of the Maneuver Division solved the safety problem by prohibiting further flying at Fort Sam Houston. Once again, the flying school moved to College Park, Maryland.

There were many differences in the two types of aircraft owned by the Signal Corps and differences in the training approaches. For instance, the throttle on the Curtiss plane worked the same as the foot throttles on our cars today. To speed up the engine, the pilot pushed the throttle down. To slow up, he relaxed the pressure.

On the Wright airplane, it worked just the opposite. To throttle back, the pilot had to push down on the foot pedal. The engine had so little compression that when the pilot glided in for landing, the engine continued to pump gas. The gas spilled over the side of the engine and ran down on the wing into a metal pan. At least 50 percent of the time, the dripping gasoline caught fire as the pilot added power to taxi in. Consequently, the ground crew had to be standing by to douse the fire as the plane arrived. How would you like to fly an aircraft you knew would catch fire on at least half your landings?

Another early problem with the Wright planes involved the control system. There were two elevator levers, one for each pilot, but only one wing warp or rudder lever. This lever was between the two seats so it could be used by both pilots. This resulted in "left seat" or "right seat" pilots depending on which seat they learned to fly in. This problem was corrected in 1912 when a complete set of dual controls was installed.

Pilot training was much simpler in 1911 than it is today, but there were significant differences in the way pilots were taught to fly. In the Curtiss section of the flying school, the students taught themselves by the "grasscutting" or "short hop" method. The Curtiss airplane didn't have enough power to carry two people, so all flying had to be solo.

The student began with the throttle tied back, leaving only enough power to taxi at about 15 miles per hour and not get airborne. After the student learned to taxi in a straight line, he was given enough power to get about 10 feet in the air. After attaining this altitude, he took his foot off the throttle and landed. After perfecting takeoffs and landings, the student gradually worked into turns and finally was given full power for the first real solo.

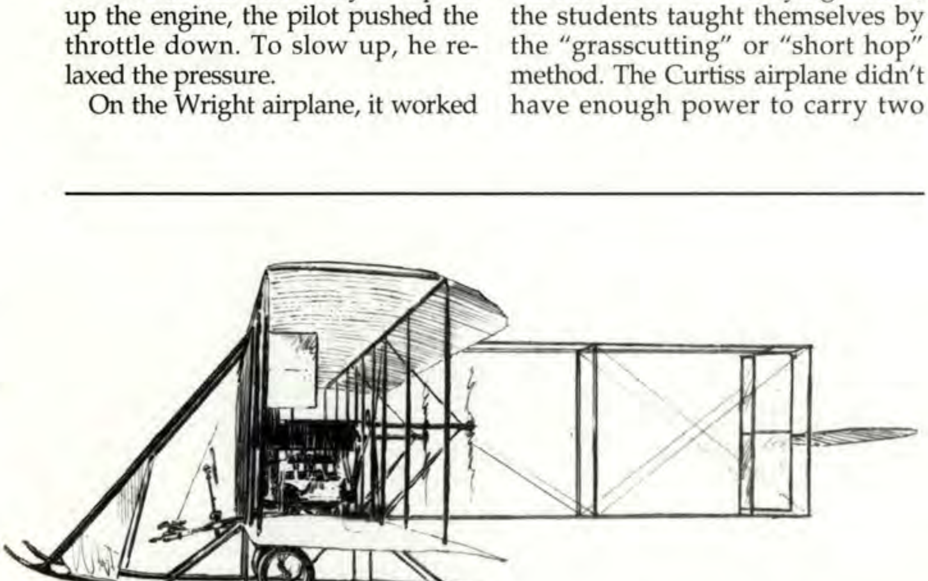
In the Wright section of the school, the student flew with an instructor and was not allowed to touch the controls for a few flights until accustomed to the sensation of flying. The student was then allowed to place his hands on the controls and feel what the instructor did to make the airplane perform the various maneuvers. The next step involved learning to use the control levers, one at a time, starting with the elevator lever.

After learning to control the aircraft at altitude, the student was taught takeoffs and landings. Once the student was cleared solo, the instructor told him how long each flight would be, how high to fly, and what maneuvers to practice.

Today, we look back at many things these early fliers did and marvel at their lack of concern for safety. But, we have to remember we have learned safety as we have learned flying — in stages. These were pioneers feeling their way along with less than wholehearted support.

Many of the line officers considered this newfangled toy a waste of time and money. They saw no practical use for it and preferred to stick to proven concepts. But the fliers persisted and experimented with new concepts which are the foundation for many of the ways we use aircraft today.

These were not daredevils with no regard for safety. They were serious aviators who were expanding the horizons of the Aeronautical Division, the Army, the War Department, and the Nation. ■



*Wright B Model - U.S. Army Signal Corps No. 3 - 1911*


# Aviation Sign Language

**DEAN CHAMBERLAIN**
Associate Editor
FAA *Aviation News*

■ For those airmen who have not seen a recent copy of the FAA's *Airman's Information Manual* (AIM), the good news is part of it is now printed in color. The better news is some of the color illustrates the new standardized airport signs for both pilots and ground personnel. The best news is you have plenty of time to learn about the new signs before they go into effect.

FAR Part 139 airports must have the new signs installed by January 1, 1994. (FAR Part 139 airports are those airports serving scheduled or nonscheduled air carrier passenger operations using aircraft with more than 30 passenger seats.) However, some of these airports started installing the new signs last summer.

Because of the possibility of this ongoing installation process, flight and ground personnel may find a mixture of old and new styles of signs at some FAR Part 139 airports between now and the end of 1993. As part of the sign installation, some airports will be redesignating taxiways. Therefore, it is particularly important to use the latest airport diagram and have the latest NOTAMs and ATIS information when taxiing.

Although non-FAR Part 139 airports are not required to comply with the new sign format, many will probably install the new sign format as older signs are replaced. To accelerate the installation of signs at these airports, the FAA is developing a standard for retroreflective signs.

These signs will appear to be the same as the ones being installed on the FAR Part 139 airports but will not be lighted. Several state aviation agencies have expressed interest in assisting with the installation of the new signs at these particular airports. However, it is conceivable a combination of the old and new signs could exist for many years at non-FAR Part 139 airports.

The new signs are explained in both FAA Advisory Circular (AC) 150/53400-18 (Standards for Airport Sign Systems) and paragraph 2-23 (Airport Signs) of the AIM. Both the AC and the AIM include color examples of the five new types of signs. Ordering information is provided below.

The first new type provides MANDATORY information. These RED SIGNS with WHITE INSCRIPTIONS may mark a runway holding position or other critical operating area, or aircraft prohibited areas.

The second type of sign shows LOCATION. The signs will identify the taxiway or runway on which your aircraft is located. The taxiway and runway signs have YELLOW INSCRIPTIONS on a BLACK BACKGROUND with a YELLOW BORDER.

Two other location signs may be seen as you exit a runway or clear an ILS critical area. The runway boundary and ILS critical area boundary signs have BLACK INSCRIPTIONS depicting the pavement markings on YELLOW BACKGROUNDS. The runway boundary and ILS signs show you when you are clear of these areas.

DIRECTIONAL signs are the third type. These YELLOW signs with BLACK INSCRIPTIONS use arrows to show the direction to various taxiways. If a sign contains more than one message, the messages are divided by a vertical message divider.

Groups of signs are read from left to straight ahead to right. When a location sign is located in the array, all signs for turns to the left will be located to the left of the location sign while signs for straight ahead or turns to the right will be to the right of the location sign.

If it is just a simple intersection, i.e., one crossing taxiway, the loca-

## GUIDE TO AIRFIELD SIGNS (U.S.)

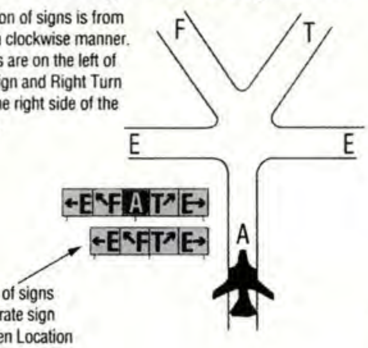
| SIGN and LOCATION | PILOT ACTION or SIGN PURPOSE |
|---|---|
| 4-22<br>On Taxiways at Intersection with a Runway | Controlled Airport - **Hold** unless ATC clearance has been received.<br>Uncontrolled Airport. - Proceed when **no** traffic conflict exists. |
| 4-22<br>Runway/Runway Intersection | Taxiing - Same action as above.<br>Taking Off or Landing - Disregard unless a "Land, Hold Short" clearance has been accepted. |
| * 4-APCH<br>Taxiway in Runway Approach or Departure Area | Controlled Airport - Hold when instructed by ATC.<br>Uncontrolled Airport - Proceed when no traffic conflict exists. |
| * ILS<br>ILS Critical Area | Hold when approaches are being made with visibility less than 2 miles or ceiling less than 800 feet. |
| ⊖<br>Areas where Aircraft are Forbidden to Enter | Do not enter. |
| B<br>Taxiway | Identifies taxiway on which aircraft is positioned. |
| 22<br>Runway | Identifies runway on which aircraft is positioned. |
| *<br>Edge of Protected Area for Runway | These signs are used on controlled airports to identify the boundary of the runway protected area. It is intended that pilots exiting this area would use this sign as a guide to judge when the aircraft is clear of the protected area. |

**Notes:**
1. See the *Airman's Information Manual* for additional information on airfield signs.
2. The signs shown on this guide comply with FAA standards. In some cases ICAO's proposed sign standards differ with FAA's. The asterisk (•) in the left column denotes these cases so the pilot can be aware that some differences may be encountered outside the United Sates.

| SIGN and LOCATION | PILOT ACTION or SIGN PURPOSE |
|---|---|
| *<br>Edge of ILS Critical Area | These signs are used on controlled airports to identify the boundary of the ILS critical area. It is intended that pilots exiting this area would use this sign as a guide to judge when the aircraft is clear of the ILS critical area. |
| B→<br>Taxiways and Runways | On Taxiways - Provides direction to turn at next intersection to maneuver aircraft onto named taxiway.<br>On Runways - Provides direction to turn to exit runway onto named taxiway. |
| 22 →<br>Taxiway | Provides general taxiing direction to named runway. |
| TERM →<br>Taxiways and Runways | Provides general taxiing direction to identified destination. |
| 4<br>Runway | Provides remaining runway length in 1,000 feet increments. |

### Arrangement of Signs at an Intersection

**Note:** Orientation of signs is from left to right in a clockwise manner. Left Turn Signs are on the left of the Location Sign and Right Turn Signs are on the right side of the Location Sign.




Alternate array of signs shown to illustrate sign orientation when Location Sign not installed.

For additional copies contact:
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800 Independence Avenue, S.W.,
Washington, DC 20591
(202) 267-7770

**Time Conversion to UTC (Z)**

| | Add hrs. | | Add hrs. |
|---|---|---|---|
| EDT | 4 | MDT | 6 |
| EST | 5 | MST | 7 |
| CDT | 5 | PDT | 7 |
| CST | 6 | PST | 8 |
| Hawaii & Alaska | | | 10 |

The charts above show the complete set of new airfield signs. The signs will either be red and white (as shown) or black and yellow (shown here in gray tint).

tion sign may be located to the left of the direction sign. Normally, the direction signs will be located on the left side of the taxiway before an intersection. Runway exit signs will be located prior to and on the same side as the exit.

The fourth type of new sign shows direction to specific DESTINATIONS such as runways, terminals, FBOs, specific types of operating areas, and other such locations. These YELLOW SIGNS with BLACK LEGENDS show direction several ways. An abbreviation (minimum of three letters) for the area with a directional arrow may be used. If two areas share the same direction such as two runways, the runway numbers will be separated by a dot. A directional arrow would then point in the common direction. If a sign shows separate routes for different locations, the information will be separated by a vertical black message divider line.

The last of the new standardized signs shows RUNWAY DISTANCE REMAINING. Although these signs are not required by FAR Part 139, many airports are installing them. The signs have a BLACK BACKGROUND with WHITE NUMERALS and may be installed on one or both sides of a runway. The signs indicate the remaining runway distance in thousands of feet with the last sign, showing the numeral 1, at least 950 feet from the end of the runway.

We have only shown a few of the new signage here. To make sure you are up on "the signs of the time," get a copy of the AC or AIM. A busy airport is no place to lose your way. ■

**Editor's note:** Copies of AC 150/5340-18 are available from Department of Transportation, M-484.1, Distribution Requirements Section, Washington DC 20590. Copies of the AM can be purchased from the Superintendent of Documents, US Government Printing Office, Washington DC 20402. Telephone number is (202) 783-3238. The AIM stock number is 750-00100000-9.

Contact your local FAA Accident Prevention Program Manager (APPM) to view a 25-minute videotape called "Aircraft Surface Movement — What every pilot should know about airport markings, lighting, and signs." You can also obtain copies of the reference card above called "Guide to Airfield Signs (U.S.)" from your APPM.

And remember, at towered airports you can still ask ATC for progressive taxiing instructions.

# IFC APPROACH

By the USAF Instrument Flight Center, Randolph AFB, TX 78150-5001

# The Fat Lady Doesn't Sing Till Yer Done Taxiing

**MAJOR MARK CATO**
Air Force Flight Standards Agency
Instrument Flight Center


■ Geez, what an awful mission. The forms were missing, the communications were a mess, ATC was doing their best to max out our frequent flier miles, and — to cap off a perfect day, we had to shoot the approach to minimums in real-live, sweaty-palms goo (a feat we have not been required to perform since a Canadian team won the Stanley Cup *and* the World Series).

The pucker factor was so high even the adhesion strength between the metal and the dull gray paint on the seat bucket had been put to the test. However, we've successfully mated rubber to asphalt once again, so all that is left now is a no-brainer taxi to the stables, debrief, food, and sleep. NOT!

Even something as simple as taxiing poses a threat to the unsuspecting pilot. Now, we're not just talking a potential bent wingtip or a lighthearted romp through the infield. We are talking about downright serious buffoonery.

Of the 75 taxi incident reports received through NASA's Aviation Safety Reporting System (ASRS) — a nonattribution system for reporting errors — most involved taxiing onto a runway without permission. Although many of the examples we'll look at involve civilian pilots, the lessons learned apply to us, the military pilots, as well.

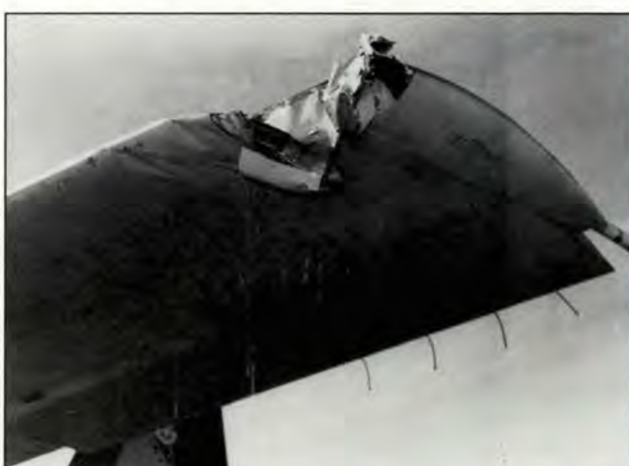
Taxiing onto a runway without permission can have deadly consequences. In fact, the worst mishap in aviation history occurred in 1977 at Tenerife, Canary Islands, when a 747 attempted to taxi across a runway being used for takeoff by another 747, and 583 crewmembers and passengers were killed.

Fortunately, not all runway incursions involve mishaps, but the potential for catastrophe accompanies each mistake. While there is a national effort to reduce these runway incursions, such as the recent requirement to repeat hold-short clearances, FAA figures show the percentage of pilot-caused runway incursions has increased since 1988. According to the FAA's Office of Safety Analysis, of the 224 unauthorized runway entries reported in 1991, 41 percent were caused by pilots.

So how can we make the complete mission safer? Let's take a look at some of the answers.

### #1 Cockpit Resource Management

Keeping taxi mishaps or incidents



Cockpit resource management could have prevented this C-130 taxi mishap.

Is the taxiway capable of supporting the weight of your aircraft?

to a minimum is really a matter of proper cockpit resource management. Take tasks in sequence, and do not let trivial matters or duties interfere with more important tasks. SPEAK UP IF SOMETHING IS WRONG OR POSSIBLY WRONG. Don't be afraid, even as the junior member of the crew, to speak up. The only stupid question is the one which isn't asked.

In numerous recent mishaps and incidents, a contributing factor was someone intimidated by the rank or position of the person "driving the bus." These less experienced or less senior people felt something was wrong or knew it was wrong but apparently felt "Hey, the boss knows what's happening." For some, it is the last decision they ever made.

#### #2 Reduce Distractions

Proper cockpit resource management reduces distractions in the cockpit. Taxi mishaps are frequently blamed on distractions such as completing checklists, obtaining weight and balance information, loading flight management computers, etc. Other causes were blocked radio transmissions (a key factor in the Tenerife mishap); a mindset to taxi to a particular runway when another runway is in use; or rushing to make an "on time" takeoff.

Some unauthorized runway entries occurred because the pilot did not hear the clearance to hold-short. Having the copilot obtain a clearance at the time the aircraft commander is talking to command post, squadron operations, job control, etc., may take you both out of the taxi equation. Let's face it. No matter how many electrical gewgaws we put on an airplane, they're still really stupid when it comes to looking for ground obstacles or knowing when it is time to take the active runway.

The initial call to ground or ramp control should not be initiated until both pilots are monitoring the frequency. We don't just mean having it toggled up, we mean really listening. This will ensure both pilots know what the clearance is and can compare notes to ensure it is understood. Clearances at large airports, especially unfamiliar ones with strange-sounding names, routes, etc., are unfamiliar, so write them down.

If there is any doubt about your taxi clearance, query the controller. Whenever a hold-short clearance is received, if the other pilot fails to acknowledge the hold-short clearance, challenge them to ensure they heard it. For example, the copilot reads back the hold-short clearance, and when off the radio, the pilot says "Hold short of runway X?"

ASRS narratives show the effects of distractions on the flight deck.

"I was busy running checklists and not looking outside."

"My copilot was busy getting our weight and balance data and loading it into the computer. Had he been more in the loop, he might have had time to review his taxi chart and point out I was going the wrong way."

"We took off, and to this moment I do not remember being cleared for takeoff. This had the potential for a 'Canary Islands' takeoff mishap."

#### #3 Write Down the Taxi Clearance

Make it a habit to write down the taxi instructions and repeat back hold-short clearances. We write down clearances for flight because the routings are complex and unfamiliar. Operations away from Base X can be the same with unfamiliar layout of runways and taxiways. How well would you do at Chicago's O'Hare International?

#### #4 Review the Airport Diagram Prior to Taxi

Ensure all members of the cockpit crew, whether single seat or multiplace, review the airport diagram before beginning to taxi. It's common sense, but often ignored. We've planned the mission down to the last detail, so why not figure out how to get safely from the chocks to the active runway and back? Many runway incursions occurred because

continued

the pilot(s) were disoriented while taxiing, sometimes because of a lack of conspicuous taxiway markings and signs.

#### #5 Display Diagram Where It Can Be Seen

Put the airport diagram inside your cockpit where it is readily available for reference and in plain view at all times. Now, this one is a bit more difficult for fighters and some trainers who have a nice open cockpit and giant paper-eating engines looking for an early lunch. We can't exactly tell a pilot how to do it, but to be effective, the diagram should be located where it can be seen without diverting eyes too far or too long from the taxiway. As #1 said, crew coordination is critical. "At the time all eyes are down in the cockpit, something unexpected happens outside the cockpit." (Murphy)

#### #6 Clear Taxi With the Ground Crew

A quick question: What is the fastest way to tick off a crew chief? That's right — forget to clear them away from the aircraft when starting to taxi. Don't taxi until the ground crew has given the "all clear." Make sure at the same time the flight deck crew watches for obstacles, both moving and stationary. We know of a mishap where a "bread truck" raced to get around a taxiing aircraft. The truck lost the race, but then again so did the pilot who hit the truck with a wingtip.

An ASRS report illustrates the hazards associated with starting to taxi without obtaining the "all clear" signal from the ground crew (marshaler). A jump seat rider stated:

"The captain pushed up the power and released the parking brakes even though he had not received the required salute and release from the push back ground crew. When the copilot looked up, he found the wide body aircraft moving between 5 to 10 mph.

Knowing we had no clearance from the ground crew, and unable to see the ground crew under the nose, the copilot slammed on the brakes to stop the aircraft. Three flight attendants were slammed into the bulkheads and injured, one seriously."

Most of us look at this incident and figure it is not applicable to Air Force aircrews. After all, we don't normally use push back and all movements on the ramp are approved by ground control.

True statements, but let's look at this scenario. We've had to bag drag to another jet and are behind the power curve on timing. We're really humping to get this bird off the ground. After signaling the marshaler we're ready to taxi, how closely do we watch the marshaler? Instead, are we running the checklist or possibly thinking about something else? For most aircraft, the marshaler is the only person who can see all quadrants of the aircraft. As we've seen before, being geared to something besides actually taxiing the aircraft can get people hurt.

#### #7 Be Careful on Inactive Runways

Use caution when taxiing on inactive runways, especially when they cross an active runway. Runways are marked for takeoffs and landings, they are not marked for taxiing. Therefore, the usual cues, such as hold lines for intersecting runways, will probably not be there. Some runway incursions occurred because these visual cues were not present, and the pilots inadvertently taxied onto or across an active runway.

#### #8 Watch for Hold Lines

While on taxiways, watch carefully for taxiway and runway hold lines. The basic hold line normally lies parallel to the runway and consists of two continuous and two dashed lines, each spaced 6 inches apart. When approaching the hold line (from the side with the continuous lines), do not cross them without ATC clearance at a controlled airport, or without making sure you have adequate separation from other aircraft at an uncontrolled airport. Do not cross hold lines unless all crewmembers agree clearance to enter a runway was received.

#### #9 Review the Airport Chart Before Landing

We need to use special care where the turnoff taxiway crosses another runway, be it active or inactive. Remember, when clearing a runway after landing, a pilot must not turn onto another runway without authorization from tower. Previous study of the airfield layout will develop situational awareness.

We all know the danger of a midair collision exists, but statistically the chances are three times greater we will run into another aircraft, vehicle, ground personnel, or other object rather than striking another aircraft while airborne. So the bottom line is taxiing must be treated as a continuing portion of the flight which does not end until chocks are in and engines are shut down.

The IFC would like to thank NASA's ASRS and author Robert Sumwalt for their permission to reproduce portions of this article. For questions or comments, the IFC 24-hour number is DSN 487-3077. ■

# Hey lead, where are you going?


**LT COL JOHN VOSS**
Chief, Aeronautical Information Division
Air Force Flight Standards Agency
Instrument Flight Center


■ The F-15s had planned a short, four-leg low-level from Bitburg to Low Fly Area 8 to bump heads with some Hornets from Sollingen. As the flight arrived at the second turn point, the flight lead turned to the new heading and selected the next destination on the INS control panel.

Oh great! The bearing pointer swung around to about the 8 o'clock position on the HSI, and the DME wasn't even close to what he had flight planned. A quick "alpha check" with No. 2 confirmed the preplanned heading was correct, leading him to the obvious conclusion he had clearly fat-fingered the wrong coordinates into the Inertial Navigation System (INS). Well, no harm done. A good map and an alert wingman had kept him honest.

The B-52 was on the Area Navigation (RNAV) portion of the mission. They were proceeding RNAV direct to the Sausalito TACAN when Center called up and said something cute like, "Buff 11, where do you think you're going?" A few quick exchanges of information between the Nav, the AC, and Center finally confirmed Buff 11 was heading to an empty point in space about 60 miles south of the Sausalito TACAN.

The Nav was not happy and more than a little confused. He had used the IFR Supplement coordinates for the TACAN and had not made a data entry error. Center said the TACAN was at 122°N and the IFR Supp listed it as 121°N. Had the TACAN moved? Not hardly, but Center was right. The crew "fixed" the immediate problem by following Center's vector, but they didn't forget about their inadvertent excursion into unsanctioned airspace. When they got home they did some serious investigation, which ended with a phone call to the Instrument Flight Center.

What do these actual scenarios have in common and why make a big deal out of it? Well, in the first situation, I made a mistake while entering data into the INS and almost went the wrong way. In the second situation, the Buff Nav did everything right and still ended up heading in the wrong direction. In both situations, we were expecting our navigation systems to take us where we wanted to go, but something went wrong.

Technology is allowing all of us to do a lot more coordinate-based navigation. That's a new buzz word for things like LORAN, INS, and Global Positioning System (GPS). These are all great systems which take a big workload off the aircrews; however, each of these systems requires a very

continued

# Hey lead, where are you going?

continued

The systems we are using in our aircraft are fantastic; however, we must not let them replace good solid airmanship.

accurate data base of waypoints or coordinates. Some of this data comes from digital data bases provided to a mission planning or navigation computer and some from aircrew manual data entry. The digital data bases themselves can come from various DOD or commercial sources. In both digital data bases and manual entries, a human must input information into the system at some point. This means Murphy's Law applies — if an error can be made, it will be made.

In the case of the Sausalito TACAN, a Defense Mapping Agency (DMA) analyst had been given a change to the TACAN coordinates (122°31.3 to 122°31.4), and, in turn, forwarded them to the contract printer of the IFR Supplement. Somewhere in the paperwork, the 122 got changed to 121. No small mistake! What's worse is nobody found the error until Buff 11 was headed into never-never land. Once the error was identified, a quick NOTAM was published and DMA advised of the mistake; however, the damage had already been done. Fortunately in this case, it wasn't serious.

The human factor has always been a part of aviation. Since pilot training, we have been taught to look for and try to compensate for our own mistakes. All of this new technology makes it even more possible for us aircrews to become victims of someone else's mistakes. We have also developed the tendency to think if something comes from a computer it's correct.

If you are not currently flying with a coordinate-based navigation system or mission planning on a computer system, you are in the minority of Air force aircrews and there is no way you will avoid these systems for long. It is not a slam against the providers of these systems, but we can't bet our lives on their perfection. In the case of the F-15s, the wingman was there to back up the flight lead, and they had a hard copy map for dead reckoning.

In the case of the B-52, air traffic control came through with the correct information. What about those of you who are flying into previously uncharted territory on a regular basis? Who is checking your six in Somalia or Eastern Europe? We must not let our guard down. The guy who publishes the mistake in some computer data base leading your crew into the side of a mountain won't ever know it. The systems we are using are fantastic; however, we must not let them replace good solid airmanship.

What can we do to help each other? First, keep flying smart. Just like "the old days," flight plan your entire mission. Use the computers and all the magic, but wherever possible, doublecheck the products and, of course, use dead reckoning. The responsibility for the safe conduct of the flight has been and will always remain with the aircraft commander, not the computer. For years, we have used FLIP paper products and come to trust them, but just like with Buff 11, mistakes can happen. Second, when you find a mistake of any kind, let someone know. There is an easy way to do this — the new IFC Comment Card (AF Form 3546). It is a stamped card addressed directly to the IFC and will get you a phone call with an answer (see *Flying Safety* magazine, Feb 93).

If you feel the mistake is a safety of flight problem or needs immediate attention, call the IFC directly and we will take whatever action is necessary (NOTAM, Urgent Care Notice, etc.).* The important thing is, don't keep it a secret! No one knows how long the Sausalito TACAN coordinates would have been wrong or what unfortunate circumstances might have occurred if the B-52 crew had not been professional enough to take the time to fix a known mistake.

DMA and the services are doing a lot of work towards developing the paperless cockpit. It won't happen overnight, but you can expect to see new FLIP products headed in that direction. Quality remains high on the priority list, and the IFC is dedicated to providing all aircrews the best FLIP products possible. We eagerly solicit your inputs. Don't forget, it is you and your crew who are on the line. Help yourself and help others. Check six and fly safe. ■

*IFC 24-hour answering machine is DSN 487-3077. FAX number is DSN 487-4904. See FLIP General Planning Chapter 11 for more information.

# There's a Good Reason They're Illegal

Reprinted with permission from Bulletin of the Civil Aviation Medical Association.

**Drugs of abuse and addiction have one effect in common — they are used for their effects on the brain and central nervous system. The best advice we can give all operations and maintenance people — don't ever take any of them not prescribed by your doctor.**

### Background

■ In December 1989, the Department of Transportation (DOT) mandated individuals holding certain "safety-sensitive positions" within the transportation industry be randomly tested for drug use. This program is a part of the national drug abatement program. Although it is sometimes touted as such, it is not a fitness-for-duty safety program, nor is it designed to be. It is intended to curtail illicit drug use.

The program is based in part on Department of Defense experience with the military services. In the past, illicit drug use was considered to be a problem, so the armed forces began a program of random urine testing. Over the years, this program has been credited with decreasing illicit drug use among military personnel. It seemed natural enough to adopt this technique in the transportation industry.

### Drug Selection

The DOT consulted with the National Institute on Drug Abuse (NIDA) and chose what has become known as the "NIDA Five" for urine drug testing. There are actually seven drugs in the test program, but two are from similar groups — thus the references to five drugs.

All drugs of abuse and addiction have one effect in common. They are used for their effects on the brain and central nervous system. One of the more easily understood classification schemes makes use of four basic drug effects. Addictive drugs may be considered as sedatives, stimulants, hallucinogens, or opioids.

### Sedatives

This group of drugs includes the so-called tranquilizers; e.g., benzodiazepines, etc., barbiturates, bromides, and the most used of all, ethyl alcohol. While beverage alcohol differs from the others, it is a legal drug which requires no prescription — all are addicting — with potentially serious and even fatal conse-

continued

Marijuana is the most frequently used illicit drug. Small smoking pipes, like the one above, are used to smoke the dried leaves of marijuana.

# There's a Good Reason They're Illegal continued

quences. Not too many years ago, one of the benzodiazepines, Valium®, was the most prescribed drug in the USA.

Addiction to sedatives is characterized by performance decrements worsened with larger and larger doses. Tolerance to a given dose is usually seen early in the addiction; i.e., it takes more of the drug to produce the same effect. Withdrawal symptoms are also common with sedative addiction and can be life-threatening.

While sedatives can pose a safety hazard for some occupations, there are no sedative drugs on the NIDA proscribed drug list. Obviously there *should be* concern from the public safety standpoint about any vehicle or machinery operator who is found to be using sedatives. These concerns must be managed by company rules and procedures.

### Stimulants

Three of the seven NIDA test drugs are found within this group; i.e., cocaine, d-amphetamine, and d-methamphetamine. Of the three, cocaine is by far the most commonly found. All are addicting, but the addiction has a strong psychological component and much less of a physical component. Some performance measures do improve when under the influence of a stimulant. After a period of stimulant use — a "run" as it is sometimes called — a "crash" occurs as the exhaustion following continued stimulation can no longer be put off. The prolonged and dangerous withdrawal seen with sedatives is not commonly found with stimulants. On the other hand, stimulants can and have caused sudden death during the acute drug effect stage.

Interestingly, all three of the above stimulants are legal drugs. Physicians can and do prescribe them for legitimate medical purposes. For example, cocaine may be used during nasal surgery, during suturing of minor lacerations, for tear duct surgery, and during gastroscopy. The amphetamines are sometimes used for weight control, for attention deficit disorders, and for certain sleep disorders. Therefore, the presence of any does not automatically mean the specimen donor is a drug abuser. A careful medical analysis will be needed to avoid falsely accusing someone of drug abuse.

The problem becomes even more complex because certain other medicines can also result in a finding of amphetamines in the urine. A new drug used to treat Parkinsonism and some depressions may cause a positive urine test. A Vick's® inhaler, available at most drug stores on an over-the-counter basis, may also result in a positive test. Very sophisticated laboratory work is required to tell the difference. Unfortunately, not even all NIDA-certified laboratories are able to carry out that work. Any physician charged with the final determination must be sure the specimen donor is not falsely accused when a cold or early Parkinson's disease is the culprit.

Paradoxically, a number of street drugs of abuse, called "designer drugs"; e.g., "Eve" and "Ecstasy," etc., also belong to the amphetamine family. They are not included among the NIDA test drugs. A NIDA test will report a specimen as negative which contains any other amphetamine than d-amphetamine and d-methamphetamine. Just as a positive test does not always mean drug abuse, so a negative test does not always rule it out.

### Hallucinogens

Two drugs — marijuana and phencyclidine (PCP) — are the NIDA test drugs in this group. Of all seven NIDA drugs, only PCP is absolutely illegal in the U.S. It was originally developed for anesthetic use, but there were so many unwanted side effects it was finally classified as a drug with no medical uses. It is rarely found during urine testing although small amounts are

Cocaine powder or "crack" cocaine crystals produce unpredictable and potentially deadly effects when smoked or inhaled.

apparently used in Washington DC and on the U.S. West Coast.

Marijuana is the most common of all drugs used illicitly. Yet even marijuana has some legitimate medical properties. A handful of individuals have special permission to use active components of marijuana. It is helpful in treating the nausea and vomiting which often occur with chemotherapy. Legal uses are easy enough to determine, however.

The overwhelming majority of positive marijuana urine tests represent illicit use. Many such users will try the passive inhalation excuse; i.e., they were at a rock concert or in a car where others were smoking marijuana. The laboratory sensitivity values are set such that this exposure will not cause a positive test. If a urine specimen is positive for marijuana under these circumstances, it is because the donor smoked or ate it directly!

Once again, however, a negative test does not rule out intoxication with a hallucinogen. No other drugs, e.g., mescaline, LSD, peyote, etc., will be reported by a NIDA laboratory even if present.

**Opioids**

The remaining two drugs in the NIDA urine battery are morphine and codeine. When found, they are among the most difficult to assess. Morphine is one of the best painkillers known. For that reason, it is used in almost every hospital in the U.S. to alleviate severe pain.

Codeine is also an excellent painkiller, particularly for sprains, following dental work, for menstrual cramps, and so on. It is also used for cough suppression. Although it can be addicting, it is relatively safe and is used in large quantities for the outpatient management of moderate pain. In some states, it is available in small quantities over the counter as in Canada and other neighboring countries. The body metabolizes codeine to morphine which is then found in the urine.

Morphine is a major product of heroin. That's why both morphine and codeine are tested under the NIDA rules. The intent is to find heroin users. Unfortunately, morphine can also be found in the urine of someone who has recently eaten poppy seeds. (Natural morphine comes from poppies as do poppy seeds.) Therefore, urine specimens which test positive for morphine or codeine are among the most difficult of all to manage. A careful history and physical examination may be necessary to discriminate between someone who innocently ate poppy seeds, a codeine abuser, or someone who uses heroin.

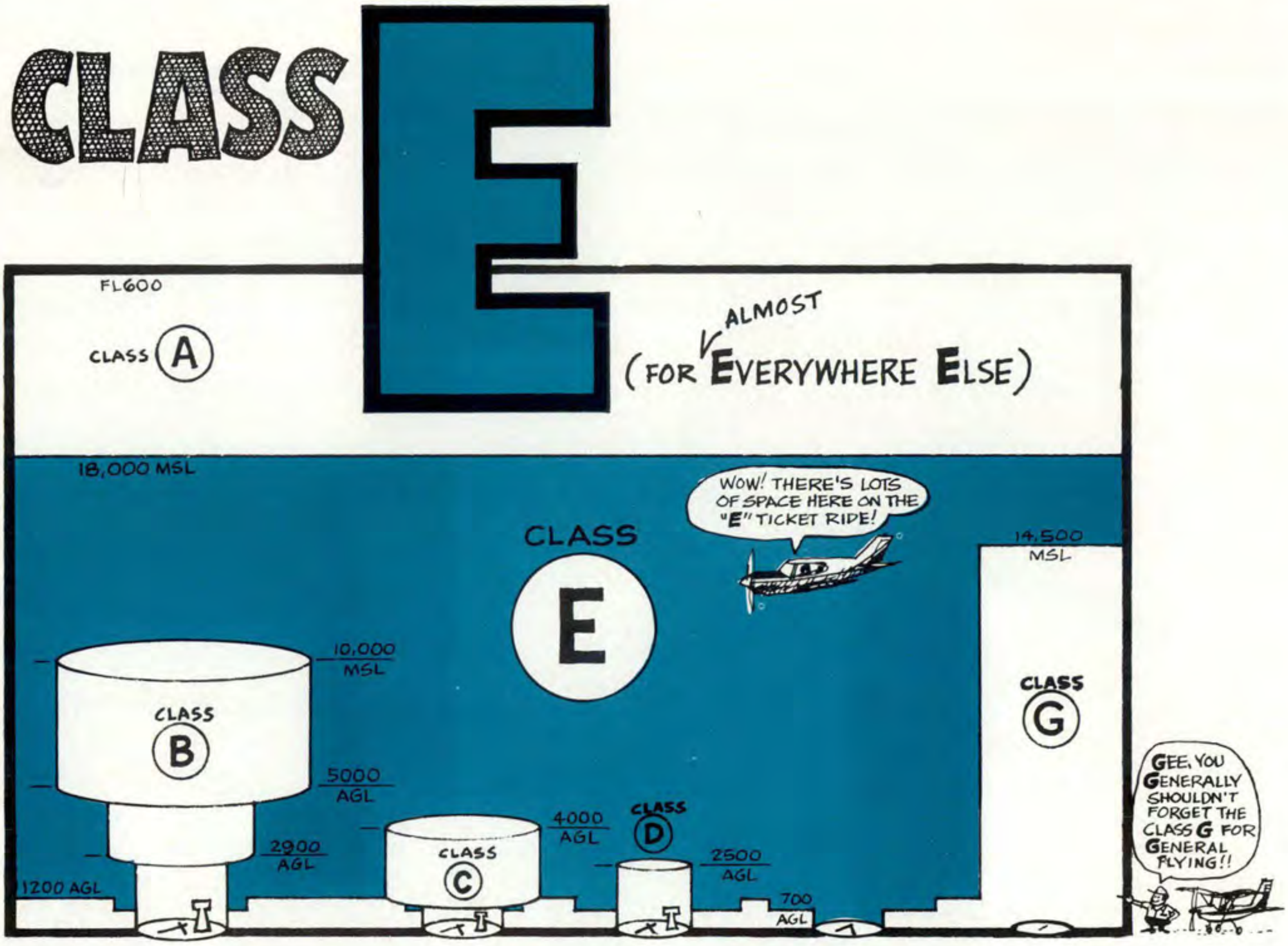
The problem of negative tests is present with opioids as with other drugs. Under NIDA rules, only morphine and codeine will be reported. There are many other addicting opioids; e.g., Talwin®, Demerol®, Darvon®, oxycodone, hydrocodone, methadone, etc., which can be and are abused. Yet a specimen which contains any of them will be reported as negative.

The interpretation of urine drug tests is tricky business — by no means easy or cut and dried. Even experienced physicians find it tough going at times. In addition, a negative test is not always what it seems. An individual can be grossly affected by drugs, but under the government program at least, can have a "clean" urine drug test.

The best solution for industries, large and small, requires a good laboratory of unquestioned reputation and a physician who is trained to interpret such tests. That combination provides the best chance of weeding out drug use. At the same time, it protects those who don't use drugs illicitly.

Under these circumstances, what's the best advice we can give our pilots? The answer: "Don't ever take anything not prescribed by your doctor."

Pilots who follow this advice will have "no sweat" on a drug test. ■




# IT'S EASY TO USE E

**LT COL ROY A. POOLE**
Editor

■ In the great alphabet soup of life which all pilots must swallow after September 16, it's nice to know some of it is Easy to Explain. Class E airspace isn't the simplest, but it's not far from it.

Class E airspace is loosely defined as "general controlled airspace." Class E airspace covers areas we used to call control areas, transition areas, extensions to control zones, control zones without a tower, and airspace along the Victor airways.

With all the changes to other airspace, don't expect the former sectional chart depictions for controlled airspace to remain the same. The blue vignette is no longer used to indicate controlled airspace at 1,200 feet AGL or above, unless it abuts uncontrolled airspace. The outer edge of the transition area at 700 feet AGL (remember the magenta vignette?) automatically indicates where controlled airspace at 1,200 feet AGL or above begins. Controlled airspace with *other than* 1,200 or 700 feet AGL bases is indicated by a broken line with the base altitude shown in either AGL or MSL.

Like all airspace (except Class A), either IFR or VFR flight is authorized. If you are on an IFR flight plan, you must have a working radio for your clearance. This also means VFR aircraft may not necessarily be using a radio while in Class E airspace.

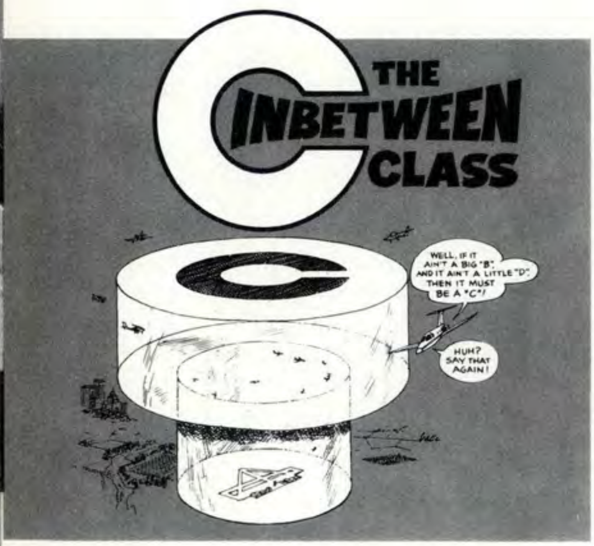
Inside Class E airspace, the basic VFR cloud clearances remain the same and can be found in FAR 91.155 (after September 16th, of course). They are: *Below* 10,000 feet MSL — 3 sm visibility, 500 feet below clouds, 1,000 feet above clouds and 2,000 feet horizontal from clouds. *At or Above* 10,000 feet MSL — 5 sm visibility, 1,000 feet above, 1,000 feet below clouds, and 1 sm mile horizontal from clouds.

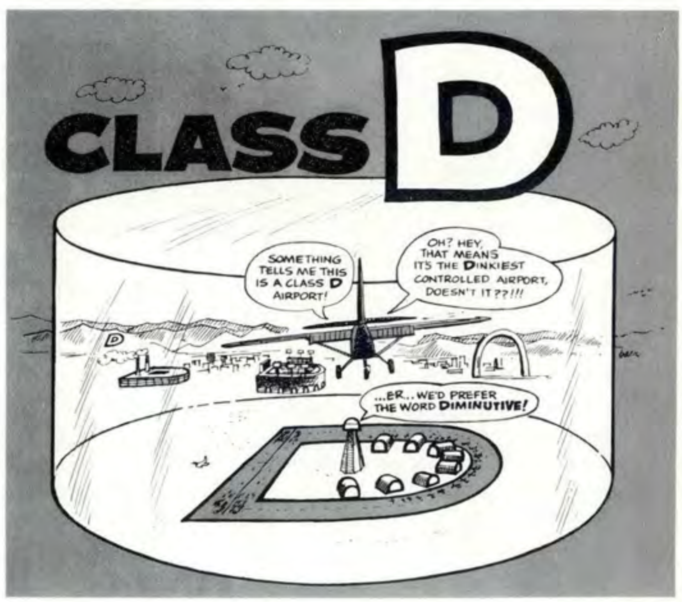
For the most part, Class E airspace is going to be the place where VFR pilots, not talking to any controlling agency, will be traveling. These pilots are trying to carefully avoid Class B, C, or D airspace until they need to land at a field inside the more stringent airspace. Nobody should make the mistake of thinking the new designation in some way reduces the possibility of a close encounter with some little airplane pilot who's not talking to approach control.

You might even say Class E airspace is the easiest to identify, the easiest to get into, and easiest to encounter someone unexpectedly. ■

*As you will recall, these are the previous chapters of our story ...*






Don't miss the exciting conclusion in the August issue.

# NO SKIDDING

**CMSGT ROBERT T. HOLRITZ**
Technical Editor

■ Although hydroplaning has been a problem since man first returned from the skies, it was not seriously investigated until the mid '50s. It is not surprising, with their wet climate, the British were early pioneers in studies of the effects and prevention of "aquaplaning." In 1956, they began to texture and groove their military runways. The method worked so well it was quickly adapted by military and major civilian airfields worldwide.

By the early '60s, the space shuttle was on the drawing board, and NASA began to study how hydroplaning would affect a heavy space vehicle landing on a wet surface. After all, for the Shuttle, there would be no chance for a "go-around."

## The Formula

The NASA study yielded some important information. One of the most surprising facts the researchers discovered was minimum hydroplaning speed was more directly related to tire pressure than to tread design. Specifically, they found for a nonrotating tire, the minimum hydroplaning speed on a wet runway is equal to 9 times the square root of the tire pressure. For a rotating tire, the formula is 7.7 times the square root of the tire pressure.

For example, if a nonrotating tire is inflated to 100 psi, the hydroplaning speed would be 90 knots. For a rotating tire at the same pressure, the minimum hydroplaning speed would be 77 knots. Refining the formulas, for an underinflated tire, the minimum hydroplaning speed is lowered 1 knot for every 1 to 3 psi below proper inflation pressure.

It is a good idea to make a quick calculation of the tire pressure, hydroplaning speed, and landing speed of your aircraft before landing on a wet runway. These may only be ballpark figures, but at least you will have some idea of what to expect.

## Three Types

During their research, NASA also discovered there were three different types of hydroplaning.

*Dynamic hydroplaning*, which is perhaps the type most familiar to military aviators, occurs when the tires are separated from the runway by the presence of water. As the formulas show, the pressure is greater for a nonrotating tire than a rotating one. Dynamic hydroplaning usually occurs when there is standing water on the runway. Fortunately, most US military runway surfaces have a crown and a 1 to 1.5 percent slope which allows drainoff. But during periods of heavy rainfall, there may be standing water on any runway.

*Viscous hydroplaning* occurs on smooth, wet surfaces. This problem can be expected on runways which have not been grooved or textured or on ones which are heavily coated with rubber deposits. Painted surfaces, such as runway markings, also provide an environment for viscous hydroplaning.

During viscous hydroplaning, the tire is able to displace only a portion of the moisture on the runway surface. This can be a problem if you happen to set one of the main tires on the centerline stripe.

*Reverted rubber hydroplaning* is the result of a complex series of events which can occur when a pilot locks the brakes on a wet runway. When the brakes are locked, the tires generate enough heat to create a superheated layer of steam. The heat of the steam is great enough to revert the rubber on the tires to an uncured state, and the aircraft rides on a layer of compressed steam and melted rubber.

Evidence of reverted rubber hydroplaning can be seen as white marks where the superheated steam has actually "steam cleaned" the landing spot.

### Other Variables

There are other factors which affect hydroplaning. For example, some tread designs are much less susceptible to hydroplaning than others. The amount of tread remaining on a tire is also important. Any time an aircraft is subject to land on a wet field, pilots must ensure the tires are replaced according to the manufacturer's wet runway criteria.

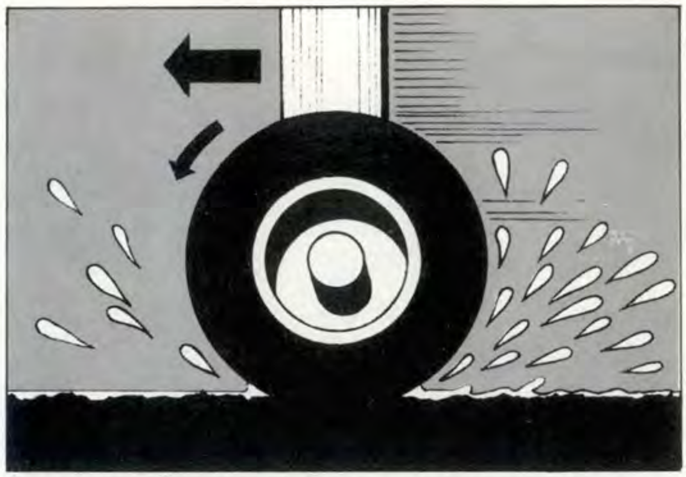
All things considered, there are few places a pilot can be absolutely sure of a dry runway landing. Even desert bases experience unexpected heavy rain. The last few flights left on a tire under dry weather conditions may not cut the mustard during an unexpected wet touchdown.

### Landing Technique

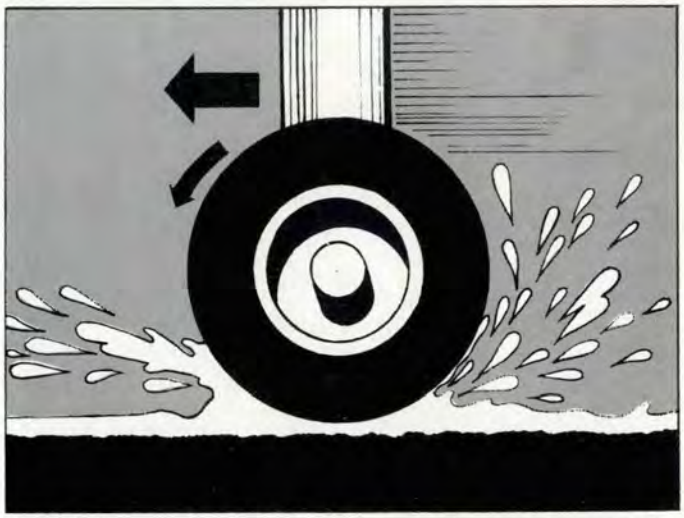
As one might expect, landing on a wet runway requires some special considerations. Approach speed should be as low as possible considering factors such as weight, crosswinds, and turbulence. Every extra knot adds to the distance of your flare and ground roll. Don't try to grease it in. On a wet runway, a firm landing helps prevent dynamic hydroplaning and can dissipate 12 to 15 knots.

Use the braking technique in the Dash-1 and make the most of the aircraft's aerobraking ability. Before putting on the binders, give the wheels time to spin up. This not only helps prevent locked wheels from causing reverted rubber hydroplaning, but it also gives the antiskid system a chance to operate.

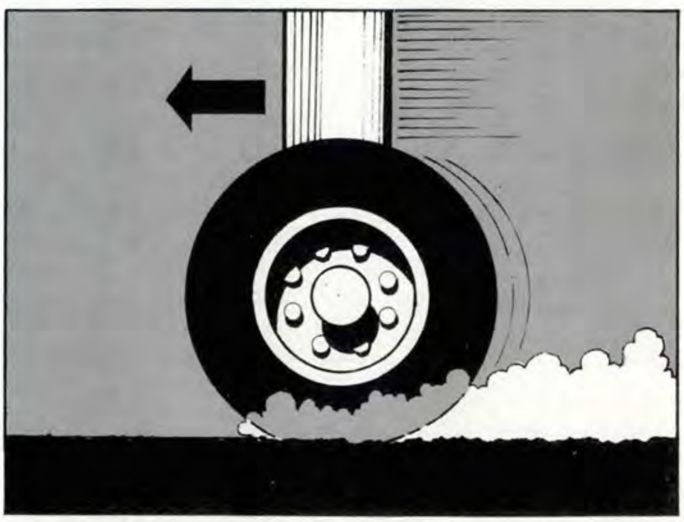
For some aviators, wet weather landings are a way of life. For others, they are an infrequent experience. But sooner or later, every pilot will be required to set down on a slick runway, so it is a good idea to break out the Dash-1 and make at least a mental plan of action should a wet landing be necessary. Good tires, antiskid systems, and properly maintained runways help make landing on slick surfaces safer. But as the Boy Scouts say, it is best to "be prepared." ■



Viscous hydroplaning (normal wet runway friction). A thin film of water acts like a lubricant. The microtexture of the runway surface (sandpaper-like roughness) breaks up the water film and greatly improves traction.



Dynamic hydroplaning. At high speed the tire planes on deep, standing water. Tire grooves and runway surface macrotexture (stony or grooved surface) help drain water from the footprint and improve friction.



Reverted rubber hydroplaning. When a tire locks up on a smooth wet or icy surface, the friction heat generates steam. The steam pressure then lifts the tire off the runway, and the steam heat reverts the rubber to a black gummy deposit.


L to R Top Row: SrA Alvin L. Simpson, Sgt Robert T. McDowell, Sgt Scott N. Einfalt, SMSgt Vaughn M. Shirley, Sgt Michael J. Harris. Bottom Row: 1Lt Hiroshi Wajima, TSgt Neil S. Rideout, Capt Keith D. Golden.

Captain **Keith D. Golden,**
First Lieutenant **Hiroshi Wajima**
Senior Master Sergeant **Vaughn M. Shirley**
Technical Sergeant **Neil S. Rideout**
Sergeant **Michael J. Harris**
Sergeant **Scott N. Einfalt**
Sergeant **Robert T. McDowell**
Senior Airman **Alvin L. Simpson**

**15th MAS, Norton AFB, California**

■ A 15 MAS C-141 crew from Norton AFB departed Yokota AB, Japan. The weather was reported at 600 feet with broken clouds and 2½ miles visibility.

Immediately after entering instrument conditions, the aircraft experienced dual attitude and partial gyroscopic failure. The pilots selected the Attitude Heading and Reference System as their backup system. This action partially stabilized the copilot's ADI. However, the pilot's ADI showed no signs of stabilization.

The aircraft commander requested vectors for an instrument landing system (ILS)/precision radar approach back to Yokota AB. The heading system indicated they were maintaining runway heading. In fact, they were 20 degrees off course/runway centerline.

As the aircraft began to turn on final approach, the crew received a Master Caution followed by a Door Open Light. The petal doors were unlocked. Because airspeed was within limits and considering the decreasing weather, the approach was continued and the door system bypassed.

Upon landing, the spoilers would not deploy to the ground limit. The spoilers were reset and deployment reattempted. With the runway length quickly shortening, the crew used brakes and thrust reversers as the primary means of stopping the aircraft. Distance remaining was 1,500 feet when the aircraft was stopped.

During the mission, each emergency occurred during a critical phase of flight, during unfavorable weather conditions, and with passengers on board. The crew's immediate and accurate responses, timely decisions, and coordination led to the safe recovery of a valuable airplane, its crew, and the passengers.

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.*

MAJOR

## David C. Markl

**Headquarters 9th Wing**
**Beale AFB, California**

■ Major David C. Markl was flying a night U2-R ferry mission from Plattsburgh AFB to RAF Alconbury. Four hours into the flight, while above 60,000 feet and well outside the range of any radar facility, the Inertial Navigation System malfunctioned resulting in failure of all primary flight instrumentation and the autopilot.

Using backup flight instruments, he began to "hand fly" the aircraft — a feat which requires extreme concentration due to the narrow margin between stall and overspeed at high altitude. With most of his attention focused on maintaining flight parameters, Maj Markl began a deliberative process of attempting to regain primary heading and attitude systems.

Eventually, he restored the attitude indicator to a somewhat usable condition. However, the primary heading system maintained a 30- to 70-degree differential from the emergency magnetic compass heading. Dead reckoning was the only way to maintain course.

After 45 minutes, with fatigue setting in, the autopilot began functioning. A lock-on with the Keflavik TACAN was finally established, but it pointed 90 degrees off of his dead reckoned position. Maj Markl correctly assumed his NAVAIDS to be unreliable and continued to dead reckon across the icy North Atlantic.

Finally, Icelandic radar acquired him only slightly off course and provided a vector to Scotland. He requested a no-gyro radar approach into RAF Alconbury. Despite a 1,500-foot ceiling and 10-12 knot crosswinds (the U-2's crosswind limit is 15 knots), Maj Markl flew a flawless approach and landing. Major Markl's exceptional situational awareness, clear thinking, and outstanding airmanship during all phases of this emergency ensured the safe recovery of an irreplaceable national asset.

WELL DONE! ■

# "... But the crew chief told me it was only a ***tiny cut!***"