flying SAFETY

International Operations

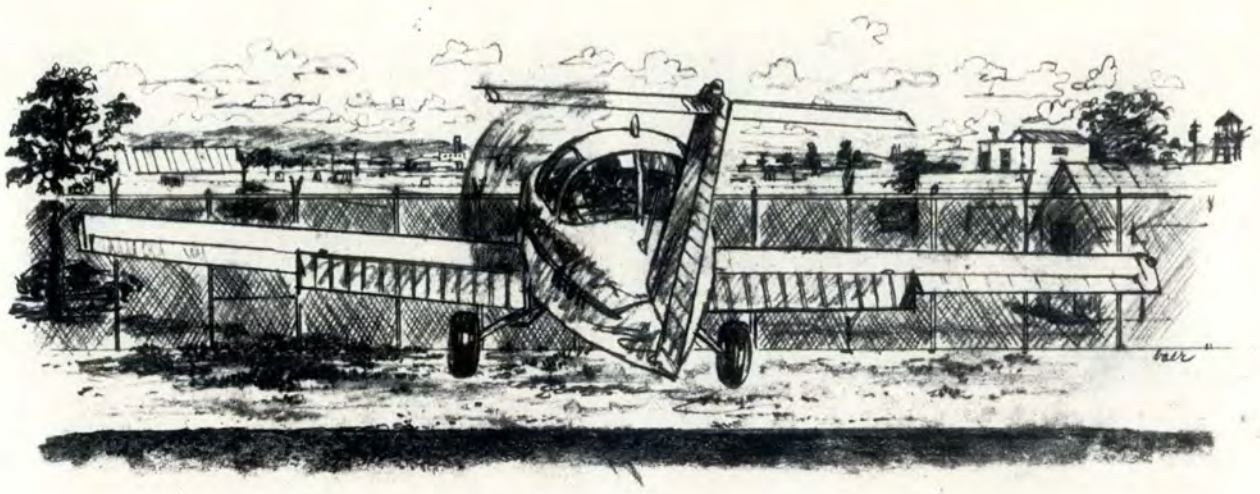
The Toughest Approach I Ever Flew

Altitude Reservations

We Have the Technology

JUNE 1992

Instrument Flying Worldwide



THERE I WAS

■ When I was a student pilot, I soloed at 9½ hours of instruction. My instructor had been telling me I was doing some of the best takeoffs and landings he had ever seen a student perform. My pattern work was also excellent.

Well, when it was time to do my first solo, I thought I was hot stuff! I did my three takeoffs and landings with no problems. I did some more dual work with the instructor and was doing very well. Needless to say, I was getting a big head.

At about 18 hours total flight time, I again started some solo work in the traffic pattern. I was flying from "Peter O. Knight" airport in Tampa, just outside MacDill AFB. There were three of us Tomahawks in the pattern doing touch and goes. We were all students. A friend of mine was in front of me with his instructor. He did his landings, but mine were better — so I thought. I was doing so well I thought to myself, "I don't need to use a checklist, I know it all."

Well, in my seventh pattern, I made my turn to base with flaps at one-half, turned to final, and on short final, lowered flaps to full. I touched down at 55 knots, lowered the nose, applied full power, and started my takeoff while calling on Unicom 122.8 to tell everyone my intention. I was on the go. Mistake #1.

I got off the ground and flew to about 15 feet, and airspeed stayed at 65 knots. "What's going on here?" I lowered the nose to gain speed, but it stayed at 65. Five hundred feet ahead was a 25-foot-high security fence at the end of the runway. Talk about pucker factor! I checked for full power — it was maxed out. I checked carburetor heat — it was off. I did not have room to land and stop on the remaining runway, and I sure could not fly through the fence.

I made another quick scan of the instruments. All were okay. I then saw a bird fly past my left wing, and there it was! Out of the corner of my eye, I saw the flaps full down! I reached down, grabbed the flap handle lever, and moved the flaps up. Mistake #2.

I dropped down to 5 feet above the runway. The fence is now 100 feet ahead. I then figured if I lowered flaps a tad, I might make it over the fence. I lowered the flaps a few degrees and was now flying at 70 knots.

I kept the nose down until I was about 50 feet from the fence. I yanked back on the yoke and cleared the fence, but I think I knocked off a few fleas. I climbed to 1,200 feet and squawked 7700. After I finished shaking, I noticed MacDill AFB was calling me on the Unicom channel. They directed me to change to their frequency and gave me another squawk.

I told them what happened, and they let me fly around over Tampa Bay for about 30 minutes and kept other aircraft away from me. I did a fly-by at their tower, and they let me go back to Peter O. Knight to land and stand by the phone. The senior controller called and reassured me and encouraged me to continue flying, which I did. The only thing I did right that day was follow MacDill's instructions.

I learned three things that day. (1) Follow your checklist. It will keep you out of trouble. (2) Don't be afraid to ask for help. (3) Air Force air traffic controllers are professionals and know their jobs well. ■

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CONTRIBUTIONS

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INTERNATIONAL OPERATIONS

Flying into ICAO airspace can be embarrassing for the pilot who does not know the rules.

USAF INSTRUMENT FLIGHT CENTER STAFF
Randolph AFB, Texas

■ A recent survey showed the average pilot has nightmares about walking onto the flight line wearing only underwear, having to fish for the 12-jeweled Seiko™ which accidentally dropped into one of the toilets at the O'Club with a covey of hecklers to "help," or, last, but not least, *flying into ICAO airspace.*

Dreams about torture, deprivation, and death are normally scoffed at by pilots because they realize those apply only to non-godlike beings. But dreams which vividly portray embarrassment or humiliation usually end with the pilot waking up in a cold sweat, screaming, "Not my wings! Anything but the wings!"

Flying into ICAO airspace can be especially embarrassing or humiliating for the uninformed pilot who journeys into ICAO heavens armed only with a so-so knowledge of the rules and a faulty mike switch. Want to avoid the immortal phrase "Execute a 180° turn and exit ICAO airspace" or "Please contact our control facility *immediately* upon landing"? Read on.

The International Civil Aviation Organization (ICAO) is an aviation body affiliated with the United Nations. ICAO, headquartered in Montreal, Canada, establishes the guidelines for worldwide aviation operations. The rules of ICAO are not binding on the member nations. However, countries must publish exceptions through their Aeronautical Information Publications.

When a nation modifies ICAO *Standards and Recommended Practices and Annexes,* the new set of rules forms that nation's rules of the air. U.S. aircraft are governed by these national rules of the air when operating in another country's sovereign airspace, and you, as Air Force pilots, have FLIP to guide you. But, there is more to know. Let's look at two clear nightmares and follow with a sample listing of some international procedures.

Nightmare No. 1

You are doing your normal superb job of holding altitude, heading, and airspeed when the controller says, "PIFAX 52, we see you going feet wet. Advise upon entering international airspace." You look at the copilot, who has a question mark etched into his furrowed, sweating brow and realize he is going to be as valuable as a hairless chinchilla.

Where does the aircrew stop using the national rules and start using the international rules? The U.S. recognizes only territorial claims (set by the International Law of the Sea Conference) of 12 NM out to sea. Outside of this 12 NM limit, it is U.S. policy to comply with the rules of ICAO (international flight rules) as long as they do not conflict with the best interests of the United States.

Probably one of the most misunderstood and abused international procedures is the use of "Due Regard." When in international airspace and directed by political, military, or classified reasons, or for mission accomplishment, you will operate under the rules of "Due Regard." In other words, you will operate with due regard for the *safety* of other air and sea traffic. Under Due Regard, you will be acting as your own air traffic control authority and must keep yourself separated from other traffic. Consult FLIP General Planning, Chapter 6 for further guidance on specific requirements.

Nightmare No. 2

You draw Major Scrutiny in the stan/eval lottery for your instrument check. He eats line pilots for breakfast, lunch, and dinner, and he's notorious for going for the slow kill via ICAO rules. You pick the brains of your fellow pilots for hours on ICAO rules just to discover they contain a plethora of misinformation. Finally, in a desperate, last-ditch attempt to save your quivering hide, you decide to turn to the source documents (i.e., the books).

So where do you find these international rules of ICAO you are supposed to follow? The answer begins with FLIP General Planning, Chapter 5, *Pilot Procedures.* This chapter contains ICAO procedures modified for our way of operating in the United States. The majority of the procedures are the same as those in the ICAO documents.

Chapter 6 contains the ICAO Standard Procedures and modifies Chapter 5 guidance. FLIP Area Planning books 1, 2, and 3 list regional, national, and air traffic control region differences you must follow to comply with the local rules of the air. Additionally, the FLIP Foreign Clearance Guides, classified and unclassified, contain other nation's customs, entry and filing procedures, clothing restrictions, etc. International incidents are known to cause stress, premature balding, chest pains, and a host of other unpleasant occurrences for flight crews who "highlight" themselves. Knowing international flying rules is great preventative medicine.

A Sample of Specific International Procedures

Unfortunately, not every ICAO rule or procedure you need to know is in the FLIP system. It provides some of the more common differences necessary for planning and day-to-day flying. The following provides additional ICAO information and procedures important to you.

continued

International Operations

continued

General Items of Interest Under the rules of ICAO, an ATC controller will not issue the clearance "follow another aircraft." Only the no. 1 aircraft for landing will be cleared for a visual approach. All following aircraft will be cleared for instrument approaches.

Occasionally, you'll see DVORTAC listed on an approach or in the en route supplement. The "D" means the NAVAID is a doppler VORTAC. Doppler is being used by the NAVAID equipment to generate the signal to your aircraft. No special airborne equipment is required. Your systems will not notice any difference.

You'll frequently see LZZ in the name of an approach. LZZ stands for localizer. We must use the host nation's approach titles in the approach books. Again, it's no difference to you.

As in the U.S., do not compensate for winds when being radar vectored. However, compensate for known or estimated winds when flying departure routes expressed as tracks and on dead-reckoning courses.

There are maximum speeds published for a turning departure. They are by category: "A" — 120 KIAS, "B" — 165 KIAS, "C" — 265 KIAS, "D" — 290 KIAS, and "E" — 300 KIAS. When these speeds do not provide enough obstacle clearance, a separate speed cautionary note is published, e.g., "Departure turn limited to _____ km/h (kt) IAS maximum." An average 15° of bank is used by the procedures specialist when designing the approach.

Aircraft will climb to 400 feet AGL before starting a turn on departure. Where a turn at 400 feet AGL is not practical because of obstacles, the procedure will specify a 200-foot-NM climb to an altitude or height where omnidirectional turns can be made.

Some departures will be listed as "sector departures," e.g., "Climb straight ahead to altitude _____ before commencing a turn to the east and to altitude _____ before commencing a turn to the west."

Blue table. No, this isn't a list of adult movies. It's a listing of specific units of measurement countries use. The blue table is referenced by individual listings in the Area Planning documents and can be found in General Planning, Chapter 6.

A precision approach may have a separate decision height listed for each category. The reason is because different aircraft may dip below decision height when performing a missed approach. Because higher categories will dip lower, ICAO obstacle identification surface starts lower for each category (possibly taking into account an obstacle not seen by the obstacle identification surface of a previous category). The decision height is raised to provide the required aircraft clearance over the obstacle.

Procedures

Reversal procedures, like the 45°/180°, 80°/260°, or base turn, have very specific procedures for entry and approach. Entry will be restricted to a specific direction or sector (figure 1). It must be noted the airspace provided for the course reversal (procedure turn or base turn) does not provide for a racetrack or teardrop maneuver unless the procedure so specifies.

The procedure turn will be published specifically as a 45°/180° or 80°/260° maneuver. In the U.S., we simply enter by turning in the shortest direction. However, ICAO rules are, unless particular entry restrictions are listed, reversal procedures shall be entered from a track within ±30° of the outbound track of the reversal procedure (sector 1). However, on base turns where the ±30° direct entry sector does not include the reciprocal of the inbound track, the entry sector is expanded to include it. In sector 2 areas, you must use a depicted holding pattern to align with the ±30° cone prior to starting the rever-

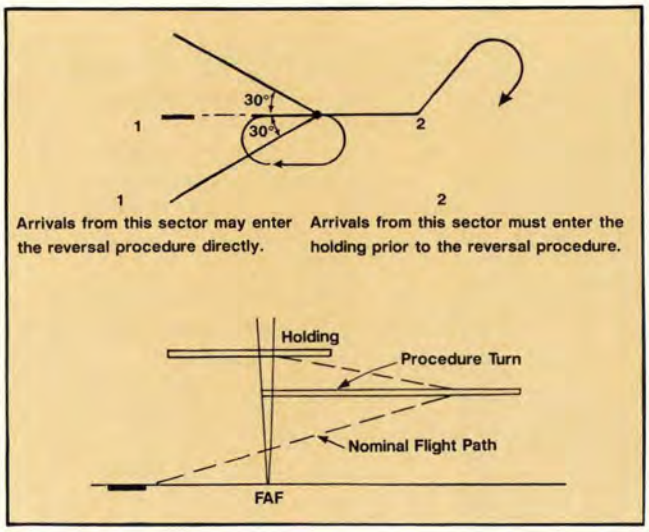


Figure 1

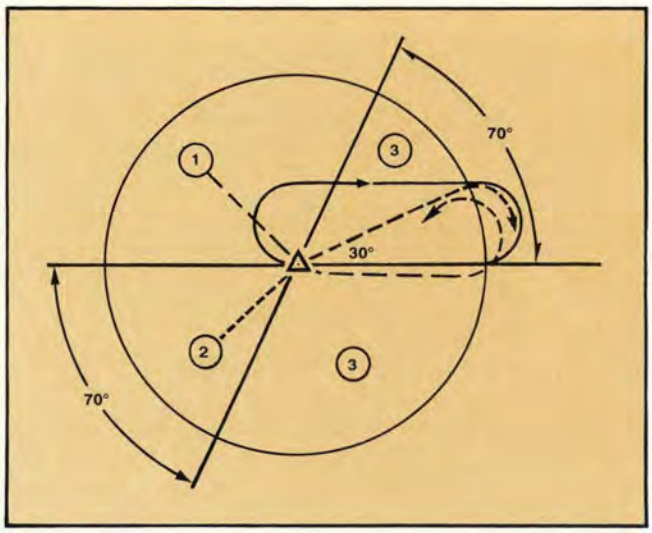


Figure 2

sal procedure. In addition, if you are above the depicted IAF altitude, you must lose altitude in the holding pattern prior to departing the IAF.

For course reversals, the aircraft will depart the fix or facility used as the IAF and fly outbound on the specified track descending as required. If further descent is required after the inbound turn, this descent cannot be started until established on the inbound track. ICAO considers established on the inbound track as being within half-scale deflection for the ILS and VOR/TACAN or within 5° of the required bearing for the NDB.

Racetrack procedures are used when there is not sufficient distance available to lose altitude in a straight segment and when a course reversal is not practical. They may be specified as an alternative to course reversals to increase your operational flexibility. Basically, the ICAO racetrack procedure is a holding pattern listed as 1-, 2-, or 3-minute legs. Outbound length may also be specified as a DME. There may be a limiting radial or bearing listed which you are not allowed to pass for airspace and safety considerations.

For teardrop offsets, the maximum offset is 30° for all aircraft, including USAF. (AFM 51-37 states 45° offsets are not allowed internationally.) The teardrop leg is limited to 1 minute and 30 seconds, after which you are expected to parallel course for the remainder of the holding pattern.

Obviously, for 1-minute patterns, the maximum teardrop leg is 1 minute. Unlike U.S. procedures, when flying a parallel entry, you cannot turn and fly direct to the facility or fix. You must first intercept the inbound track when proceeding to the final segment of the approach procedure. All maneuvering shall be done to the maximum extent possible on the maneuvering side.

Shuttles are climbs or descents in a holding pattern. It is normally prescribed where the descent between the end of the initial approach segment and beginning of the final approach exceed certain values.

ICAO ILS obstacle protection assumes the pilot does not deviate from centerline more than half-scale deflection after being established on track. More than half-scale course deflection or more than half-scale fly-up deflection, combined with other system tolerances, could place the aircraft near the edge of the protected airspace and lose obstacle protection.

ICAO circling requires you to maintain visual contact with the runway environment (e.g., the runway threshold or approach light aids or other markings identifiable with the runway), not the airport environment.

Holding (figure 2) International holding airspeeds have been added to FLIP General Planning, Chapter 6. Ensure you are familiar with them. The ICAO holding rules state timing is based on the outbound leg for ICAO procedures. All turns in holding are made at 25° of bank or 3° per second, whichever is less. Twenty-five degrees is used since it is the worldwide standard for flight directors.

All procedures depict tracks, and pilots should attempt to maintain the track by allowing for known winds in entry and while flying the holding pattern. The ICAO holding rules use only heading and timing to adjust for winds. Notice the previous sentence did not say adjust bank. This means the "triple drift" method of adjusting for winds must be used. (See AFM 51-37 for an explanation of triple drift.)

Offset entry (teardrop) is a maximum of 30° for everybody including USAF aircraft. The entry cone for a teardrop is ±30° of the 30°-teardrop offset plus an additional 5° either side for a total entry cone of 70°. Either you are inside of this cone or you are not. ICAO does not have a conveniently aligned rule. There can be special entry procedures for VOR/DME holding. An entry radial to a secondary fix on the back side of the holding pattern may be used. Sector 1 and 2 entries are not authorized in this case. Enter the pattern using direct entry (sector 3)

continued

International Operations

continued

procedures. The rules of ICAO also require you to descend in holding when cleared for an approach at an altitude above the depicted IAF altitude. Even if you feel you can safely fly the approach from the higher altitude, the controller is expecting you to descend in the holding pattern, and to do otherwise can get you violated.

Altitudes

Transition altitude The altitude in the vicinity of an aerodrome at or below which the vertical position of the aircraft is determined from an altimeter set to QNH.

Transition level The lowest usable flight level available for use above the transition altitude.

Transition layer The airspace between the transition altitude and transition level.

When operating an aircraft near the transition altitude, either during departure or arrival, it is important to know what the transition level is. The transition level can be assigned by ATC or it may be depicted on an approach procedure, on en route charts, in the applicable IFR en route supplement, or in FLIP Area Planning documents. By definition, the transition level must always be greater than, or equal to, the transition altitude. Remember, you can only accept the transition altitude as a flight level to fly when the local altimeter is greater than 29.92" Hg. If the local altimeter is less than 29.92" Hg., then you must refer to section B of the Flight Information Handbook to determine your minimum acceptable flight level. International controllers are aware of these procedures and will generally not even assign you to fly at the transition altitude, but, as with everything else in aviation, it's the pilot's responsibility to operate the aircraft in the safest possible manner which includes backing up controllers.

One final note: Once cleared for the approach and descent, you can switch to the local altimeter before the transition level, assuming there are no altitude restrictions based on a flight level or level flight above the transition level is not anticipated. Also, when climbing, switch to 29.92" Hg. passing the transition altitude.

Secondary Surveillance Radar (SSR) Transponder Operating Procedures

When an aircraft has a serviceable transponder, it must be operated whether the aircraft is inside or outside of airspace used for air traffic services.

Use transponder codes as assigned by ATC. In the absence of any special regional air navigation agreements or ATC instructions, squawk MODE A Code 2000.

MODE C must be operated continuously unless otherwise requested by ATC.

Pilots will not operate the SSR special position indicator (IDENT function) unless directed by ATC.

The use of MODE A Code 7700 in certain areas may result in the elimination of the SSR response from the ATC radar display.

If you squawk 7600, the controllers will try to verify by asking you to IDENT or change code. When they know the receiver is functioning, they will continue to control the aircraft using IDENT or a code change to verify receipt of the clearance issued.

When you have selected 7500, you will be requested to confirm the code by ATC. According to your circumstances, either confirm this or do not reply at all. The absence of a reply from the pilot will be taken by ATC as an indication the use of 7500 is intentional.

Summation

We are often asked, "When do I apply the international rules and when do I follow AFM 51-37 rules?" A simple rule of thumb is you apply U.S. procedures when in FAA-controlled airspace and when flying approaches at NATO *military* airfields! Even if you are talking to a "G.I." controller overseas, if it is not a NATO military airfield, fly the international or host nation rules of the air. Some countries around the world may have rules which are similar to those in the U.S. However, it is very difficult to know when this is true, and the FLIP products may not be specific enough to tell you. The previous rule of thumb will keep you out of trouble.

If you have any questions concerning international and national approach procedures, etc., please give the USAF Instrument Flight Center a call at DSN 487-3077. ■

SEE AND AVOID?

LT COL ROBERT LUNDIN
Air Force Safety Agency

■ This really happened. I didn't think it could . . .

An Army U-21 King Air was cruising westbound at 7,000 on a beautiful, clear day, IFR, and in radar contact. A Piper Navajo was climbing out eastbound, squawking 1200 with altitude encoder ON. The Army crew was tracking a twin Cessna at 12 o'clock and 8,000 feet. The Navajo pilot had chosen not to use the radar service which was available. (Because of that, ATC did not "tag" the Navajo so their Conflict Alert equipment did not provide an automatic warning to the controller.) The U-21 and Navajo smacked head-on. Nobody survived.

In my years of flying, I haven't heard of one quite like this . . . that is, two transponder-equipped, altitude-encoding airplanes running into each other while in a radar environment.

Reading about this in a magazine article bothered me. I didn't think it could happen. I've been IFR and had nontransponder, VFR airplanes zoom past me, and when I asked the radar controllers if they saw them — "Nope!" That's amazing enough. But two Mode C planes — it makes you think! The mishap investigation revealed two controllers did not "see" the traffic conflict, but a review of the radar tapes showed the info was there.

Bottom line: Don't completely trust ATC and radars. *USE YOUR EYES — AND USE THEM CORRECTLY.* Your 20/20 Mark I eyeball is your best defense! Here are some tips out of FAA Advisory Circular 90-48C:

1. Be alert — scan the entire field outside your plane.

2. Shift your viewing angles to refocus your eyes.

3. Give your eyes several seconds to refocus — longer if you're fatigued, bored, preoccupied, ill, or anxious.

4. "Sector scan." Don't "sweep" your eyes from side to side like a radar. Look in small (approximate 10-degree arcs) sectors, focus, then move to a new sector.

5. Peripheral vision is good for detecting movement, but the object that appears to not be moving is the one that's on the collision course!

6. Visual search at night depends a lot on peripheral vision. To perceive a dim light at night, don't look directly at it.

7. Lack of brightness or color in day and ground lights at night add to midair risk.

8. Move your head to see behind that windshield post or other cockpit obstruction.

9. FAA research says it takes about 13 seconds to see, identify, and react to a threat. Use available radar to help you!

10. And, of course, CLEAR, CLEAR, CLEAR! A "healthy paranoia" in a pilot's clearing discipline goes a long way.

Smog or haze adds a new dimension. VFR in 3-mile smog or haze visibility is marginal at best. But flying into the setting (or rising) sun with smog cuts your vis to zilch! And it can sneak up on you!

The other day, our vis was wintertime-great, so I strapped on the airplane for some late afternoon airport hopping. After a landing at Riverside, I headed west at 140 knots. As I passed the Paradise VOR — wham — a wall of summertime-like SMOG! With the setting sun, vis = zilch. I can think of other places in the country where something like this can happen. It just adds to one of my favorite sayings: Keep your airspeed up and your EYES OPEN. ■

THE TOUGHEST APPROACH I EVER FLEW

Approach plates for unfamiliar airfields can be confusing for even the most experienced aviator.

USAF INSTRUMENT FLIGHT CENTER STAFF
Randolph AFB, Texas

■ As any group of pilots will do, the three aviators were swapping "war stories" over their favorite libation at the end of the flying day. Many a watch was shot off a wrist that evening as they talked into the night. Having cleared the skies of enemy aircraft, making the world safe again for democracy, the conversation turned to getting the aircraft back to earth.

The first pilot finished munching his free hors d'oeuvres and washed them down with a cool drink. "There's an approach I've flown for years that never bothered me until I found out more about it. I would see 'NOT FOR CIVIL USE' (figure 1) on the approach plate, and I figured it didn't apply to me as a military pilot. Boy, did I find out how wrong I was."

The other pilots' eyebrows went up, indicating a renewed spark of interest in the conversation. The first pilot picked up his drink and looked at it as though it was a crystal ball containing the wisdom of the ages. Still looking at the drink, he said, "It was one of those days in the squadron. The weather was WOXOF, and we were down for the day. The squadron was shooting the bull, and someone finally asked what does 'NOT FOR CIVIL USE' mean anyway?

"Well, we all looked at each other, waiting for someone to come up with the answer, and no answer came. Then one of the lieutenants picked up the phone and called the USAF Instrument Flight Center (IFC). He got his answer. The term, 'NOT FOR CIVIL USE,' means the

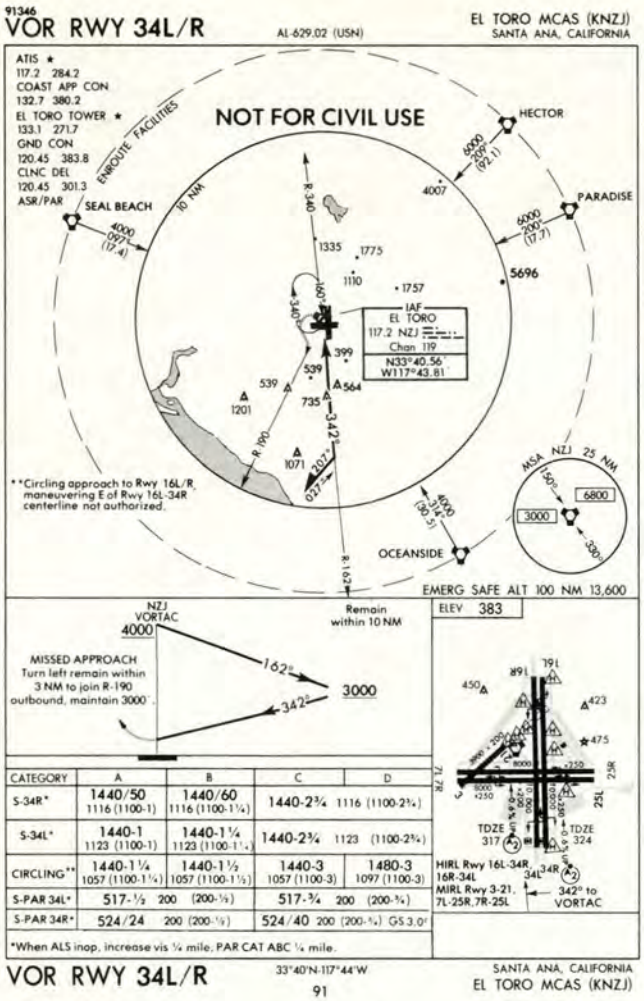


Figure 1

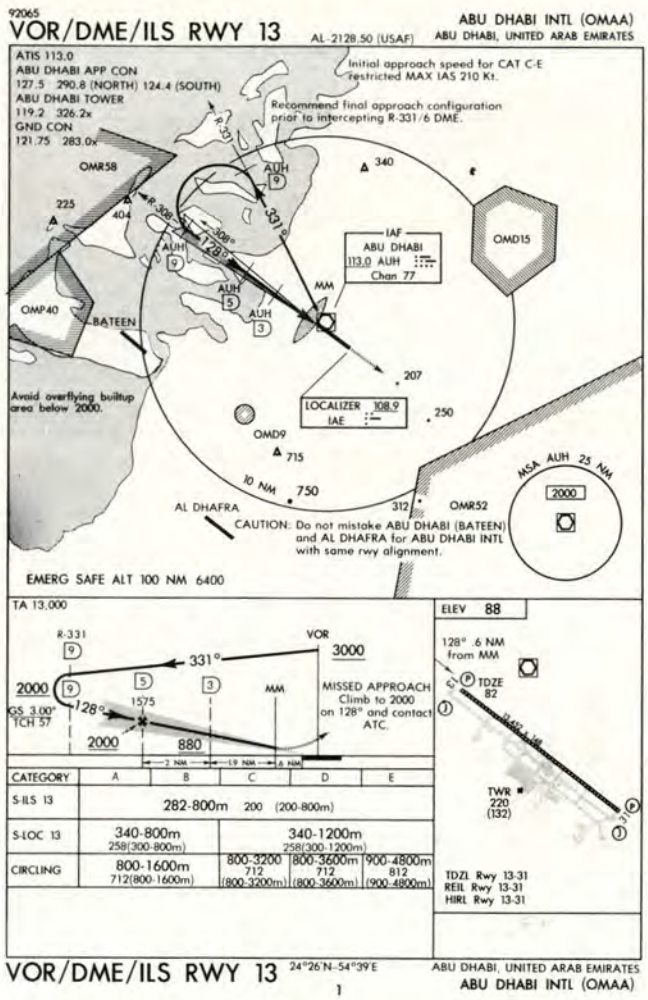


Figure 2

approach does not meet standard design criteria, and an equivalent level of safety is not met. However, the airfield commander deems the approach an operational necessity, so it gets published with the disclaimer.

"Basically, it is a message telling you to stay on centerline and on altitude or you may have a close encounter with an obstacle . . . in other words, CDI deflections could be deadly. For instance, the **VOR RWY 34L** we fly into El Toro. Look at all the obstacles around final approach. The place looks like an antenna farm. I tell ya, when you're in the weather and the pucker factor is already trying to suck up a seat kit, the phrase is not comforting."

The youngest throttle jockey spoke up. "Ya know, the toughest approach I ever flew was the **VOR/DME/ILS RWY 31 at Abu Dhabi** in the United Arab Emirates (figure 2). It wasn't tough to fly physically. It was tough 'cuz of all the studying of the approach plate I had to do. Normally, my C-21, a C Category aircraft (shooting down aircraft in a C-21 must be a "wannabe"), can fly an ICAO initial approach at 240 knots, while heavies or fast mover Categories D and E can use up to 250 knots. In this procedure, however, all categories are limited to 210 knots maximum initial approach speed.

"Also, I found two procedure tracks depicted which was a new one on me. The notes indicated Cat A-B use the 116° track and Cat C-E use the 105° track. On top of that, I nearly got into trouble because of other airfields near the approach. A caution on the plate warns Al Dhafra and Bateen are aligned with the Abu Dhabi runway. Fortunately, I remembered to refer to FLIP A/P 2A to check on the restricted areas which almost cover the approach plate. Turns out the procedure track butts up against restricted area OMR 52. The profile view has its share of notes, also. Cat A-B aircraft have to remain within 3 minutes of the Abu Dhabi VOR/DME while Cat C-E must remain within 2 ½ minutes of the same point.

"I tried to figure out what this meant. Near as I can figure, the clock times back up the 9 DME action point. I tell ya, going into this place tired, at night, or in the weather, is no time to try to figure this stuff out! Some LMD4D pilot (large metal desk, four drawer) told me ICAO IAPs are supposed to provide a specified outbound track and timing or DME distance from the facility. So I was really confused since

continued

THE TOUGHEST APPROACH I EVER FLEW

continued

the approach followed both rules.

"I also called the IFC, and they told me not to proceed beyond 9 DME, and if I flew the proper speeds for the depicted time, I shouldn't exceed the 9 DME point. As if that wasn't enough, the crowning glory to this masterpiece is the note which recommends you configure prior to intercepting 6 DME on the 105° or 116° radial.

"The IFC says this note is there to warn you the intermediate segment on the approach is 3 NM long instead of the minimum standard of 5 NM. A more appropriate note would be to recommend configuration prior to commencing the inbound turn. I think it's more realistic and supplies aircrews with the necessary information. I tell ya, it took longer to figure out all those notes than it did to fly the mission."

One of the older pilots, with more hours airborne than the C-21 driver had alive, let out a long, low, "Well, I'll tell ya, son, ya ain't done it 'til ya done it on a curve!" The young pilot came back with a well-thought-out "Huh?"

Seeing his opportunity to educate the younger generation, the grizzled veteran set out to explain a RWY 13 arrival into Hong Kong International Airport. He tipped back his chair and got a faraway look in his eyes as he rode the "way back" machine to his younger days on the Pacific circuit.

"It was **IGS RWY 13 Hong Kong Intl,**" he said (figure 3), in a voice which gave the name of the approach the appearance of possessing mystical powers. "Now, that approach is not only a bear to figure out, you'll sweat off 10 pounds while you're flying it."

The other pilots said, in unison, "What the h. . . is an IGS?"

The grizzled veteran frowned as the spell was broken, and growled, "It's like the U.S.'s LDA." His answer was greeted with a sea of blank stares which made him just look at the floor and shake his head in disbelief.

Then a broad smile broke across his face as he remembered asking this very same question in his younger days as a MAC combat-tested warrior.

In a voice couched in wisdom, he said, "LDA stands for localizer directional aid and IGS is the ICAO designation and means Instrument Guidance System. It basically is a localizer that is not aligned within 3° of the runway centerline. In fact, my young children of Mars (a reference to the mythological god of war), the IGS into RWY 13 is offset 47° from the landing direction and requires a visual right turn to line up with the runway after reaching decision height. You have to complete the instrument approach by the middle marker (MM), or you have to execute an immediate, and I do mean immediate, missed approach.

"If the MM is unserviceable, you get the heck out of Dodge at 2.2 NM off the KL DME. An early or late turn WILL result in the need for a tunnel to get through the mountains surrounding the airport. In addition, you have to ignore flightpath indications after passing the MM. There is even a repeating voice transmission on the localizer emphasizing the IGS is not an ILS, and a missed approach at the MM is mandatory.

"There is a giant checkerboard against the hills to let you know the terrain is in your face. In addition, there is a complex series of ground lights involving colored, flashing, directional, or omnidirectional

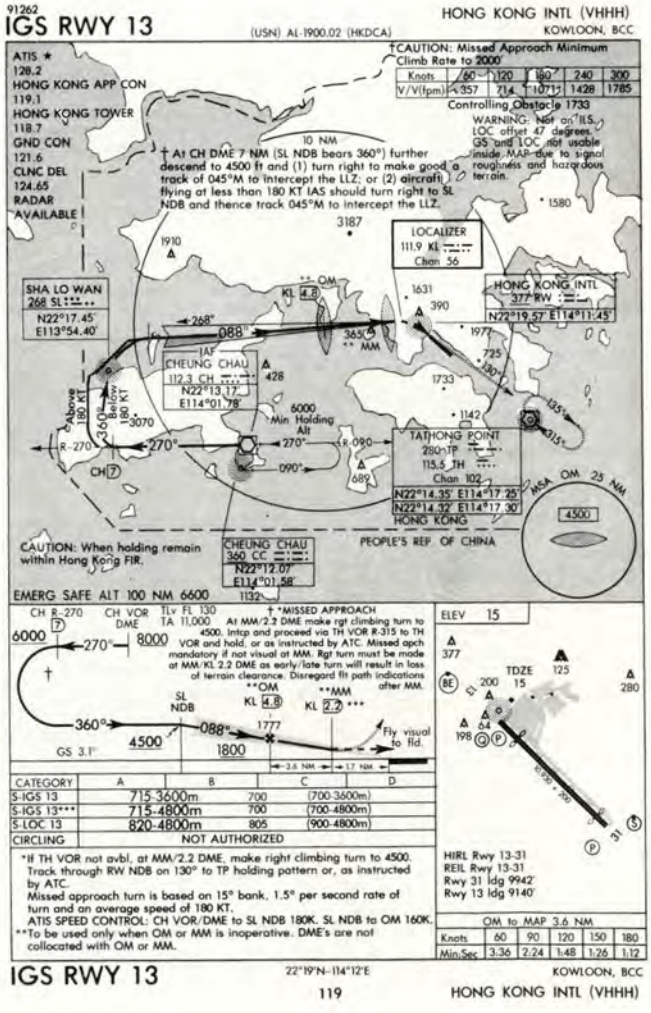


Figure 3

lights which literally form a curve to help you visually find the runway when the weather isn't too bad. Even the checkerboard is illuminated at night by orange sodium lights.

"Just as you get comfortable flying the approach, you find the IGS localizer to be as rough as a corncob anywhere inside of 1.6 NM from the RWY 13 threshold and below 550 feet on the glide slope. This is one of the few LDA/IGS that actually has a glide slope. Most of the time they don't. Because the approach is so complex, the collocated DME contains a built-in delay so the indicated distances are from the RWY 13 threshold."

The demigod of MAC operations had fire in his eyes by now as he recalled flying such a challenging approach into Hong Kong after hours and hours of relative inactivity. He continued again in hushed tones which commanded reverence from his audience.

"They even have an announcement on ATIS when they are requiring speed control. You have to know on the intermediate segment, from CH VOR to LT NDB, you must reduce speed to cross LT NDB at 180 KIAS. On final from the LT NDB to the outer marker (OM), you must reduce speed to cross the OM at 160 KIAS. After passing the OM, you can pick your own speeds.

"Just to add another piece of reality, due to the proximity of the FIR boundary, you are advised to maintain a careful crosscheck on navigation to ensure you don't wander out of the holding pattern into 'unfriendly' airspace.

"So, gawking band of fledglings, when you look at this approach, you'll see it requires multiple NAVAID changes, cross-tuning, possible visual references, and some very heavy maneuvering close to the ground to get off the IGS and onto the runway. In fact, it is *so* complex, there are higher minimums published separately for nonscheduled operators.

"I haven't even mentioned the extensive explanations on crosswinds at Hong Kong Intl, or the published *visual* approach which is still so complex (especially at night, due to the possibilities of mistaking lighting references) you are advised to carefully cross-check your NAVAIDS to confirm your position. This place is so tough I've heard commercial carriers send experienced pilots to teach the Hong Kong approach to a pilot who's never seen it before."

Lining up on the runway is no time to study a complex approach plate.

With beads of perspiration forming from his eyebrows to his receding hairline, the old MAC pilot ended his story. After a few seconds, he looked up and saw a gentleman sitting at the bar who had been listening with obvious interest to the conversation. He wore a real honest-to-goodness bomber jacket, old and cracking with age (the jacket, not the gentleman). The back was adorned with a faded rendering of some nose art from World War II or Korea. His eyes had the characteristic crow's-feet of a pilot who had squinted into a thousand sunsets and flown planes which were little more than box kites.

Our Hong Kong veteran said, "Say, there, oldtimer, you look like you've got a million hours flying time! What was the toughest approach you ever flew? I bet you've got some great ones about Adcock ranges or something like that."

The oldtimer softly smiled as he eyed the pilots at the table before him, for they were the new guardians of the world he had helped shape. He said, "Son, there is one approach I do know of that is the oldest one on the books. It has remained unchanged since it was developed despite the massive changes which have taken place around the flying world and the improvements in technology. It has killed, or come close to killing, more aircrews than any other approach in the world, and it even claimed my closest friend."

The sage pilot paused for a moment and saw he had the intense attention of the pilots seated before him. It was an important moment, for he was about to pass on a legacy.

"The most hair-raising, gut-wrenching, what-the-h. . .-am-I-doing-here approach in bad weather I ever flew was the one for which I had not prepared. I either read the approach just before starting to fly it or tried to decipher the approach as I flew it. Those were my younger days when I thought I was the baddest bull in the field and indestructible. I would study my tech order and weapons manuals till they were dog-eared. I knew all there was to know. There wasn't anybody better. I knew no matter what I did, I could salvage any approach if I got behind. It wasn't 'til I saw them salvage my buddy's aircraft with a crane that I realized how wrong I was."

The pilots at the table sat quietly as the oldtimer's words sunk in, and each of them recalled the times they let out a low whistle to themselves in the cockpit, shook their heads, and said, "That was too close!" ■

Altitude Reservations

CAPT DAVID RUBALCABA
USAF Instrument Flight Center
Randolph AFB, Texas

■ "Altitude reservations? Yeah! It's a system that allows me free use of a chunk of the sky, and forces other traffic out of my way so I can get to where I'm going and do what I need to do when I get there — without any hassles. All I have to do is send a message to the Central Altitude Reservation Function. Right?"

Wrong.

Ask anyone, and they'll tell you what you already suspect they think: Air Route Traffic Control Centers (ARTCC) "sterilize" their route as shown in figure 1.

Some may even admit they don't really understand what altitude reservations (ALTRV) are. Yet, between January 1 and April 30 of this year, approximately 2,000 were requested and subsequently approved by the Federal Aviation Administration (FAA). That's for

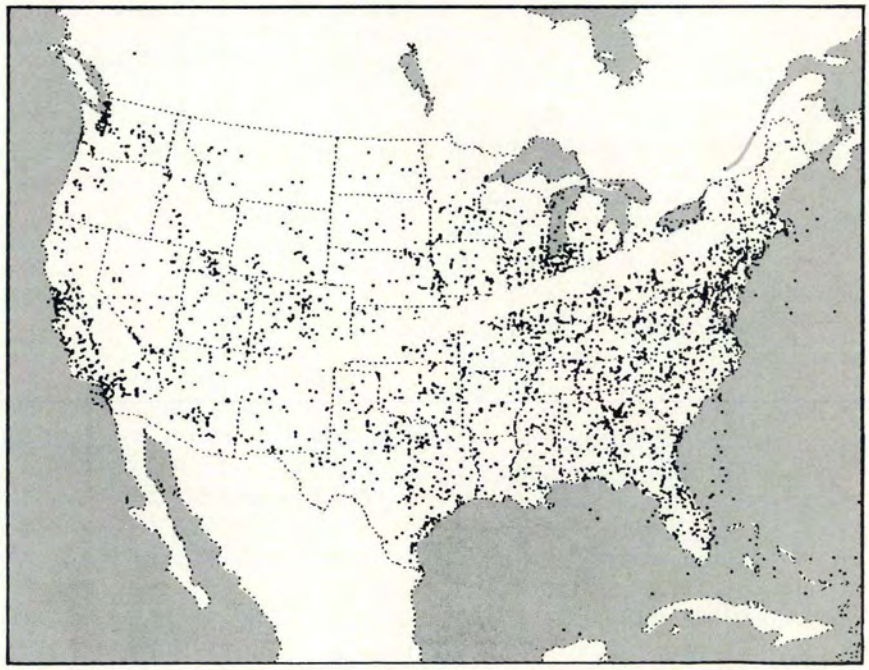


Figure 1

Contrary to what many pilots believe, air route traffic control centers do not sterilize their routes as depicted above.

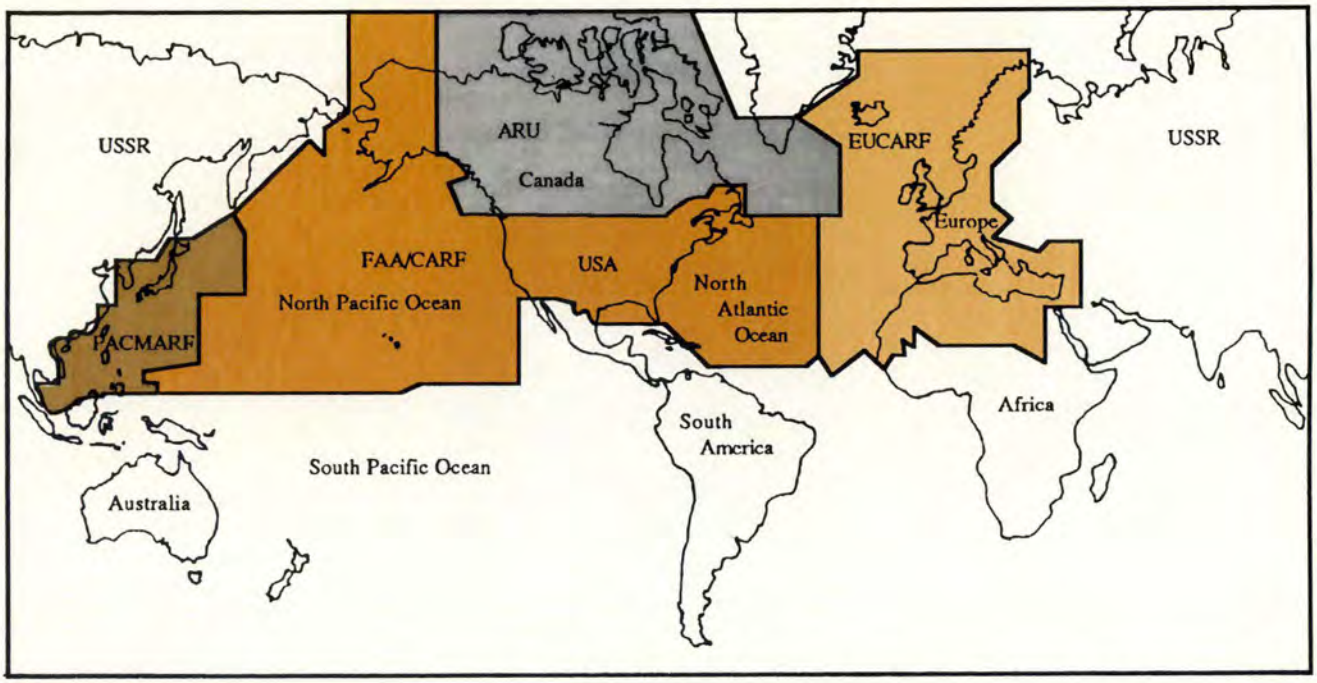


Figure 2

In addition to the FAA's reservation function, there are facilities in Europe, the Pacific, and Canada. Each are governed by a separate set of policies and procedures. Aircrews must consult appropriate theater regulations before their missions.

CONUS only! Now, imagine what those numbers do to figure 1. Imagine also the coordination involved, and you'll see why ALTRVs befuddle most people.

So, what is an ALTRV, and what do you need to know to be able to use one? Hopefully, this article will answer this question and any other you may have concerning ALTRVs.

ALTRVs

So, what is an altitude reservation? Since 1956, it's been a request for the use of airspace under prescribed conditions normally employed for the mass movement of aircraft, or other special requirements, which cannot otherwise be accomplished through normal flight procedures.

What types of ALTRVs are there, and when can we request one?

ALTRVs can be either moving or stationary. A moving ALTRV encompasses en route activities and advances as the mission progresses. It's an ALTRV which takes the aircraft from base A to base B along specific times and points along the route. It includes the en route and arrival phases of flight up to the arrival holding pattern at which ATC provides separation between aircraft. Central Altitude Reservations is responsible for separation of the mission from other ALTRV missions after the aircraft have reached the first cruising altitude.

The other type, a stationary ALTRV, can be subdivided into three basic areas:

- It can be a fixed *radius* from a specific point within the altitudes requested.
- It can be a *line* within fixed geographical points and altitude requests.
- It can be in *areas* within fixed geographical points and the altitudes requested.

As you can see, a stationary ALTRV normally defines the fixed airspace area, as well as the specific altitudes and time periods to be occupied, and the moving ALTRV does not.

Application of ALTRVs

In addition to the FAA's reservation function, there are reservation facilities in Europe, the Pacific theater, and Canada. Each provides the framework for the ALTRV system we operate under today. Each has its own boundaries (see figure 2), and (this is important to remember) *each has its own brand of policies and procedures* which are outlined in their own regulations. What's more, Pacific and European facilities are coordinating agencies only, i.e., they have no jurisdiction over their airspace.

No matter what type of ALTRV you're on, remember your route of flight will not be sterilized; however, you will receive special handling from FAA facilities. Pure and simple, that's the primary FAA policy concerning ALTRVs.

There are other important points to note concerning FAA ALTRV applications. During the application of ALTRV procedures, policies, and criteria, due consideration must be given to all other air traffic. You can't request an ALTRV if you can accomplish your mission without an ALTRV or if you plan to operate in special use airspace. ALTRVs are not authorized for single aircraft unless the mission is a Class One (national emergency plans or missile activities) or Class Two (search and rescue operation). If you plan to air refuel in Canadian airspace, you are required to file an ALTRV except as noted in FLIP AP/1B. Both tankers and receivers are required to file an ALTRV.

Remember, the ARTCC can can-

continued

Altitude Reservations continued

cel the entire ALTRV if the aircrew requests routing or altitude changes which are not in the approved ALTRV — so be careful. If ARTCC initiates changes to the ALTRV due to safety or other extraordinary circumstances, MARSA (military authority assumes responsibility for separation of aircraft) is suspended, and the ARTCC assumes responsibility for separation. The ARTCC is then responsible to return you to the ALTRV as soon as practicable.

We cannot leave this section without mentioning the altitude reservation approval "void" for aircraft not airborne. The "void" is used by Air Traffic Control to advise an aircraft the ALTRV is automatically canceled at a specified time. Aircraft must depart before the assigned "void" time to help provide separation between approved reservations and other aircraft. Normal "void" time is 1 hour.

Some ARTCCs apply "void" not only to the departure time or airborne activation time, but also to each reporting point or fix. If you arrive at a fix or reporting point ahead of schedule, advise the appropriate controlling agency as soon as possible. This helps controllers ensure standard separation. If unable to contact the center involved, you may be required to lose or gain time to arrive over the reporting point at the altitude reservation approval time.

Pilot is Responsible

It's impossible to note all the fine points of ALTRV coordination, but if you are curious, the detailed guidance is in Chapter 3 of FAA Handbook 7610.4H. Suffice it to say the project officer does most of the legwork for you.

There's not too much magic involved when filing a flight plan on the day you're supposed to fly the mission (see figure 3), except be aware host nation procedures may require you to file several days in advance. Be sure to consult the appropriate theater regulations well in advance of the mission, if possible. You do, however, need the ALTRV approval time. Flight plans which include an ALTRV in CONUS airspace are processed to the ARTCC by the Central Altitude Reservation Function; however, the procedures involved depend on where the ALTRV starts.

ALTRV PREPARATION HELPERS

1. Central Altitude Reservation Function Planning Charts
2. DOD FLIP — Flight Information Publications
   a. Area Planning
   b. General Planning
3. FAA 7110.65, *Air Traffic Control*
4. FAA 7110.83, *Oceanic Air Traffic Control*
5. FAA 7350.5, *Location Identifiers*
6. FAA 7610.4H, *Special Military Operations*
7. FAA 7910/47, *ICAO Location Identifiers*
8. Miscellaneous
   a. ARTCC Stratification
   b. Letters of Agreement
   c. SIDS
   d. STARS
9. PACAFR 55-12
10. USAFR 55-100

If the ALTRV starts at the originating base and the aircraft is on an ALTRV immediately after departure, the pilot submits an IFR flight plan for routing and information not included in the ALTRV. When you contact Clearance Delivery, state "Call Sign, request priority handling for (ALTRV names)." If the ALTRV exit point occurs prior to the arrival holding pattern, or you decide to end the ALTRV, file an individual flight plan from this point on the appropriate flight plan form.

On the other hand, if the ALTRV is initiated or begins en route, the pilot submits an IFR flight plan as usual and specifies the fix where the ALTRV begins, followed by the amount of time required to fly from the ALTRV entry point to the ALTRV exit point and remainder of the route. The altitude and duration or delay time may be determined from the ALTRV approval message. When you're ready for the ALTRV, contact ATC and state "Call Sign, request clearance into (ALTRV name)."

Regardless of where or when you enter an ALTRV, be sure to contact Air Traffic Control at least 10 minutes prior to the ALTRV exit point to secure an individual flight plan clearance. That way, you don't pop up in the middle of other IFR traffic with no clearance.

No amount of policies, applications, or flight planning can prepare you for the types of problems you can encounter when filing to, or flying in, an ALTRV. Things such as route errors or late requests for changes or delays will bring everything to an abrupt halt, so make wise and timely decisions long before you saunter out to the aircraft.

We have included a handy list of products and publications to help answer any questions you may have about ALTRVs (see "ALTRV Preparation Helpers").

There you have it: Purpose, FAA's policy and application, and mission planning tips for ALTRVs. You've even been given a list of reference books! All we need now are some "There I Was" ALTRV stories, so if you have them, please send them to us. ■

	TYPE FLT PLAN	TRUE AIRSPEED	POINT OF DEPARTURE	PROPOSED DEPARTURE TIME (Z)	ALTITUDE	ROUTE OF FLIGHT	TO	EET
	I	420	CEF	1210	9E(1)61 260/R290	ALB 9E(1)62 ALB/D4+39 PGS		0+11
	I	425	PGS	1700	280	HEC CIVET PDZ	SBD	0+27
REMARKS ALTRV: (ALTRV name) joined at ALB/MARSA NAME AND HOMOR CODE								

Write a Dumb Caption Contest Thing ...

Is this the perfect picture for the newest internationally famous Dumb Caption Contest Thing? Or what? Like the classic caption photographs before, this one opens the sick and twisted (Oops! We meant creative and insightful.) dumb caption geniuses to a world of possibilities. Send all of those warped captions to:

Dumb Caption Contest Thing
***Flying Safety* Magazine**
AFSA/SEDP
Norton AFB CA 92409-7001

Once Again, Thanks For Your Support

AND THE WINNER FOR THE DECEMBER 1991 DUMB CAPTION CONTEST IS . . .

Larry Hinton
Production Engineering
Tinker AFB, Oklahoma

See what we mean? The sick and twisted (Oops! There we go again.) humor of Larry Hinton has taken top honors in the latest contest. We are arranging for a fast, over-week delivery of his Cheap Little Prize. For all of those Honorable Mention winners who nearly reached stardom, don't give up. Your time will come.

HONORABLE MENTIONS

1. **I won't say it's a difficult approach, but the missed approach point has a subtitle of "Impact Area."**
   Jim Burt, Academic Training, Bldg 1824 NAS, Corpus Christi TX

2. **See, it says right there, "The person in the right seat gets to pick the music."**
   Major Dennis W. Kotkoski, 127 CAM/CC, Selfridge ANGB MI

3. **(Both saying) You've got it!!**
   Jim Burt, Academic Training, Bldg 1824 NAS, Corpus Christi TX

4. **"Well let's see, it says switch does not work in O-F-F position ... O-F-F? What does that stand for?"**
   AT3 Britta Tinney, VP 30 NAS JAX, Jacksonville FL

5. **These new "Scratch-n-Sniff" maps are great. See — this is a dairy farm!**
   TSgt John L. Hamerla, 443 EMS/MAWE, Altus AFB OK

WHOOP! WHOOP! Pull Up!

MAJOR ROY A. POOLE
Editor

■ All too often, the cold, electronic voice directing a flightcrew to pull up was the last thing they ever heard. The alarm, given by the ground proximity warning system (GPWS), came only a few heartbeats before disaster.

GPWS was installed on many large aircraft beginning in the mid-70's in an attempt to prevent controlled flight into terrain. The years immediately following installation saw a decrease in these mishaps by commercial air carriers of 50 percent.

Sadly, however, at least 11 civilian mishaps since 1975 were caused by pilots who failed to react or failed to react quickly enough to the GPWS alerts.

The latest updated GPWS is able to provide about 15 seconds from the first warning to impact. You would think 15 seconds would be enough to allow aircrews to get away from the ground. But in a study conducted by one airline immediately following installation of the system in all of their aircraft, the pilots' average time to react was 5.4 seconds. Some of them took as long as 13 seconds.

Most airplane manufacturers recommend a 2-degree-per-second rotation rate to between 15 and 20 degrees body angle in order to arrest the sink and begin a climb away from the ground. The same pilots who waited for 13 seconds also managed to achieve a deck angle of only 8.2 degrees — clearly not enough to keep from hitting the ground. It's enough to make you wonder if pilots are taking these warnings seriously.

In 1983, the pilot of a jumbo jet flying into the Madrid-Barajas airport did not. Ceilings for the approach were broken and less than 2,000 feet. The pilot had inadvertently set the autopilot altitude controller 900 feet low and arrived on the ILS glideslope very low. Fourteen seconds before impact, GPWS warned, "TERRAIN, TERRAIN!" The pilot took no action.

Ten seconds before impact, GPWS warned, "WHOOP! WHOOP! PULL UP! PULL UP! TERRAIN!" The pilot said, "Okay, Okay," and did nothing. Five seconds prior to impact, the pilot disconnected the autopilot. All 181 people on board died 5 miles from the runway.

In response to a solicitation for comments from the Federal Aviation Administration, the Aerospace Industries Association (made up of companies like Beech, Douglas, Boeing, and Lockheed) offered a solution to mishaps like the one above. They stated the no. 1 priority should be effective simulator training in GPWS go-around maneuvers. Since controlled flight into terrain is the no. 1 cause of larger aircraft mishaps, they felt the FAA should direct additional emphasis on simulator training for go-around maneuvers.

Some interesting things have been discovered when pilots are initially exposed to simulator training for GPWS-directed go-arounds. First, pilots almost always reacted slower than the required 4 seconds. Second, they rotated at an average 1.2 degrees per second, not the re-

Pull Up!

Ground proximity warning systems can prevent controlled flight into the ground only if flightcrews heed their warnings.

quired 2.0 degrees. Third, most of the pilots failed to achieve the minimum pitch angle of 15 degrees during their first attempts. Fourth, many pilots failed to apply adequate thrust for the maneuver. Since the GPWS is warning of imminent disaster, simple missed approach power settings may not be enough. And lastly, the crew coordination was frequently nonexistent during this critical phase of flight.

Continued, hands-on training in simulators offers the best means to give the pilots the skills and the confidence to safely execute the GPWS-directed go-around maneuver. Some airlines use an electronic mountain which is the equivalent of flying into a volcano and then waiting for the GPWS to go off. If flown correctly, the pilot will escape the volcano. If flown with the slightest hesitation or poor technique, the electronic mountain will claim more "lives" and an "aircraft."

The reasons why aircraft are allowed to get too close to the ground are as varied as the pilots who fly them. So too are the reasons pilots don't respond to GPWS warnings appropriately. Some air carriers have removed all doubt from the operations manuals: *Any time* a GPWS alert is given, the pilot **MUST** execute the go-around procedure. Even if the weather is perfectly clear, and the GPWS seems to have sounded in error, the pilot must respond.

The safety advantages of GPWS are great, but only if their alerts are respected. In the last 10 years, commercial aviation recorded 2,304 fatalities from controlled flight into terrain. This type of mishap is the no. 1 cause of large jet transport mishaps around the world. During the last few years, at least six documented mishaps were caused by the crews' failure to execute the go-around procedure when directed by the GPWS. None of these crews had received simulator training on the maneuver.

The lesson for Air Force crews is clear. Make the most of your simulator training, and don't delay when your aircraft's warning system tells you, "WHOOP! WHOOP! PULL UP! PULL UP!" ■

GPWS ALERT

How much time do you have if the GPWS alert goes off?

On a flight from England to Germany, a twin-engine jet transport aircraft began its approach in clear air with an occasional thunderstorm near the destination airport. The copilot was flying the manual VOR/DME approach for this leg. The pilot pointed out a large thunderstorm to the north of the field on the aircraft's radar.

Inside the final approach fix, while on a normal descent, a microburst hit the aircraft. The GPWS sounded, "WHOOP! WHOOP! PULL UP! PULL UP!" At the time, their altitude was 1,200 feet above the terrain. An immediate go-around was begun in accordance with technical manuals. Full power was applied, the flaps were reset to 18 degrees, and the pitch angle raised to near 20 degrees. The descent rate still indicated more than 2,000 feet per minute down.

Eight seconds later, the aircraft finally stopped sinking and began to climb. Passengers and crew both believe the aircraft was within a few hundred feet and a few seconds of hitting the ground.

How much time do you have when the GPWS goes off? You have the rest of your life. Start early, and make it a long life.

WE HAVE THE TECHNOLOGY

Since 1 January 1982, the Air Force has had 138 Class A mishaps which the Air Force Safety Agency classified as collision with the ground. They have resulted in 132 pilot fatalities and 238 total fatalities. This accounts for a combined cost of $1,344,641,401*. We have the technology to significantly mitigate this type of mishap!

* As of 9 April 1992

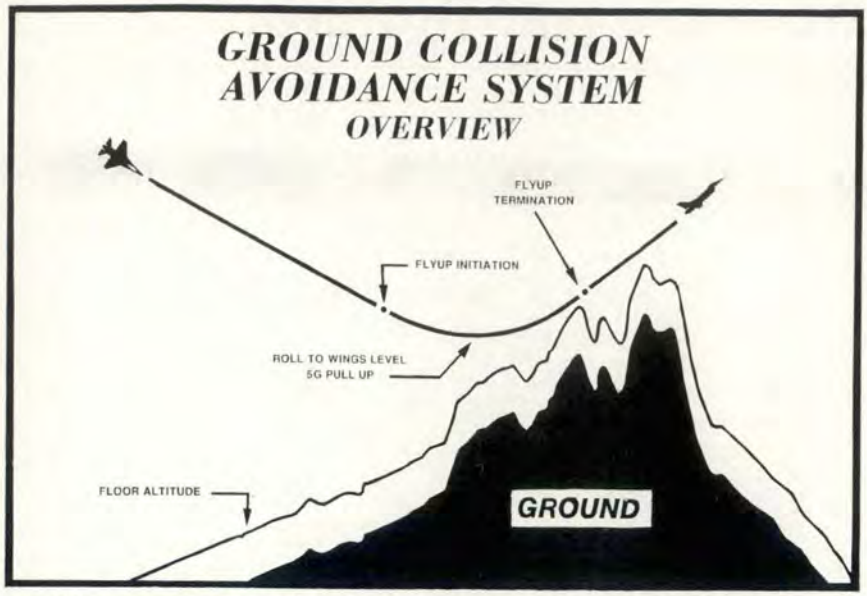
PEGGY E. HODGE
Assistant Editor

■ The mishap files at the Air Force Safety Agency show us many mishaps occur where *good* pilots fly *good* aircraft into the ground. We have always had to live with this danger — all part of being an aircrew member. Or is it?

The members of the Advanced Fighter Technology Integration (AFTI)/F-16 Joint Test Force at Edwards AFB, California, don't think so. They have been flight testing an automatic recovery system for the past 7 years — a system that can make most of these mishaps something we will not have to deal with in the future.

CFIT

Roughly one out of every four fighter/attack aircraft lost is due to



The GCAS computer constantly calculates altitude needed to recover above the floor altitude. The system begins warning the pilot visually and aurally 5 seconds before taking control. If the pilot doesn't respond, the GCAS performs a flyup maneuver at the last second.

controlled flight into terrain (CFIT) mishaps where the aircraft inadvertently hits the ground. (See the chart below.)

Since 1976, 24.3 percent of fighter/attack Class A mishaps have been collision with the ground.

	Mishaps	CWG	Percent
Fighter	647	137	21.2%
Attack	149	57	38.3%
TOTAL	796	194	24.3%

Ground collision avoidance systems (GCAS) are being developed today to handle CFIT mishaps. Most of these mishaps result from the pilot losing track of where the ground is and where his aircraft is headed. Typical examples are the pilot that is distracted during low level flying and starts a shallow descent toward the ground, or the pilot who is well above the ground during air-to-air flying but is looking behind him and doesn't realize he's in a steep dive.

"The difference between the AFTI/F-16 GCAS and other ongoing efforts is that we use an automatic recovery," said Mark A. Skoog, Chief Engineer on the AFTI/F-16 Program. "Other systems are designed to warn the pilot. We do that also, but, if the pilot does not react, our system will wait until the last possible moment and then take over and recover the aircraft."

In recent years, there has been much publicity on a new, although smaller, category of CFIT mishaps — those caused by G-induced loss of consciousness (GLOC). Because the AFTI/F-16 GCAS automatically recovers the aircraft, it can be used to prevent ground collision during GLOC.

Flying Safety first visited the AFTI people in 1987 when their GCAS could prevent 80 percent of CFIT mishaps. Today, with the use of a digital terrain data base, their automatic All-Terrain Ground Collision Avoidance System (ATGCAS) is the technology that can almost eliminate this deadly and costly mishap category. Here's how it works.

The AFTI/F-16 aircraft is a single seat, full-scale development F-16 aircraft which includes a Block 40 General Avionics Computer and Digital Flight Control System. The pilot does have full override capability of the GCAS system through the standard sidestick controller.

A Digital Terrain Data Base

In July 1985, when testing began, the AFTI people used the simple altitude sensing system available on most of our aircraft. This allowed flat terrain avoidance. Today, the system employs a digital terrain data base where all of the terrain, and known obstructions such as towers, the aircraft is going to fly over is digitized and entered into computer memory on board the aircraft. This system can almost eliminate CFIT mishaps. Flight testing of the current ATGCAS design began in September 1991 and is still ongoing.

The digital data base is a series of numbers corresponding to the terrain elevation at various points arranged in a grid pattern. This data is stored on a removable optical disk. The data base covers an area

continued

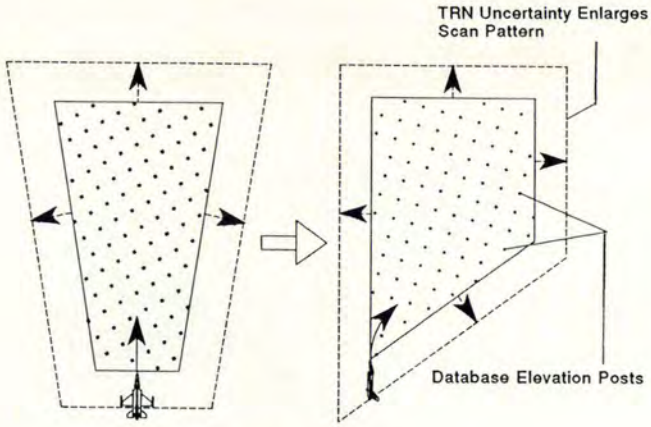


Figure 1 Terrain Scan

The data base is scanned ahead of the aircraft similar to a terrain following radar. The scan region grows in length with increased speed, dive, and bank, while it expands laterally and shortens in length due to turn rate.

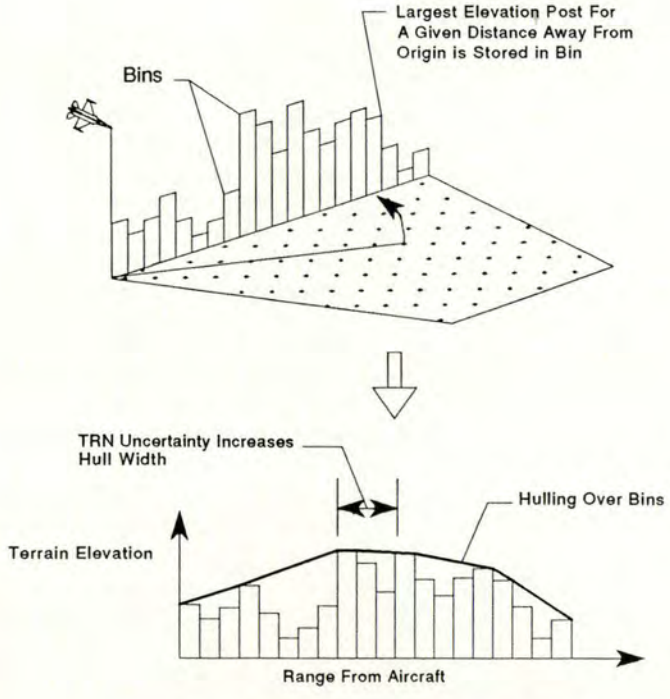


Figure 2 Binning and Hulling Process

Binning and hulling are methods used to simplify a complex, three-dimensional model of the local terrain contained within the scan region into a two-dimensional representation of the local terrain.

of approximately 40,000 square miles, but the optical disk is capable of storing an area 10 times that size.

The data base is scanned ahead of the aircraft similar to a terrain following radar. The scan region grows in length with increased speed, dive, and bank, while it expands laterally and shortens in length due to turn rate. (See figure 1.) The three-dimensional model of the local terrain contained within the scan is then reduced and compressed to end with a simplified two-dimensional representation of the local terrain.

Figure 2 shows the compression techniques. These data reduction techniques were used to increase computational efficiency.

The Autorecovery Maneuver

The pilot controls the autorecovery system operation by setting above ground level (AGL) altitude, or floor, that he does not want to descend below.

During flight, the GCAS continuously compares the aircraft flightpath (altitude, airspeed, and attitude) to the set floor altitudes. According to Mr. Skoog, "The GCAS is always calculating how much altitude it would take to roll the aircraft wings level and pull 5 Gs to make the aircraft clear the near horizon. The pilot is given audio and visual warnings as the GCAS senses the aircraft running out of altitude. When the GCAS has just enough altitude to recover, it takes over."

The actual maneuver the aircraft performs is very simple. When the autorecovery is commanded, the aircraft rapidly rolls to wings level and pulls 5 Gs until the near horizon is cleared. The pilot is reminded to take over by the voice warning which announces "you've got it."

Ability to Override

One of the important parts of the AFTI/F-16 GCAS is *the pilot's ability to override the automatic controls.* The pilot is always capable of completely overriding the automatic controls and can temporarily disconnect the system with a paddle switch on the

Since 1 January 1982, the Air Force has lost 132 pilots and 238 total fatalities due to controlled-flight-into-terrain (CFIT) mishaps! The AFTI/F-16's automatic All-Terrain Ground Collision Avoidance System is the technology that can almost eliminate CFIT mishaps.

control stick. Switches are also available in the cockpit for the pilot to select a warning only (no automatic recovery) or completely turn off the system.

The ability of the pilot to override and turn off the system is considered important because the automatic recovery would not be wanted when the pilot is aware and can prevent flying into the terrain himself. He would also want to turn the system off to intentionally descend below the floor altitude. The pilot can easily override the automated recovery through the control stick. According to Major Dana Purifoy, AFTI/F-16 Ops Officer, "Our basic design philosophy is the pilot must have ultimate control of the aircraft. We're not trying to take the pilot's place — *just help him*."

When the GCAS is in operation, it takes over only when it has *just enough* altitude to recover.

Audio and Visual Warnings

Audio The AFTI/F-16 GCAS audio warnings are computer-generated voice commands similar to other GCAS systems. The pilot hears "pullup, pullup" prior to the recovery and "flyup, flyup" when the GCAS actually takes over.

Visual The traditional GCAS visual display is a "break x" — where a flashing "x" appears in the headup display (HUD) to warn the pilot to recover. "The problem with this type of display is it appears suddenly and does not give any trend information," said Mr. Skoog. "A pilot is expected to rapidly understand the warning and maneuver correctly."

continued

Operation of this system begins prior to takeoff by selecting the automatic or manual recovery mode. If a floor altitude other than the default 400 feet is desired, a new one can be selected at this or any other time during the flight.

WE HAVE THE TECHNOLOGY continued

Everyone in the control room carefully monitors the test profile as the chevrons come together indicating time to flyup.

The AFTI/F-16 program elected, instead, to split the "break x" into two chevrons that appear in the HUD at 5 seconds prior to flyup. They move smoothly together to form the "break x" at flyup. Members of the test force say this display has met with universal approval from pilots who have flown both displays.

GCAS Operation

The operation of GCAS begins prior to takeoff. All that is required is to turn on the system by selecting the automatic or manual recovery mode. If a floor altitude other than the default 400 feet is desired, a new one can be selected at this or any other time during the flight.

The system automatically goes into a standby mode while the aircraft is still on the ground. The system then automatically arms after takeoff and the aircraft has climbed above the floor altitude. There are indicators inside the cockpit and in the headup display informing the pilot of the GCAS status. During flight, the system automatically goes into a standby mode while the gear are down, the refueling door is open, or if the radar altimeter or navigation systems fail to give accurate information.

Lt Col Lawrence Davis, Director of the AFTI/F-16 Test Force added: "Due to budgetary constraints, there are additional self-imposed limits. Currently, the system does not work at dive angles above 60 degrees, Mach numbers above 0.95, and airspeeds below 265 knots. We've shown in simulation the system will function beyond these limits. Our auto GCAS was designed with limited ability, purely for the support of testing other AFTI/F-16 systems. The auto GCAS should be expanded to full envelope when funding is available."

Plans for Production

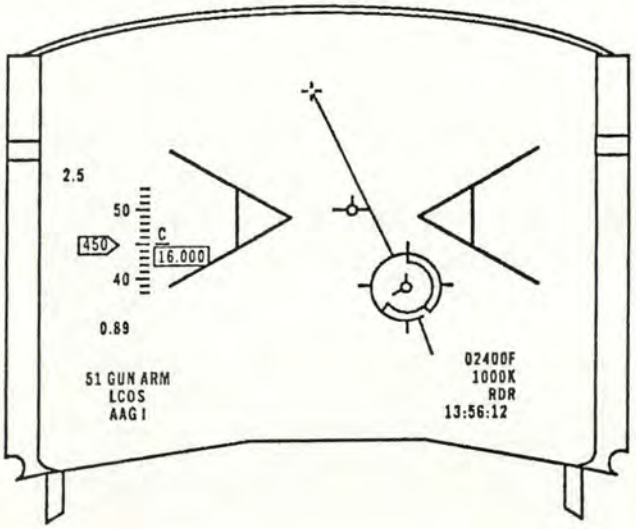
The obvious benefits of this system have generated interest in the Air Force and Navy; however, there are no official plans to install it at this time. Candidate aircraft would begin with air-to-ground aircraft having computerized flight control systems such as the F-16, F-15E, and F-18. However, other aircraft, such as the F-22, C-17, B-1, B-2, as well as commercial aircraft, would also benefit.

Is It Worth It?

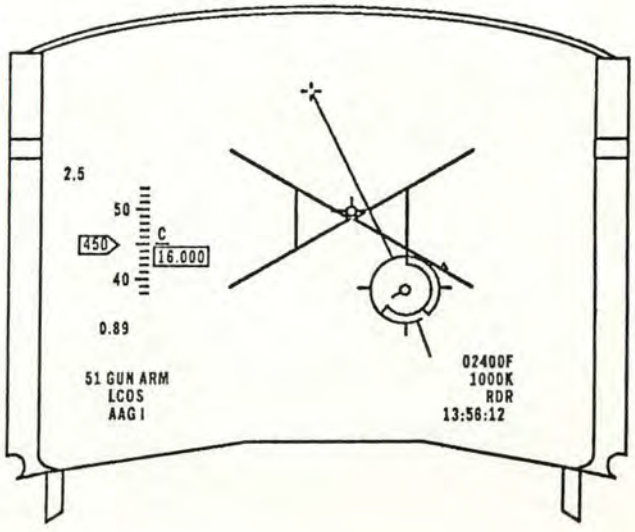
Since 1 January 1982, the Air Force has lost 132 pilots and 238 total fatalities due to CFIT mishaps! Lt Col Davis contends, "With the technology currently available on many aircraft, we could integrate this system effectively. With shrinking defense budgets, we can't afford to lose aircraft or pilots. With auto GCAS, we can save lives, project lower expected losses, and decrease the total procurement dollars." ■

Rather than have a flashing "break x" suddenly appear in the headup display to direct a flyup, the AFTI/F-16 uses two chevrons. The chevrons appear 5 seconds prior to flyup and move together to form a "break x" at flyup.

A. Headup Display, 5 Seconds to Flyup



B. Headup Display at Flyup



IFC APPROACH

My Instrument Question Is:

THE INSTRUMENT FLIGHT CENTER STAFF
Randolph AFB, Texas

■ As the focal point for Air Force instrument flight procedures, the USAF Instrument Flight Center receives numerous inquiries on instrument-related topics. We have published the most recent questions in hopes this information will increase your understanding of instrument rules, procedures, and techniques and dispel the myths, rumors, and misunderstandings that misinform our pilots.

QUESTION: *On the plan view of the Instrument Approach Procedure (IAP), what is drawn to scale? I was always told it is what is inside the 10/20 mile ring.*

ANSWER: You are partially correct. We'll use the low (figure 1) and high (figure 2) IAPs into the Fresno Air Terminal, California, to answer the question. *Book #4* of the Interagency Cartographic Committee provides the specifications for designing all low IAPs. All high IAP specifications are in *DOD Product Specifications 1FA/091 (PS/1FA/091).* Both of these books specify when the plan view of an IAP contains only one ring. Everything in the plan view is to scale.

Looking at figure 1, the ILS RWY 29R at Fresno, there is only one circle in the plan view, so everything is to scale. There is one exception to this rule, and we see it depicted at the LATON fix. Where a distance cannot be depicted to scale, a double jagged line crosses the radial indicating the distance is not to scale. Where there are concentric circles (translation: More than one circle), only the items inside the inner ring are to scale. In figure 2, HI-ILS/DME 1 RWY 29R at Fresno, we see more than one circle in the plan view. IAW the cartographic committee's *book #4* and *PS/1FA/091,* only the information depicted inside the 20 NM circle in our example is to scale. Regardless of the number of circles, the length of the ILS "feather" does not tell you anything.

QUESTION: *In the examples at Fresno Air Terminal, the low altitude IAP uses a timing box as well as DME to define the missed approach point (MAP), but the high altitude approach does not. What gives?*

ANSWER: Again the *book #4* and *PS/1FA/091* allow for differences. The low-altitude approach (figure 1) is titled ILS RWY 29R. DME is not mentioned in the title and is not necessary for flying the final approach portion of the approach. The FAF can be identified using the outer marker (OM) or crossing radials, and missed approach timing can be started from this point. In figure 2, HI-ILS/DME 1 RWY 29R, DME is specifically mentioned in the name. Since DME is listed as being needed to fly the final portion of the approach, the "TERPster" is not required to give you a timing box. Although it appears to require a little interpretation, you will go localizer missed approach at I-FAT 1.7 DME as you would if you flew the low-altitude approach.

QUESTION: *Once established on the inbound leg of a holding pattern, headed to the IAF, if the controller clears me for the approach, am I allowed to accelerate or decelerate to penetration airspeed?*

ANSWER: AFM 51-37, *Instrument Flying,* page 98, para 10-5b, tells you

continued

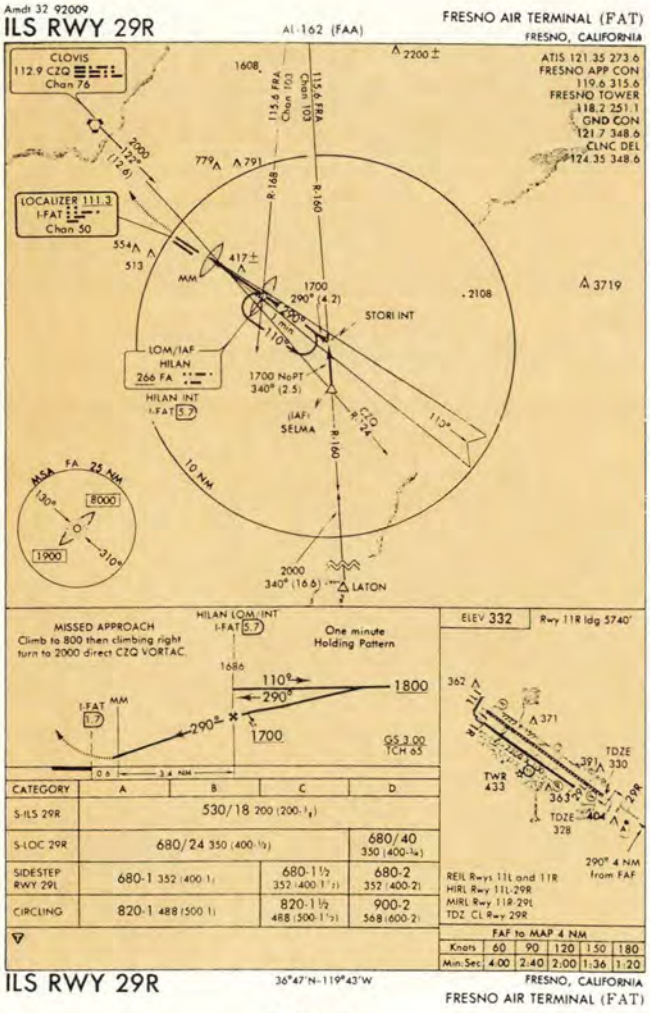


Figure 1

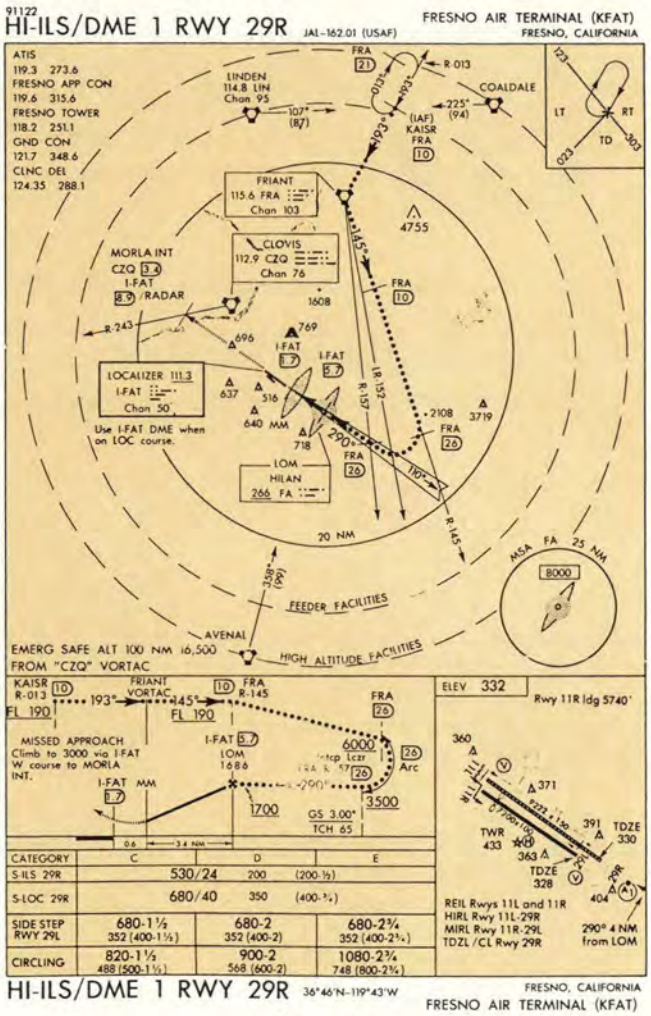


Figure 2

THE IFC APPROACH:

My Instrument Question Is: continued

before reaching the IAF, if holding is not required, slow to penetration airspeed. In the case mentioned, the controller has cleared you for the approach, and you have not indicated additional holding is required, so you are cleared to accelerate or decelerate as necessary prior to crossing the IAF.

Although AFM 51-37 says slow to penetration airspeed, you are allowed to adjust your airspeed as necessary. From a TERPS perspective, the airspeed is critical in the turns to keep you within protected airspace. For this reason, do not accelerate past your holding airspeed until established on the inbound leg of the holding pattern headed to the IAF to start the approach. Assuming you don't leave the minimum holding altitude prior to departing the IAF, you can accelerate to Warp Factor 2 on the inbound leg and still remain safe inbound to the IAF.

QUESTION: *I'm established outbound on the procedure turn course. I start my turn toward the maneuvering side. Do I have to do the 45°/180° maneuver, or can I just keep my turn going and then intercept the inbound course and proceed directly to the FAF?*

ANSWER: Nothing prevents you from continuing the turn, and unless you graduated from the Hormel™ Academy of Sciences or are affected by gale force winds, you will remain within TERPS protected airspace. However, the IFC considers this to be a poor technique. By continuing the turn, you will be intercepting the inbound course much closer to the FAF or, worst case, at the FAF. By flying the approach this way, you're giving yourself less time to configure the aircraft, to become established on course with the CDI centered, and to kill the drift.

Again, the worst case is you may find yourself inside the FAF attempting to get the CDI centered and working the drift out at a time when the aircraft should be stable, trimmed, and on centerline. By flying the 45°/180° procedure, you will intercept the inbound course further from the FAF, giving yourself more time to configure and stabilize the aircraft on the centerline of the approach.

QUESTION: *AFM 51-37, para 13-1 a(2)(c) says, "When a turn is required over the FAF, turn immediately and intercept the final approach course to ensure that obstruction clearance airspace is not exceeded." Does this mean as soon as I enter the cone of confusion or the first positive "FROM"?*

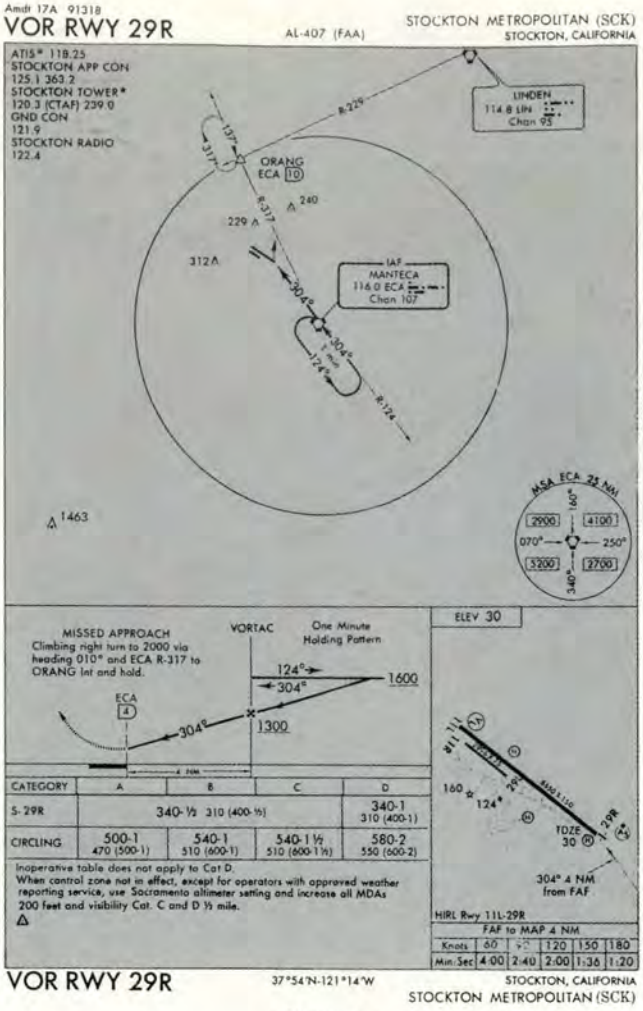


Figure 3

ANSWER: The first positive "FROM" keeps you closer to the designed centerline of the approach. If you start your turn when you enter the cone of confusion, it will put you further from course centerline than the first positive "FROM" indication.

QUESTION: *Use the VOR RWY 29R at Stockton Metro for an example (figure 3). This is a holding-in-lieu of procedure turn approach, with 1-minute timing. I am being vectored at 3,000 feet to final and cleared for the approach. Let's say I am at 10 DME and have intercepted the 124° radial. Can I consider myself established on the approach and descend to 1,300 feet?*

ANSWER: NO! The approach can be flown as a straight-in IAW AFM 51-37 because you were radar vectored. However, procedurally, the approach does not start 'til crossing the IAF/FAF. There is no "remain within" distance to help you determine where TERPS protected airspace starts, so how far out is safe?

In this example, the controller will have to give you a lower altitude, or if you can't get lower and can't safely fly the approach from your present altitude, you will have to fly the entire approach. Pilots also ask, "If I'm going 3 miles a minute, and the holding pattern is 1 minute, why can't I consider myself established when I'm 3 NM away from the FAF?" Procedurally, this is incorrect, but on a VOR or NDB approach without associated DME, you won't be able to tell how far you are from the FAF.

QUESTION: *AFM 51-37, Change 3, para 10-2 NOTE (added). Please clarify why the FAA controllers are not required to confirm clearance readbacks.*

ANSWER: First of all, USAF controllers are required to confirm your readbacks. With FAA controllers, the requirement is different. If you correctly read back a clearance to an FAA controller, that controller is not required to acknowledge your transmission. Obviously, if a controller is busy and did not hear your transmission, they cannot respond if something you said was incorrect. For this reason, the absence of a response from the controller does not mean what you said was correct or that you were even heard.

QUESTION: *If a thin overcast at 1,000 feet moves over the base, may we still operate a VFR pattern?*

ANSWER: Although a thin overcast does not constitute a ceiling, AFR 60-16 still requires you to maintain VFR cloud clearances when operating VFR in controlled airspace. So even though the cloud layer is thin, if you can't maintain your cloud and ground clearances, you can't have the VFR pattern.

QUESTION: *AFM 51-37, Change 3, para 12-2 b states, "Upon reaching the IAF, turn in the shortest direction to intercept the outbound procedure turn course." Does this mean I can no longer teardrop or racetrack the procedure turn?*

ANSWER: The USAF IFC deleted the use of holding rules to determine how to enter a procedure turn. This closely aligns us with the way the civilians are flying. You now cross the IAF and turn in the shortest direction to the outbound procedure turn course. However, that is all we changed. Change 4 to AFM 51-37 will say, "Upon reaching the IAF, turn in the shortest direction to intercept, parallel, or teardrop the outbound procedure turn course."

QUESTION: *How does the question above apply if I am established in a holding pattern at the IAF?*

ANSWER: The shortest direction rule only applies to the initial passage of the IAF when holding is not required. When you are established in holding at the IAF and subsequently cleared for the procedure turn approach (assuming you must fly the entire procedure), use the rules of holding to determine which way to turn outbound. ■

HIGH TECH COCKPIT

This technology is a major step toward reducing crew requirements while increasing performance capability and lowering operational costs.

■ A C-130 Hercules, equipped with an electronic flight station, has been delivered to the U.S. Air Force for flight evaluation. The flight station, which has completed the ground and flight test phase, uses color Active-Matrix Liquid Crystal Display (LCD) technology. Consisting of six 6- X 8-inch flat panel displays, it is the first of its kind ever tested on a military transport.

The flat screen displays replace more than 60 electromechanical cockpit instruments currently being used on the Hercules. The displays present primary flight information, navigation mapping, weather radar, engine operating data, and select fault warning messages to the flightcrew.

The electronic display system is an ideal modernization concept for the Hercules, which has limited space behind the pilot's instrument panels.

The displays require only a fourth of the depth required by television-type cathode ray tubes presently in operation by some of the newer commercial aircraft. This kind of display also provides better visibility under bright background lighting conditions. Because they are shorter, the LCD units reduce the design effort and are easier to install. Digital processing, reduced electrical power, reduced weight and cooling requirements, as well as increased durability and reliability, are added benefits.

This technology is a major step toward reducing crew requirements while increasing performance capability and lowering operational costs.

The C-130 electronic cockpit program was funded by the Reliability and Maintainability Technology Insertion Program Office of the Aeronautical Systems Division at Wright-Patterson AFB, Ohio. The office is interested in program results which generate potential enhancements in reliability and maintainability for the C-130 and other aircraft. The Air Force will continue, through operational use in the field, evaluating the C-130 electronic cockpit for the next 6 months.

This program has helped develop concepts in flight station instrumentation that will be a part of the improvements in existing, as well as future, aircraft. For example, the same technology used on the C-130 is being considered for the C-141 military transport as a part of an autopilot replacement program proposal. This technology also will be a part of all instrumentation in modernized versions of the Hercules family of airplanes.

The C-130 electronic cockpit program was recommended by the USAF MAC headquarters and is administered by the C-130 Directorate at Warner Robins Air Logistics Center, Robins AFB, Georgia. ■

OPS TOPICS

Night Landings *Are* Smoother . . . But

■ Ever since your first night flying experience, somebody in the flight room has always made the comment about night landings being smoother than day landings. Well, usually they are, but every once in a while the conversations afterwards can get a little rough.

This story begins with an instructor trying to get some night landing practice with a student in a small, bicolored jet. Beside the usual syllabus requirements, the student also needed to accomplish three night landings. However, this crew was not alone. There were a number of other students and instructors, all attempting to meet the syllabus requirements without having to schedule another night sortie.

Needless to say, the traffic pattern was crowded. The crew had to go around a number of times for inadequate spacing on a landing aircraft (night spacing is greater than day spacing). They had to break out of the pattern once for spacing as they neared the perch. They also had to fly around the outside pattern a number of times due to conflicts with other aircraft on initial approach.

During all this time, the jet continued to convert JP-4 into noise, and eventually, the fuel quantity approached the "mission complete" level. The instructor's fun meter was about pegged.

Training had been marginal. The interior lights appeared to be the same ones installed in 1967 when the jet was delivered. Only the map lights made the airspeed indicator readable. More jets were showing up in the pattern to further complicate things. All the instructor or student wanted to do was park the jet and call it a night.

Their final turn was flown as they expected. They announced "Gear down, full stop" to the RSU. Lined up on the runway, everything looked good. But as the landing light reflected from the runway back to the jet, the RSU saw clearly the gear were retracted. Their "Flare go around" call came too late. The jet touched down with power in military and slid to a stop.

We never heard how smooth they thought the landing was, but the conversations with the safety folks sure seemed rough.

This is not a night landing story. It is a story about distractions and frustrations and priorities. Even before the Wright brothers, a successful landing was the mark of a successful flight. ■

Hey, Grebe! Duck!

■ The "Beagle" was snooping around on a low-level at 700 feet above the southwestern desert when it decided to auto flyup at 4 Gs. The crew was given an "obstacle warning" announcement at the same time. During the flyup, the aircraft passed through a flock of birds, striking at least two of them.

Damage included the LANTIRN pod, the center fuselage, and the right aux fuel tank. After a control check, the aircraft returned to base for a safe landing.

The birds, which the Beagle hit, turned out to be western grebes according to the state department of wildlife. The wildlife folks had some additional words for the safety officers looking into the incident.

"Due to the exceptional spring rains across all of the southwest, there is an increase in insect life which many birds will be feeding on throughout the summer. Later, you can expect an explosion of plants to result in a higher natural seed production which will continue to attract ducks and other shore birds like the grebes. The problems with lots of birds, in the areas where you fly, won't be over for quite a while."

Traditionally, Air Force aircrews associate bird hazards with spring and fall seasonal migrations. This might be a good year to keep bird hazards near the top of your list every time you go out to fly. ■

Does It Get Any Tougher Than This?

MAJOR ROY A. POOLE
Editor

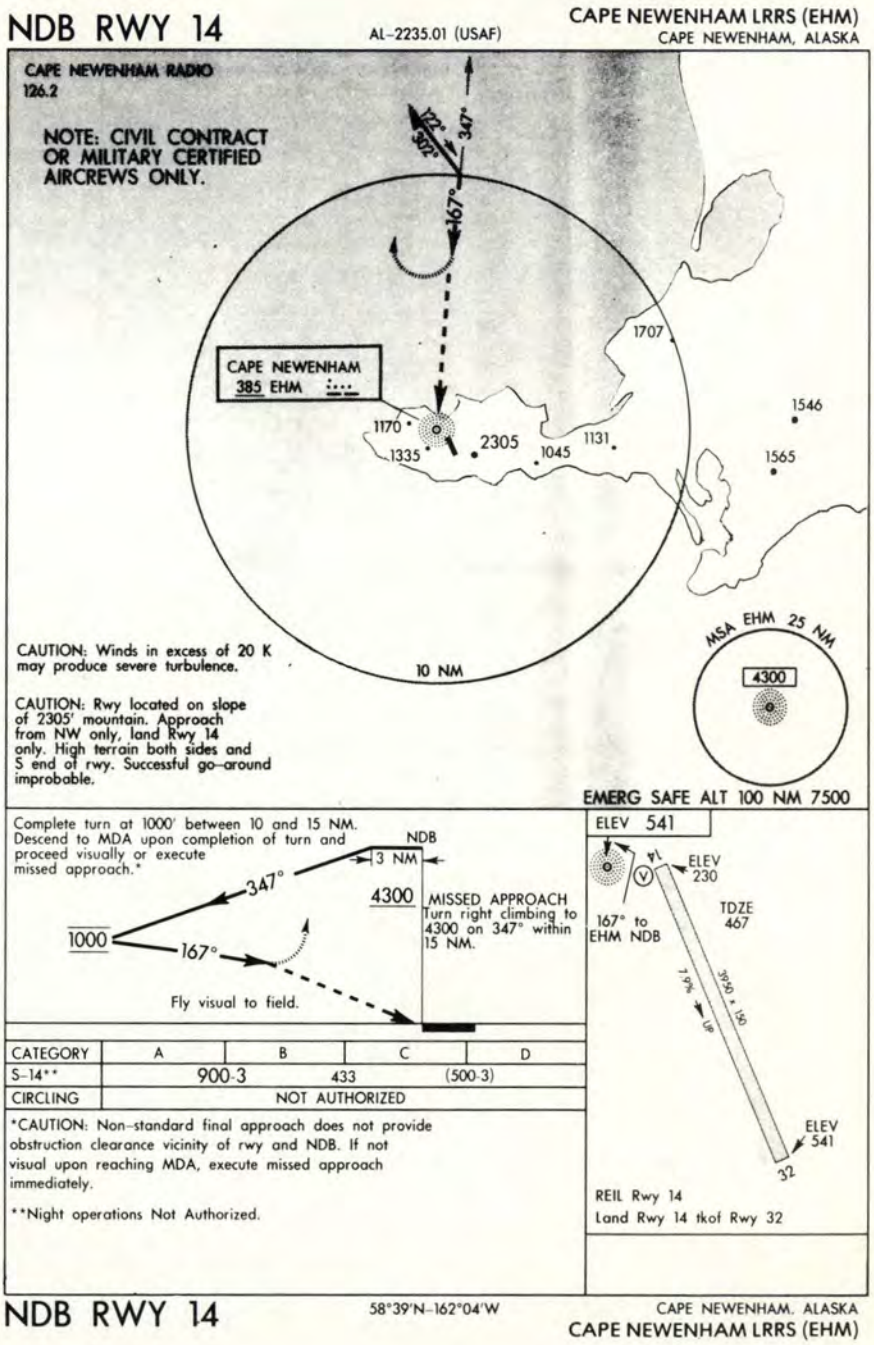
■ Our vote for the toughest approach in the world has to go to the NDB RWY 14 at Cape Newenham LRRS in Alaska. The approach itself is pretty straightforward, but what you have to do to land out of it is downright exciting. For example:

- Don't do this at night.
- The nonstandard final approach does not provide obstruction clearance in the vicinity of the runway or NDB.
- If the winds blow in excess of 20 knots, you can expect some severe turbulence.
- Although you have flown in over the ocean, the runway is located on the slope of a 2,305-foot-high mountain.
- Land only on runway 14, and make it a good one — a successful go-around is improbable.
- The approach end of runway 14 is more than 300 feet lower than the departure end.

Send Us Your Toughest

Is there an approach tougher than this one? Send us a copy of the published approach you feel takes top honors. We'll publish them in future issues to remind others there is never a dull moment on instruments. Include a description of the features which make it so tough, and tell us which airplane you accomplished it in.

Send your worst approaches to *Flying Safety,* AFSA/SEDP, Norton AFB CA 92409-7001. ■



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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
Richard P. McKee

CAPTAIN
Gregory E. Wiley

HQ 27th Tactical Fighter Wing
Cannon AFB, New Mexico

■ At 400 feet AGL and 550 knots, things happen pretty quickly on a routine F-111 training sortie. Maj Richard McKee, aircraft commander, and Capt Gregory Wiley, weapon systems officer, were in the no. 2 position of a two-ship formation to the Melrose Tactical Bombing Range when suddenly, this particular sortie was no longer routine.

An unseen bird hit the aircraft radome, shattering it and sending debris into both engines. The angle-of-attack probe was also destroyed, and much of Maj McKee's forward vision was blocked by strands of fiberglass from the radome. With no pitot static instruments, no reliable angle-of-attack information, limited visibility, both engines compressor stalling, and the aircraft pitching and rolling, Maj McKee struggled to begin a climb from the low level route.

Capt Wiley prepared for crew ejection and helped accomplish the before-ejection procedures. By this time, the lead aircraft rejoined and informed the crew of fireballs shooting from the rear of the left engine. Maj McKee selected the right engine afterburner to continue the climb to a safe altitude. He fixed the control problems by turning off the pitch damper in accordance with checklist procedures. Able to determine the F-111 was controllable, the crew turned toward the field with their leader guiding them down.

En route, Maj McKee discovered the right engine afterburner would no longer light. With the left engine in idle, altitude for recovery was critical. Realizing he might not make the field for a normal approach, Maj McKee coordinated for an opposite direction landing. Due to higher-than-normal angle of attack and limited forward visibility, Maj McKee could not see the runway during final approach. But with Capt Wiley monitoring the engine instruments and the lead aircraft providing altitude, airspeed, and attitude information, he skillfully managed the approach and performed a flawless landing.

The professional airmanship and exemplary flying skills demonstrated by Maj McKee and Capt Wiley during an extremely difficult and challenging emergency saved a valuable combat resource and prevented the loss of an experienced crew.

WELL DONE! ■


SPECIAL
ANNOUNCEMENT
Summer Is Here!