aerospace

SAFETY OCTOBER 1977

THE AIR FORCE
ENTERS A NEW AGE

First Lieutenant Mary M. Livingston checks the gear of a T-38 with 2nd Lt Goeffrey W. Jumper. One of the first ten women pilots to graduate from UPT, she has been assigned to Columbus AFB, MS, as a T-37 IP.

THE MISSION - - - - - - SAFELY!

OCTOBER 1977

UNITED STATES AIR FORCE

aerospace SAFETY

SPECIAL FEATURES

REGULAR FEATURES

NAME THAT PLANE

SEVERSKY P-35

The P-35 was the first Army production single-seat fighter equipped with retractable gear. The P-35 was almost 50 mph faster than the P-26. However, the one .30 and one .50 caliber gun armament was too light to keep up with the rapidly developing bombers. Built by the Seversky Company which became Republic shortly thereafter, the P-35's did not see combat but served as trainers or mechanics' mockups. This ignominious fate was absolved by the P-35's grandchild, the P-47 Thunderbolt.

Specifications—P-35
Engine—950 hp P & W R-1830-9
Span—36' 0"
Length—25' 2"
Gross wt—5599 lbs
Speed—280 mph at 10,000 ft

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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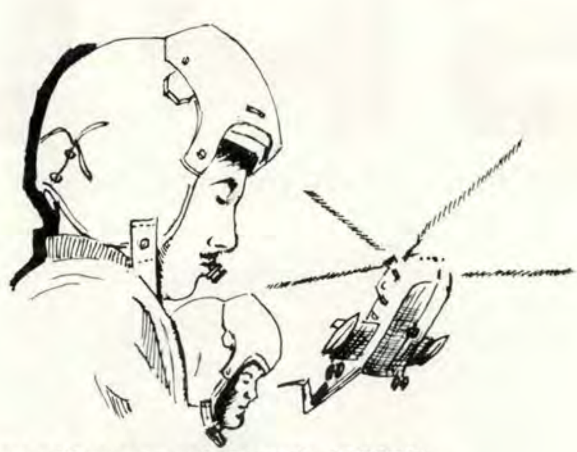
OCTOBER 1977 AFRP 127-2 VOLUME 33 NUMBER 10

news for crews



MAJOR WALTER CONNALLY, Rated Officer Career Management Branch AFMPC

THE USAF HELICOPTER PILOT FORCE

To many rated officers, a helicopter is associated only with a survivor/rescue situation. The following article provides a synopsis of the helicopter force and its demanding mission.

Historically, the helicopter force has been small compared to the total Air Force rated resource. During the Southeast Asia time frame, the helicopter force underwent a transition in weapon systems, roles and missions, and number and type of pilots. New turbine powered helicopters entered the inventory which provided increased range and lift capability. At the same time, helicopter instrumentation was improved and helicopters were utilized in more diverse roles and missions. Post Southeast Asia has found the helicopter force diminishing. Currently, the Air Force has helicopters and helicopter pilots assigned to six major commands (MAC, TAC, AFSC, USAFE, ATC, and PACAF). These commands fly H-1s, H-3s, or H-53s and perform local and long range rescue, missile site support, midair and surface recovery, special operations, tactical air control, VIP ferry and range support missions. Presently, there are approximately 600 cockpit authorizations and, in addition to the cockpit authorizations, there are approximately 500 helicopter pilots serving in supplement, staff, AFIT, PME and ATC instructor duties.

Avenues for officers to enter helicopter pilot duties are undergraduate pilot training/helicopter (UPT/H) and rotary wing qualification training courses conducted by the United States Army at Fort Rucker, Alabama. Officers who enter UPT/H are normally new accessions to the Air Force, while rotary wing training is provided to a limited number of Air Force fixed-wing pilots who do not have major weapon system identification. Following the initial training at Fort Rucker, advanced specialized training in an assigned weapon system is provided at Kirtland AFB, New Mexico.

Air Force helicopter pilots have the same career progression opportunities as other Air Force pilots. The initial assignment is operational where the opportunity exists to upgrade to aircraft commander, instructor pilot and flight examiner. Presently, the Air Force is providing fixed-wing qualification training to the Army trained "helicopter only" pilot. This training is provided after four to seven years of aviation service in the Air Force; however, in the future this cross-training will be provided only if it is determined necessary by Air Force requirements. As Air Force requirements dictate, helicopter pilots are also considered for cross-training into other type helicopters or assignments to operational staff and support duties. They are also eligible for attendance at the Air Force Institute of Technology and professional military education courses.

The helicopter force has undergone, and is continuing to undergo, tremendous changes; however, the opportunity exists for a challenging and rewarding career to those assigned to helicopter duties. ★

ABOUT THE AUTHOR

Major Connally is currently assigned to the Rated Officer Career Management Branch, Air Force Military Personnel Center, where he serves as the helicopter resource manager. His helicopter background includes a SEA tour in HH-43s and an assignment to Myrtle Beach Air Force Base, South Carolina, as the Detachment Commander, flying UH-INs.

GPWS

A bee in your bonnet or an angel on your shoulder?

MAJOR ROBERT W. SWEGINNIS
Directorate of Aerospace Safety

"What's this ground proximity thing you turkeys are putting into the new transport?", the veteran multi-engine driver growled as he stalked toward the program office engineer. "What are you trying to do? Drive us crazy with more flashing lights and buzzers! Don't you guys think we can hack it? Look at the record! The accident rate has been going down for years! Why don't you save the money and give us taxpayers a break? Take that cock-a-mamy system and sho . . . ."

"Wait a minute major! Give me a chance," the engineer broke in. "I think I have some answers. Pull up a chair, fill your mug, and I'll try to explain what we have in mind and answer your questions one by one," continued the engineer as he guided the major to the coffee pot.

"First, what is this ground proximity warning system, GPWS for short, we are looking at? Basically, it picks up parameters which are already being measured, compares them, and provides three types of warnings. One type tells you when you and the ground are coming together at an unusual rate or time, another sings out when landing configuration isn't established prior to descending below some threshold altitude."

"Great, another gear warning horn," the major muttered into his coffee cup.

The engineer pretended not to hear and proceeded, "The third type of warning will inform you when you fall below the ILS glide slope."

The major's coffee cup slammed down on the desk, "Horns and red lights at minimums I don't need!"

"And you won't have them! Stay with me and I'll explain. When I said the system will tell you when the ground is coming up fast, I meant TELL YOU. Maybe we'll get some sweet young thing to record the warning, but, in any case, it will be a voice warning. And it will be specific too. If you are sinking too fast into relatively flat terrain, it would call out, perhaps, SINK RATE. If you were in relatively level flight and the terrain were rising due to hills or mountains, it could call out TERRAIN or maybe RISING TERRAIN."

"Beautiful. Every time I make a descent for an approach or fly over some hills during a low-level mission some gal is going to whisper sweet nothings in my ear," was the comment into the now near empty coffee cup.

"Agreed, that's a problem, but not an unsolvable one. Refill that cup while I get out a couple of charts."

As the major returned with another steaming cup, the old pro motioned him around the desk to look at the charts. "The first type of warning I mentioned, you and the ground coming together too fast, has been separated by the FAA into two subsets or modes. Mode 1 compares barometric sink rate to vertical height above the terrain. The pitot static system provides the first input, the radar altimeter the second. All the GPWS has to do is compare the two; and when they get into this area," pointing to the chart marked MODE 1, "give the appropriate warning. The warning can be varied according to how far the parameters measured move into the warning area. If the threshold value is barely exceeded, a one time or low repetition rate SINK RATE may be generated. These warnings are called soft and are used around the edges of the envelope. If the height above the terrain continues to decrease with no decrease in sink rate or the sink rate increases, the repetition rate or volume could be increased. We could even change the warning to PULL UP if the time to ground collision became critical. These warnings are called hard and are used inside the envelope. The human factor folks are giving this a close look, trying to come up with the best way to alert the crew to the exact situation so they can take the best possible corrective action."

"Wake them up so they can die all tensed up, huh?!! Mind if I get another cup of coffee? Thanks. Say, how are you going to balance this thing, keep it from blabbing in my ear with useless warnings and still provide the warnings we need?"

"False warnings are a problem; too many and the crews will ignore them. Backing off on the warning thresholds, on the other hand, reduces the warning time, decreasing the value of the system. You can see the thresholds that the FAA requires for large commercial jets. The dashed lines radiating from the lower left are times to impact."

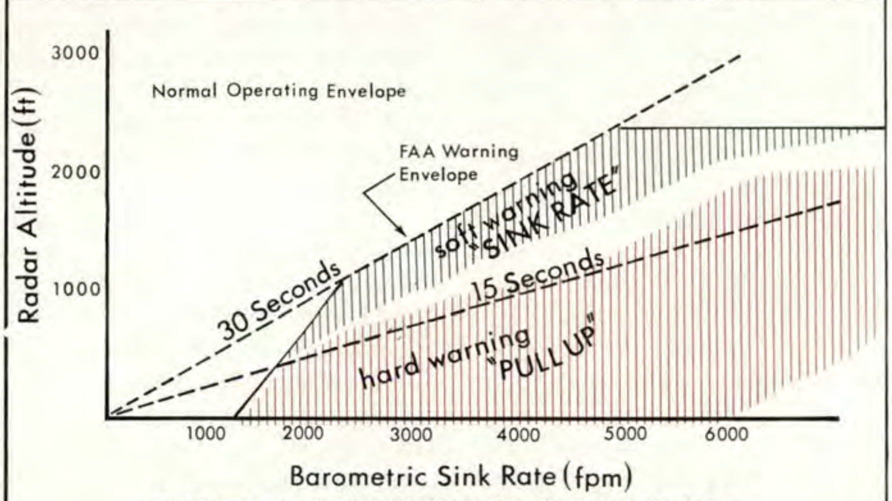
"Will these thresholds work for us?", asked the major.

"Perhaps as a starting point. But it looks like our missions are different enough to warrant significant changes. In some cases, we may have to cut back on the FAA standards to provide the flexibility we need on tactical missions. In other cases, we may be able to provide increased warning times. We are picking data points off actual test missions to ensure that we get the warning threshold as close as possible to, but not overlapping, our expected performance.

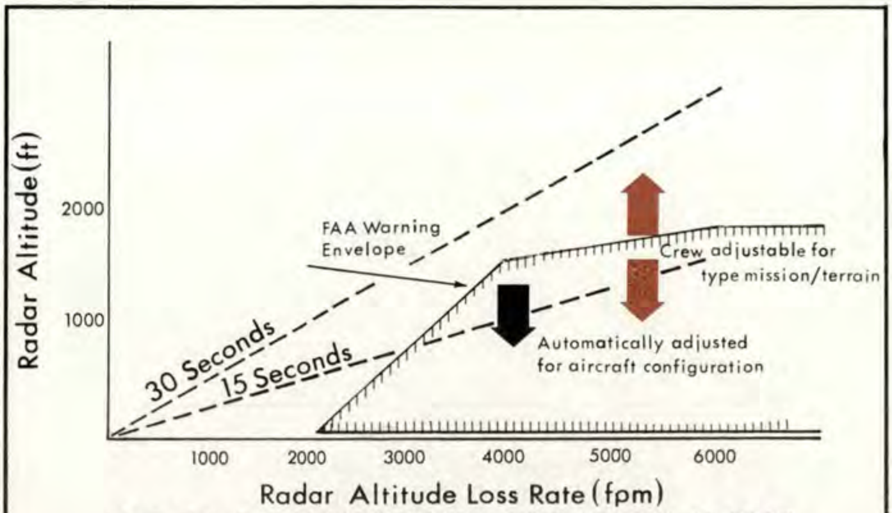
"Take a look at MODE 2. It, like MODE 1, examines how fast the gap between the ground and the aircraft is closing. But it looks at rate of change of radar altitude instead of sink rate. Where MODE 1 looks at how fast you are sinking and how much you have left to go, MODE 2 tells you that the ground is coming up to meet you fast. Different modes and warnings for different threats will allow the crew to react appropriately."

"How will a MODE 2 warning keep some crew from smacking into the side of Superstition Mountain if he's off course and in the suds?" piped up the major. "According to this chart, the GPWS only looks down and can't see those vertical cliffs. Or what about some real steep hills? You know we can't exactly climb straight up."

"True, GPWS won't keep you out of the face of a vertical cliff rising out of a relatively flat plain



MODE 1 - EXCESSIVE SINK RATE



MODE 2 - EXCESSIVE CLOSURE RATE

GPWS continued

. . ." admitted the engineer as the major sat back with a smile, thinking he had uncovered a chink in the old man's armor ". . . but . . ." and the smile faded, ". . . when looking over past accidents, this type of accident, collision into a steep incline without any foothills, is very rare. The cost of including a forward looking radar just doesn't appear to be justified, at least for transports.

"One last thing before we leave MODE 2. Because of our tactical mission, we fly at low level a lot more often than the airlines. Since even moderately rolling hills can generate significant closure rates, a USAF GPWS may have to provide some pilot control over the altitude threshold on the upper right side of the curve. When landing configurations are established, we may want to lower the upper right edge of the warning envelope to allow for maneuvering prior to landing."

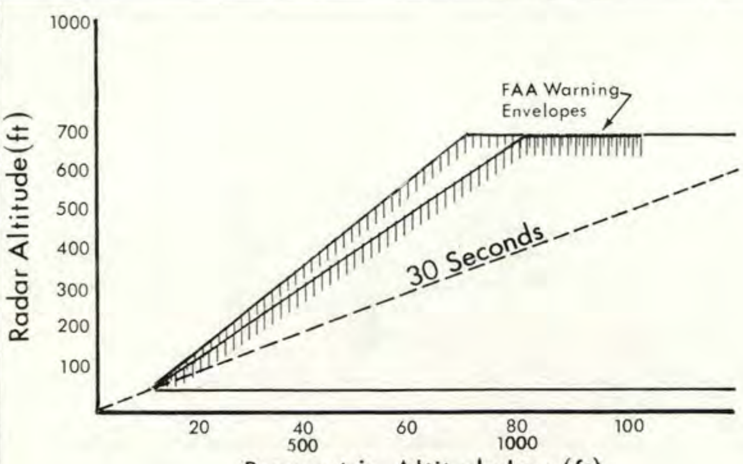
"Even if it means cutting down the warning time?", asked the major.

"The only alternative appears to be lots of false warnings . . . and that's unacceptable. It may even be necessary to be able to turn off some of the features. When you're VMC, you may have to occasionally fly this new machine more like a fighter than a transport. Some method of automatically resetting the GPWS will probably have to be worked in.

"MODE 3 is designed to warn of altitude loss after takeoff or missed approach. It compares altitude loss, which could be measured barometrically or with the radar altimeter, against the height above the terrain."

"Altitude above the ground comes from the radar altimeter?", asked the aviator as he reached for yet another cup of coffee. "And if I fall asleep right after takeoff, the GPWS hits me in the face with a wet sock."

"Radar altimeter is right, but you don't have to be asleep to lose visual references at night or in weather. We've also had some criticism of the old PULL UP warning which could be like a wet sock and cause problems when you're close to a stall. We're considering various voice warnings such as SINKING or TERRAIN RISING. Again, the warnings would be appropriate for the threat and correction available. MODE 4 is a bit different than the first three which all relate to absolute altitude loss. MODE 4 looks at altitude above the ground and compares it to the landing gear or flap position. When you're close to the ground, generally you want the gear and flaps down. This is the only FAA required mode that provides a ground proximity warning for all phases of flight regardless of rate of closure with the ground."



MODE 3-ALTITUDE LOSS AFTER T/O

"Could you run that by again?", said the major, spilling some coffee as he sought a more comfortable position in the chair.

"Sure. MODE 1 and 2 require the gap between the terrain and the aircraft to be closing at over 1500 feet per minute. If you are closing the gap at something less, like 500 feet per minute . . . no warning."

"I see," echoed out the emptying coffee cup. "For a slow, steady descent, MODEs 1 and 2 are no help. And MODE 3 works only for the initial climb after takeoff or go-around. What about MODE 5?"

The engineer pulled another chart from the file. "MODE 5 is pretty simple. It tells you when you are falling below the glide slope. Our main questions are what kind of warning and when. The general feeling is that a soft warning be given at about one dot low. At about 3 dots low the warning would be more severe in repetition rate, volume and/or terminology. We may also vary the warnings with the height above the terrain."

Draining the last of the coffee pot, the major commented, "Tap him on the shoulder at one dot, hit him over the head at three."

"Not exactly hit him on the head, but we do want to get his full attention. For that reason, we are considering wiring all the hard warnings into the call circuit. That way it would override all other voice communications. But first we want to look closely at how this would affect crew coordination during this critical period."

"There is one other mode that I should mention. It's not required by FAA, but it is sometimes referred to as MODE 6. You're familiar with it as the radar altimeter's low-level warning index and light."

"Oh yeah, that's the light that's behind the yoke where I can't see or behind a lip where the copilot can't see it."

"I don't know about that," continued the engineer, "but with MODE 6, you will be automatically notified through the intercom when you reach whatever altitude is set on the low-level warning index. This function is really quite similar to MODE 4. Like MODE 4, it doesn't require high terrain closure rates; but, in addition, it's independent of aircraft configuration."

"So all MODE 6 will do is wire the low altitude warning light into my headset?"

As the engineer picked up and put away the charts, he nodded. "There's really nothing new in GPWS, although we do have to filter some signals and provide small delays to avoid nuisance warnings. That's true in all modes. What is different is the way we put it together and present it to the pilot. The system is there to help the crew, not annoy or distract them. This means two things. One . . . we are working to ensure that the warning thresholds are close to, but not overlapping, the operation envelope. If we miss one way, we end up with false warnings; if we miss the other way, we degrade protection. Two . . . we are trying to build a system that will not only alert the crew to the specific hazard, but one which will identify the magnitude of the hazard. Tell the crew not only which way they have to react, but how fast."

"Do you think you'll be able to make it all work?"

"I think so. The prototype flight tests have pretty much established our operating envelope . . . plus those tests we ran in the summer of '75 with commercial systems . . . now if I could get some work done around here instead of jawing with pilots and making coffee. . . ."

The major was edging toward the door but ventured one last question, "Do we really need a GPWS in this new transport; isn't it really goldplating?"

"Would you believe that 17 of the 51 C-130's destroyed in flight related mishaps since 1962 involved collision with terrain and no contributing material failure. That's one-third of our total C-130 hull losses occurring when perfectly good machines were flown into the ground. Some crashes were due to navigation errors; others resulted when crew coordination broke down or established procedures were violated. Many combined several of these factors. But the tragic fact is that during those 17 mishaps we incurred over 50 percent of our C-130 related fatalities. I'm not saying we could have prevented all of those accidents with a modern GPWS. But in almost all cases, the crew would have received a warning in time to take corrective action. That's all we groundpounders can do; the action is up to you guys. And a GPWS is a relatively cheap system. The inputs, radar altitude, vertical velocity, configuration, and all the others are already available, ready to be picked off."

"Sounds like a good investment," said the major as he stepped out the door. "Thanks for the words." ★

OPS TOPICS

IT'S THAT TIME AGAIN

On a low level training mission a C-130 had an encounter with a large bird. After the Herky landed at home the crew found a 16-inch tear in the left wing leading edge. The fall migrations are about to start so it's time to be extra alert.

BIG WIND

A C-5 at an enroute stop caused a good bit of damage to the airdrome when TRT was used for takeoff. The use of the high power setting was necessary for the aircraft gross weight and temperature at takeoff time. The blast from the engines tore up the asphalt at the approach end of the runway and damaged several of the approach lights.

Every year there are a few mishaps where people are injured or property is damaged from jet engine blast, and it is not just the big multi-engine types which are involved. Not long ago a crew chief was blown off the access step of a T-38 when the T-38 parked behind used 85 percent power to taxi out of the chocks. The message here is be aware of what the blast from your engines can do, and observe the warning distances in the Dash 1.

RUNAWAY

Two Air Force Aero Club members were preparing a Cessna 150 for an annual inspection. During the removal of the engine cowling, one of the maintenance men turned the propeller counter-clockwise through two complete revolutions. This was for ease of movement during the removal of the cowling. After the last turn the engine started. The door to the 150 was locked, and before the man with the key could get it out and open the door, the 150 jumped the chocks and ran into the tail of another aircraft parked in front of it.

Investigators found that the ignition switch of the 150 was off and the key was removed. However, the mixture control was set at full rich and the throttle was open about ¼-inch. The aircraft had not been flown recently and radio maintenance had been performed.

The final link to the puzzle was a broken ground wire on the nr 2 magneto. Thus the magneto was hot, and when the prop was pulled through, the engine started. The club inspected other aircraft and found another with hot magnetos, this time from a faulty ignition switch.

HOLD IT

A C-130 was on a local training mission with two new copilots on their first ride after UPT. The IP was flying the aircraft while the students were making a seat change. Things were a bit busy in the cockpit since the aircraft had just completed a low approach and received clearance to the outer marker southwest of the airfield.

Then Approach Control transmitted a new clearance to hold northeast of the VORTAC on the 035 radial, 10 DME fix, right turns. The pilots misinterpreted the clearance and entered holding at the 215/10 fix (035 bearing).

The Approach Control is a non-radar facility, so the error was not noticed until two civilian aircraft holding at the outer marker asked Approach Control why the C-130 was in their airspace. After Approach Control asked them to verify their position the pilots of the C-130 realized the error and proceeded to the correct holding fix.

OPS TOPICS

KEEP THOSE EYEBALLS MOVING

A T-39 under radar control departed home AFB with an unrestricted climb clearance. As the aircraft broke out of a cloud deck the crew spotted a light plane right in their path. Evasive action prevented a collision with the aircraft passing within 100 feet of each other. No advisories had been issued. Remember

- Provision of VFR traffic advisories depends on controller workload.
- Even if the service is provided, it's subject to radar interpretation and equipment limitations, i.e., you may not get all conflicting traffic. (See "Radar Myths . . . Conceptions," *Aerospace Safety*, April 1977).
- It doesn't hurt to ask the guy on the ground for the service, either.
- Still on top of the "hit" parade is the ever-rotating MK I eyeball. (For some ideas on outside reference flying, see "Heads Up," *Aerospace Safety*, May 1977)—Sqn Ldr Peter White, RAAF, Directorate of Aerospace Safety.

SECOND GROUP OF SPACE SHUTTLE ASTRONAUTS INTERVIEWED

On August 15th, 20 astronaut candidates reported to the Johnson Space Center. This is the second group of applicants competing for the approximately 40 positions of pilot or mission specialist for the Space Shuttle. The initial screening will be completed by November, and the reporting date will be in mid-1978. Ten of the 20 applicants are USAF pilots with current assignments ranging from tactical fighters to test pilot. Once selected for the program, the candidates will go through a two year training and evaluation period before final selection is made.

OF BIRDS AND BEES

Here are two reasons for visors and pitot covers:

While on a low level nav route an A-7 struck a large bird, which penetrated the windscreen and struck the pilot in the face. Fortunately, the pilot habitually flew with his oxygen mask on and the visor down. The bird shattered his visor and damaged the mask, but the pilot was unhurt.

During an intercept the pilot of an F-4 felt an unusual sensitivity to control inputs. Shortly after this, the aircraft experienced an overstress of 7 G's.

During the recovery from the overstress the aircraft became very sluggish and hard to control. The maintenance troubleshooting after landing discovered a honey bee carcass lodged in the top of the ram air bellows inlet tube. The aircraft had not been flown for an extended period prior to the mishap flight.—Courtesy Navy Weekly Summary.

HOT SPOT

Approximately 6 minutes after takeoff on a practice scramble the cabin temp control valve on an F-106 failed, and the cabin temp went full hot. The pilot was unable to correct the situation. Before he could land about 17 minutes later, the extreme heat was causing him to have difficulty concentrating on radio and aircraft procedures. Such failures have caused major accidents in the past. If you do experience a cabin temp failure, follow your Dash One procedures and land as soon as you can. ★

"The continued reduction and prevention of regression is largely the collective responsibility of unit flying safety officers. They, through the medium of safety meetings, briefings, articles, analyses, and recommendations, must periodically remind aircrews of the lessons learned in prior mishaps."[1]

With this quote in mind, I would like to address two potential killers resulting from complacency: distraction and channelization. My renewed interest in these subjects was caused by a narrow escape from a major aircraft accident—a gear-up landing. Although there were physiological problems that set the stage for this "almost," distraction resulting from complacency was the major contributor. Following is some food for thought for those who haven't considered these subjects for a while.

When I turned base, I called the standard gear check, glanced at the flap and gear indicators and started my base turn cross-check —runway and airspeed. Halfway through the final turn I made my second check of the gear and flap indicators and rechecked the airspeed. It was too high. In fact, I couldn't get the aircraft slowed. With the speed brakes out and accepting a hot flare, mobile screamed "go around, go around, go around." Why does mobile tell you to go around in the flare? I thought the same thing, but did anyway. I found my answer when I reached for the gear handle. It was up.

When was the last time that you looked at your watch and, when you put your arm down, wondered what time it was. Try it on a friend. The next time he (she) glances at his (her) watch, wait a second and then ask for the time. This idea directly relates to scanning instruments in the cockpit. It is also what I call complacency. You look at the dial, but you know before you look what it will indicate; or you're thinking about something else and fail to absorb the information presented by the dial, whether it is a watch, engine instrument or gear indicator. Following are some quotes from major aircraft accidents to emphasize this point:

- Case A

Cause—Operations factor, operator. The copilot failed to properly monitor the flight instruments.

Results—The aircraft continued in a nose-low, left banking turn and was destroyed upon water impact.

- Case B

Cause—Operations factor, operator. The pilot-in-training failed to adequately monitor aircraft airspeed.

Result — The aircraft touched down short of the overrun, shearing both main gear.

Aircraft accident reports are replete with this type of finding. In my case, complacency caused me to misinterpret the gear indicators. The resulting problem with airspeed control was so distracting that I failed to notice the warning horn or light in the handle.

[1] "Life Sciences," **USAF Safety Officers' Study Kit.**

Lesson Learned

For the past 15 years the Air Force has averaged more than four operator caused gear up accidents per year. This figure does not include the incidents where there was little or no damage or those cases where an alert moblie controller or tower operator prevented the mishap. So you can see that the problem is a continuing one, and this article addresses an important aspect of the problem.

1LT EDWIN WHITE, JR.
DC Air National Guard

To prevent this phenomenon, the pilot must make a conscious effort to absorb the information presented by a particular instrument or cue. Various techniques can be used such as repeating aloud to yourself what you see. Find a method that works for you and adopt it. By all means, remind yourself constantly why you are doing this.

Another common result of complacency is channelized attention which causes the pilot to concentrate on one task to the detriment of others. The following Navy definition of fascination is closely related to this concept:

"Fascination is a state of narrowed attention in which a pilot fails to respond adequately to a clearly defined stimulus situation in spite of the fact that all of the necessary cues are present for a proper response."[2]

Target fixation is one example of this. My concentration on controlling the high airspeed and resulting failure to respond to the warning horn is another. In many unexplained fatal range accidents, involvement of channelized attention is suspected. Two possible situations illustrate this point:

- The pilot fails to get a release on his first pass and concentrates on checking the armament switches. As he repositions for a reattack on the tactics target the aircraft impacts the ground.

- The pilot is intent on finding an unfamiliar target because he is worried about target acquisition. In the pop-up he picks up the target and fixates on it. He fails to recognize that he is inside the MAP and exceeding abort parameters because he does not check other cues such as horizon, apex altitude, dive angle and height above the terrain. He continues beyond the minimum recovery altitude and crashes.

Like hypoxia, these psychophysiologic problems are insidious. Unlike hypoxia, however, physiology plays a minor role in their cause. The pilot's attitude plays an important part in determining susceptibility. Anytime you lose situational or "total picture" awareness, you are probably experiencing distraction or channelization. Continually force yourself to look around, check another instrument, or ground reference. A mentally alert attitude is essential in minimizing the chances of distraction or channelization. If you feel something isn't right, abort the pass, go-around, or return to level flight. In Dash 1 terms, that's maintaining aircraft control. The next step is to analyze the situation. You may have to back up and reaccomplish checklist items. The time lost for another pass or approach is miniscule compared to the potential costs of an aircraft accident.

In conclusion, I spend more time interpreting the instruments now, and I look around more often. I've learned from my mistakes, and I'm hopeful you can learn from them also. If you're not continually cross-checking something while in flight you're probably suffering from complacency. ★

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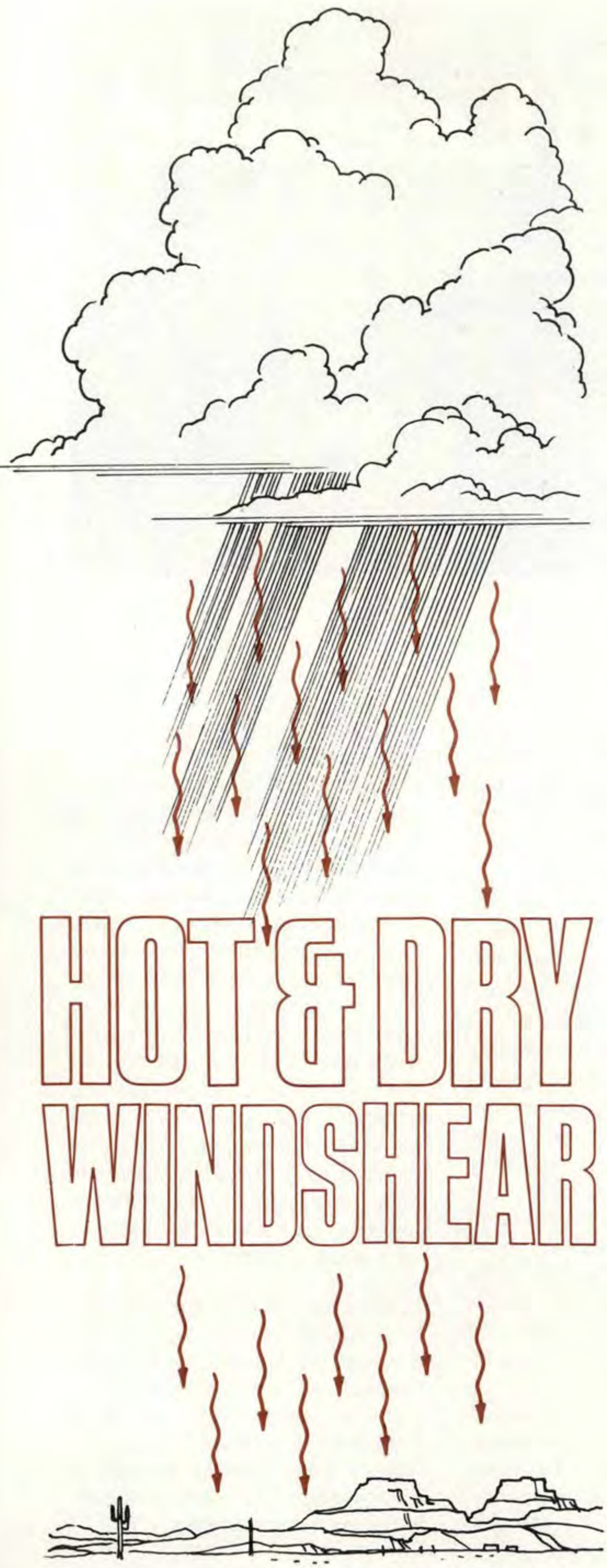
2 Vinacke, W. E., "'Fascination' in Flight," U.S. Naval School of Aviation Medicine Research Report No. NM 001 059.01.13 (X-148-AV-4-3). (July 8) 1946.



HOT & DRY WINDSHEAR

Windshear associated with strong thunderstorm winds has received much attention in the past year or so. This article looks at a different type shear condition all pilots should understand. We wish to thank United Airlines Meteorology Department for permission to print it here.—ed.

High based innocuous appearing cumulus clouds can be the root of severe downdraft and strong windshear. The dangerous phenomena occurs when rain falling from high based clouds chills the air causing a down flow. The extremely dry air into which the rain falls provides further refrigeration because of the evaporation of the water droplets. (The evaporation process is the heart of most refrigeration systems.) The combination of rain chilling and evaporation cools the downdraft well below the temperature of the surrounding air. It falls in a great cascade flowing down below the cloud until it is either dissipated by winds or by other mixing or until it reaches the ground to blow outward from the center of the downdraft. If the latter occurs, it will cause brief gusty surface winds. Light sprinkles or showers of rain may be reported if the evaporation process has not been completed before the rain reaches the ground. The rain and strong wind gusts virtually assure the presence of strong downdrafts and outflows. The effects of the downdraft and outflow as the aircraft passes through will be brief but they could be devastating.

Case histories indicate that this hazard may be expected under high based cumulus clouds whenever the following four conditions are met:

1. High based cumulus type clouds with VIRGA.

2. Very dry surface air with a dew point spread of 35°F* or more.

3. Weak winds from the ground to the cloud bases —generally less than 15 knots (any stronger winds would cause mixing and the down current would be destroyed).

4. Temperatures warmer than 75°F*.

*Temperature and dew point spreads are estimated on basis of limited samplings and are tentative.

Reports of gustiness in otherwise light surface winds and brief light showers confirm the existence of strong downdrafts and the accompanying outflow from these storms. It is prudent not to be lulled into a false sense of security because of the apparently innocuous appearance of high based cumulus clouds.

CASE I

The flight was approaching Salt Lake City on a warm, late afternoon in August. There were clouds, generally high based, but nothing that appeared threatening. Some clouds had VIRGA (wisps or streaks of water or ice particles falling from the clouds but evaporating before reaching the ground) hanging from them, and light showers reached the surface here and there, but most rain evaporated before reaching the ground.

Reported weather was SLC 100 SCT E120 BKN 250 OVC 30 89/39/0809/997 RW SE ACCAS E-SW RE11 CIG RGD.

The captain noted some recent changes in wind direction and temperature at SLC while enroute and, because of recent windshear incidents and accidents, was primed to expect some kind of shear problem during approach.

The words of the flight crew describe what happened on their approach to land at SLC: "We crossed the Salt Lake City Omni 1,000 feet high at 6,300 feet vs 5,300 feet and were indicating between 140 and 150 knots. Approaching the Omni I felt a slight sinking and I started adding power. We hit a light ripple, then a rather abrupt moderate couple of bumps, almost immediately followed by the stick shaker. The airspeed had fallen somewhat below reference speed set at 114 and the rate of sink became 2,500 feet per minute down—or possibly more. We lost 700 feet very rapidly."

The captain reported there was no visual indication of shear and concluded by saying: "Please continue to promote any information available to determine these conditions and encourage awareness in everyone as to the extremely dangerous results of contact with shear of this type without preparation. It's frightening to survive what you know was very close to another fatal, mysterious crash short of the runway."

CASE II

On July 14, 1976 a 747 flight was approaching DEN during the evening hours. (Landing time was 0320Z.) Weather conditions were strikingly similar to those in the Salt Lake City incident. The hourly weather just prior to and after the event was:

DEN 0300Z 90 SCT 50 80/39/1807/004 TCU ALQDS VIRGA N 0400Z 120 BKN 20 80/31/1006/ CB E MOVG SE PK WND 0136/16 RB18 E31

Clouds were high based with VIRGA. Surface winds were generally light and south landings were in progress.

Early in the approach the wind shifted to a reported 3222 and the landing runway was changed from 17L to 26L. VIRGA was visible northwest of the airport. Descent was smooth but a preceding flight reported a moderate windshear at 150 feet. The wind was again given as 3222 (note there were 36 kt gusts from the north recorded at 0316Z, four minutes prior to touchdown but not transmitted to the crew). The captain increased airspeed in anticipation of the reported shear. At about 150 feet the airspeed built up sharply and at 100 ft moderate to severe turbulence was encountered. Sharp roll and yaw required rapid and aggressive inputs to maintain control and effect the landing.

Despite being forewarned by the preceding aircraft the crew was surprised by the intensity of the turbulence considering the apparent good weather and steady wind report on final.

Here is a comparison of the weather in each of these cases:

Weather Element	Case I	Case II	Remarks
1. Lowest cloud layer	100 SCT	90 SCT	High base
2. Visibility	30 mi	50 mi	No obstruction
3. Surface temperature	89° F	80° F	Hot to warm
4. Dew point spread	50° F	41° F	Very dry
5. Surface wind	0809	1807*	Light
6. Pertinent remarks	RW SE Altocumulus E-SW	Virga N Towering Cumulus	
7. Thunderstorms	None reported	None reported	

*Winds given for landing were 3222. Winds of 0136 were observed near the aproach time but were not transmitted to the flightcrew until they questioned the tower after landing.

It is apparent from the 0400Z report that a gust front crossed the airport, as indicated by the peak wind of 0136 at 0316Z. This gust front moved eastward to intercept the path of the descending aircraft. Rain showers followed shortly after. In spite of 13 minutes of rain the dew point spread of 49° at 0400Z was even greater than the previous hour. ★

"The Time Has Come The PILOT Said, "To Speak Of Many Things"

CAPTAIN BRUCE E. SLASIENSKI
453 FTS
Mather AFB, CA

A T-33 was enroute between two European USAF bases. When the pilot in the rear seat attempted to change position, he inadvertently deployed the life raft in the survival kit. As the raft inflated it pushed the stick forward which caused the T-Bird to pitch over. The pilot in front attempted to correct the dive but met resistance when he pulled the stick back. Meanwhile, the GIB found and employed the raft deflation tool. Now things really got sticky. The front seater, trying to solve the control problem, heard an explosion and the cockpit filled with talcum powder which looked very much like smoke. The pilot identified the problem as engine failure, stopcocked the throttle, and secured the engine. As the haze cleared in the back, the GIB noticed the engine had flamed out and ejected. The front seater then dead sticked the T-Bird into a field.

The obvious factor in this accident was the lack of communication between the parties involved, but the underlying factors are more important in understanding why the events occurred at all. Without making any assumptions about the pre-flight condition of the pilots, we can investigate the human factors which interacted to cause damage to an airplane which was previously in pretty good shape.

One of the reasons flyers envy no other occupation is the way the earth spreads out below in a neat patchwork of greens, browns, yellows, and even sometimes the most brilliant whites. Add some of those puffy clouds that just beg you to pop through, and the radiant heat from the sun nicely offset by the air conditioning system, and you have what has got to be one of the best feelings in the world. Most articles on flight safety would probably go into a discussion of complacency now. That is not a relevant factor in this case; so, if it's complacency you want to learn about, go look elsewhere.

Maybe these two jocks were on the way home. "Get-home-itis" is a serious problem. I believe it killed the father of my best friend about 16 years ago. I don't believe it was a factor here. I don't think proficiency, weather, mechanical operations, air traffic control, health, or physiological factors were causes in this accident. The

primary factor in this accident was *attention.* Not lack of attention, but *attention* period. Each individual in that airplane was attending his own problems. He was in his own world.

We spend probably 80 percent of our time emphasizing what is known as the critical 11 minutes during takeoff and landing. So there we are, we made the takeoff and climb out, the pressure is off, the world is spread out at our feet, landing is a couple of hours off yet, so no sweat. Enjoy the view. Just content with being in the air in a dependable, comfortable airplane with all the problems left behind. The radio is quiet, the interphone is quiet, everyone is lost in his own thoughts. The three feet that separated those two people was about to become too great a distance to prevent the loss of the airplane.

The raft inflates in one world. He just took the action necessary to correct that situation. *Old George is sure going to laugh about this in the bar later on.* Wham! The raft deflates in a cloud of talcum, *what a mess in here, how dumb can you get. Something wrong! Too quiet—RPM winding down, EGT dropping, son-of-a-gun, lost the engine, airplane is diving—engine must have failed now the airplane is out of control —better get out now, so long T-Bird.*

Meanwhile up front.

Nice day out here—whoops, nose is going down, getting some resistance on the stick—nose still going down—everything else seems OK. RPM, E-Wham! . . . Smoke! . . . throttle off—maintain aircraft control—canopy just departed the aircraft—there goes the back seat. . . .

Two separate worlds. Plenty of attention, but the focus of the attention was directed toward handling the particular event occurring in each world. Ever feel like a flight of six on a B-52, or a flight of two in an F-4? The desire is to return to the feeling of contentment. Get rid of the problem with as little disturbance as possible. Direct professional action. The bold print doesn't tell anyone to talk—no one tells anyone to talk, at least not at first. "These steps are time critical and will save your life." True enough, but how about your crew? They have no more desire to depart the airplane than you do. But if they do make the decision to leave, it is probably because they are operating in an information vacuum. So (1) Maintain aircraft control (1a) Bring the rest of the crew back into your world (2) Analyze the situation (3) Perform the required actions (4) Talk to the crew as much as possible.

Communications is the key. That is just where we started from. Communications can bring help in solving the problem. In the T-33 situation, non-communications added another obstacle to the pilot which resulted in an accident. Communications is a human factor that can be dealt with on the ground. It should become habit, just like the rest of the emergency procedures. Insist that the flow of information goes both ways. Make communications a professional responsibility, not a social relationship. Anytime social status hinders professional communications, that marks a rank amateur and there is no room for an amateur in this business. ★

The Flight of the Enterprise

CAPTAIN
JAMES J. LAWRENCE
Directorate of Aerospace Safety

The Enterprise crew. On the left is Fred W. Haise, mission commander and veteran astronaut. He piloted the lunar module on Apollo 13. C. Gordon Fullerton is an Air Force lieutenant colonel and a former support crew member for Apollo 14 and 17 missions.

California Route 138 is a desolate stretch of highway that extends directly into the Mojave Desert. It's the type of road that you drive down and wonder if you'd ever be found again, should your car fail to continue operating. That was exactly what occupied my mind at 0-dark-30 on the morning of 12 August 1977. Why was I traversing this god-forsaken desert at 2:30 a.m. enroute from Norton AFB to Edwards AFB? What could be worth an 0100 get up?

We passed the Edwards AFB security gate and found we still had a long drive to reach any form of civilization. Finally, the sign for NASA, Dryden Flight Research Center appeared. As we reached the peak of a hill and started a slow descent into the press parking lot, it came into view. Against the inky backdrop of the early desert morning, the brilliant lights of the mating/device demanded our full attention. Now I fully realized why I was here.

The Space Shuttle Orbiter "Enterprise" sat atop the specially restructured Boeing 747. The magnitude of the technological accomplishments before me had not yet set in. The awe of the spectacle was all I could think about. I had stepped from the humdrum of old typewriters and 1969 Chevies into an adventure of **Star Trek.** That is when I first realized that, to quote a TV commercial, "The future is now." I knew immediately that I was to be witness to a new era of man's development. The door had creaked open just a little bit and I would be privileged to peek at what lies ahead of man in his conquest of the new frontier.

The excitement and events of that morning of 12 August 1977, I will presently describe for you. First I would like to briefly document the program development that resulted in the futuristic sight before my eyes. Of equal import is the mission and capabilities of this vehicle and the uses planned by NASA.

The story began back in August of 1972, when presidential and congressional approval was gained for development of the Space Shuttle Orbiter. This vehicle is only one part of the total Space Transportation System planned for the next decade. The rest includes the Space Lab, and the upper propulsion stages which have the capability to propel payloads into synchronous earth orbit and to other planets. The Shuttle will be used to place almost all of our future satellites in orbit and, more importantly, it will have the capability to retrieve malfunctioning satellites and repair them in orbit or return them to earth. No longer will it be necessary to write off a multi-million dollar satellite due to a malfunction following launch.

Structural assembly began in June 1974. The contractors selected for various major components were Rockwell International, General Dynamics, Grumman, and Fairchild. By March of 1976, these major components were developed and integrated. Complete final assembly was accomplished at Palmdale, California, and March 1976 to July 1977 was the system testing and crew training phase. An inconceivable amount of state-of-the-art technology and man-hours of labor went into the final product which stood before me.

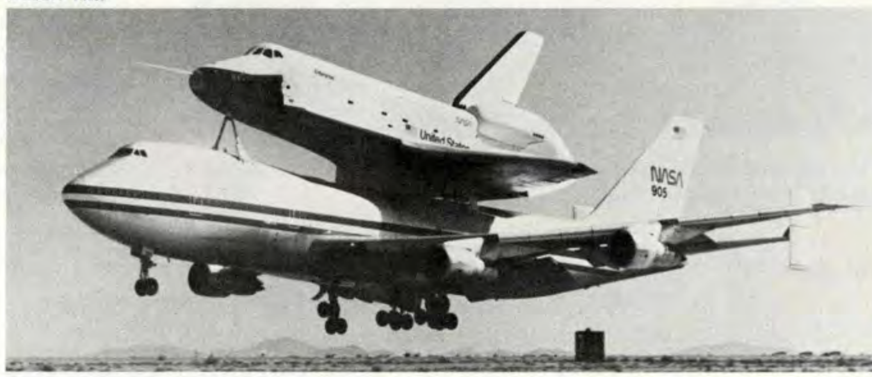
Brilliant against the desert night, the mating/demating device prepares to lower the Enterprise upon the specially restructured NASA Boeing 747.

Every development milestone was reached on schedule and costs were running well within the parameters anticipated.

Six captive flight tests began in May 1977. Here the jumbo 747, after several inert flight and wind tunnel tests, took off with the Space Shuttle Orbiter on top. Flight control tests, maneuverability, vibration analysis, and separation conditions were analyzed prior to the manned free flight phase. On August 12th all indications were go for the first of as many as eight Approach and Landing Tests (ALTs). This first shuttle free flight was designed to simulate the last two-and-a-half minutes of the Enterprise's space reentry profile. Obviously, the first flight of any aerospace vehicle is always the most important. Today would be no exception.

For those of you not familiar with the concept planned for the Space Shuttle in the near future, let me explain it. The Space Shuttle Orbiter is as big as a commercial DC-9 jetliner. Without payload or fuel, it weighs 150,000 pounds and is 122 feet in length with a wingspan of 78 feet. The Orbiter, plus two Solid Rocket Boosters (SRBs) and an external fuel tank make up the Space Shuttle system. When the first manned orbital flight occurs in early 1979, the sequence of events will follow a pattern similar to this. The Orbiter, attached to the back of the external fuel tank, with the solid boosters attached to each side,

The Jumbo Jet, commanded by NASA test pilot Fitzhugh L. Fulton, Jr., lifts off after a 6,000 foot takeoff roll.



The Enterprise and its mother ship, a Boeing 747 Jumbo Jet launch platform, make ready for separation 22,000 feet above the Mojave Desert.

Th explosive bolts are fired and astronauts Fred W. Haise and C. Gordon Fullerton begin their powerless descent glide.

Haise and Fullerton are met by their families following their successful flight at NASA, Dryden Flight Test Facility.

The Post-Mission Press Conference. Deke Slayton, ALT Program Manager, Fred Haise and Lt Col Fullerton answer questions for media representatives.

will take off from the Kennedy Space Center in Florida. The solid rocket boosters and Orbiter engines will fire in parallel at liftoff. These provide the thrust necessary for orbital insertion. The two SRBs are jettisoned after burnout and recovered by means of a parachute system. The large external fuel tank is jettisoned before the Shuttle goes into orbit. This fuel tank is the only nonretrievable component of the Space Shuttle System.

The orbital maneuvering system is used to attain the desired orbit and to make any subsequent maneuvers that may be required during the mission. The payload, in the form of satellites or experiments, is then injected into space by the Shuttle loadmaster. After orbital operations, deorbiting maneuvers are initiated. Reentry is made into the earth's atmosphere at a high angle of attack. At low altitude, the Orbiter goes into horizontal flight for an aircraft-type approach and landing at Kennedy. NASA expects a turnaround time of approximately 2 weeks between space shuttle flights.

When SRB separation occurs at approximately 27 miles up, the boosters descend via parachutes and land in the ocean approximately 150 nautical miles from the launch site. They are recovered by ships, returned to land, refurbished, and then reused. Useful life of each orbiter vehicle is estimated at 100 flights.

The shuttle system can place payloads of 65,000 pounds into orbit. Additional missions planned include retrieval of payloads for reuse, servicing or refurbishing of satellites in space, and operating and supplying of space laboratories in orbit. Of course, the biggest attraction of the Space Shuttle system is the reduction in operating costs. Boosters for the first time become reusable and the versatility of shuttle allows for repair of malfunctioning satellites. Of course, normal economic rules apply and as more launches are made, the cost of each will steadily decrease.

NASA is also heavily involved in a plan to cover shuttle operating costs over and above research and development expense. This plan concerns the charging of users for payloads carried into space. Projected customers, aside from NASA functions, include the Department of Defense with 23 percent of payload distribution, commercial requirements at 14 percent, foreign markets at 10 percent and 4 percent for other US Government agency needs. As confidence builds in space shuttle reliability, NASA feels they will gain more and more of the satellite market. Pricewise, they will be able to offer commercial and foreign clients a 40 percent reduction over the cost of an Atlas/Centaur launch.

With a description of the system and its capabilities behind us, let's return to the events of the morning of 12 August 1977. By launch time, it was apparent that

This sequence of photographs traces the Flight of the Enterprise from initial flare to main gear touchdown. This first flare began 900 feet above the ground and as the airspeed decreased below 270 miles per hour, the landing gear was deployed. The aircraft's final flare cut the rate of descent to three feet per second. The crew held this descent rate until the gear touched down. The Flight of the Enterprise, from separation point to landing, logged just under six minutes of flying time.

The Space Shuttle Orbiter Enterprise safely lands following its maiden free fall flight. Nineteen miles of useable dry lake bed at Edwards AFB's Flight Test Facility served as its landing pad.

many others shared my opinion as to the significance of this mission. Over sixty thousand spectators jammed the access roads to Edwards AFB. Nearly 900 press representatives were accredited by the NASA Public Affairs Staff. Photographers and reporters swamped the press viewing site as the platform 747 taxied toward the runway, carrying its piggyback payload.

At precisely 8 a.m., the 747 started its 6,000 foot roll to takeoff. The liftoff was spectacular yet uneventful, as the 747 began a 200-foot per minute climb to 27,000 feet above ground level. It followed a precisely pre-planned track with the assistance of a ground controlled radar. Four NASA T-38 chase planes provided in-flight assistance as well as excellent airborne video tape of the flight's events. Forty minutes into the flight, the desired altitude, position, and airspeed were achieved.

The 747 platform ship began a nine-degree dive and increased its airspeed to over 300 miles per hour. Fitz Fulton, the 747 aircraft commander voiced the order, "Launch Ready." Almost immediately, shuttle commander Fred W. Haise and his copilot, C. Gordon Fullerton, fired the explosive bolts which separated the shuttle from its mother craft. The Enterprise began its long gliding descent to the dry lake bed landing strip in the desert below.

Three minutes from separation, after several controllability tests were successfully accomplished, the Enterprise began a turn to final. It rolled out 6,500 feet above the ground, nine miles out, with an airspeed of 310 miles per hour. The glide slope at this point was 9 degrees or three to four times that of a normal ILS descent. At 900 feet AGL, the Orbiter started its first flare, cutting the descent rate from 9 degrees to one and a half. As the airspeed decreased, the free fall landing gear were deployed at 200-300 feet above the ground. The final flare established a descent rate of 3 feet per second until touchdown occurred at approximately 185 knots. A 2-mile landing roll followed, exercising minimum brake usage.

The whole affair lasted slightly under 6 minutes. Three times I witnessed spontaneous applause from the press corps I accompanied; at separation, landing, and at the post mission press conference when the Enterprise crew entered the room. They, like me, sensed the significance of the occasion. Senator Barry Goldwater observed, "There are only two really important flights in the history of aviation. This and the first Wright Brother's flight." I have no way of gauging the relative impact this program will have, just as observers at Kitty Hawk had no way to measure the importance of what they witnessed. What I do know is that this first flight marks the beginning of a new era in man's exploration of that final frontier, and it was a real pleasure to be there to observe it. ★

USAF IFC APPROACH

A CONCEPT CALLED "60-TO-1"

Pilots attending the Instrument Pilot Instructor School feel that one of the most useful concepts they are exposed to is the "airspeed-versus-pitch relationship," commonly known as "the 60-to-1 Rule."

The 60-to-1 rule is actually a series of techniques for computing predictable aircraft performance. These techniques are important for three main reasons:

1. They allow the pilot to compute the pitch change (and the resulting vertical velocity) necessary when "Establishing an Attitude" during the control and performance procedures of Attitude Instrument Flying (Establish, Trim, and Crosscheck).

2. They reduce the pilot's workload (and increase his efficiency) by requiring fewer changes and less guesswork.

3. They provide an alternative to the "TLAR" (**T**hat **L**ooks **A**bout **R**ight) method of flying. An instructor pilot can teach this alternative, as opposed to trying to teach experience, as in the TLAR method.

The 60-to-1 Rule is based on two main constants:

1. $1^\circ = 1$ NM at 60 NM (hence the name, 60-to-1). You have heard this since pilot training but probably have had no idea how to apply it except for computing the distance between radials for course interceptions. Since 1 NM equals approximately 6000 ft, then the constant, $1^\circ = 1$ NM at 60 NM, can be rewritten as $1^\circ = 6000'$ at 60 NM. This can be reduced to a more useable format:

$$1^\circ = 100' \text{ at 1 NM} \ldots \text{or, } 1^\circ = 100'/\text{NM}$$

This simply means that, regardless of airspeed, if you increase (or decrease) your pitch from a level flight attitude by 1°, you will climb (or descend) at a rate of 100'/NM. (Figure 1).

Fig 1

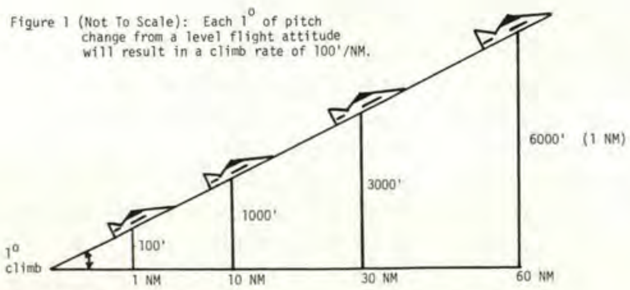


Figure 1 (Not To Scale): Each 1° of pitch change from a level flight attitude will result in a climb rate of 100'/NM.

2. True Airspeed (TAS), expressed in Nautical Miles per minute (NM/MIN), can be obtained from either TAS directly, or from the indicated Mach number:

a. Directly from TAS:

$$\frac{\text{TAS}}{60} = \text{NM/MIN}$$

EXAMPLE: $\frac{420 \text{ KTAS}}{60} = 7$ NM/MIN

b. From Indicated Mach Number:

Mach number x 10 = NM/MIN

EXAMPLE: .7 Mach x 10 = 7 NM/MIN

From these two constants, other relationships may be determined. You may have heard that Mach number x 1000 will give you the vertical velocity (VV) in FT/MIN, for a 1° pitch change. What this oversimplified relationship really means is that if you can determine your NM/MIN, you can compute your vertical velocity. The formula for the required vertical velocity for any pitch change is:

VV for any pitch change = degrees of pitch change x NM/MIN x 100

EXAMPLES:

a. For a .6 Mach number and a 1° pitch chang[e]

(1) NM/MIN = Mach number x 10
NM/MIN = .6 x 10 = 6 NM/MIN

(2) VV = degrees of pitch change x NM/MIN x 100
VV = 1 x 6 x 100 = 600 FT/MIN

b. For 420 KTAS and a 2° pitch change:

(1) NM/MIN $= \frac{\text{TAS}}{60}$

NM/MIN $= \frac{420}{60} = 7$ NM/MIN

(2) VV = degrees of pitch change x NM/MIN x 100
VV = 2 x 7 x 100 = 1400 FT/MIN

Now let's look at some of the practical applications of these concepts:

1. Pitch Change Necessary for a Level Off (when climbing or descending). If VV = degrees pitch x NM/MIN x 100, then

$$\text{Pitch Change to Level Off} = \frac{\text{VV}}{\text{NM/MIN x 100}}$$

EXAMPLE:

Climbing at 4200 FT/MIN at .7 Mach:

a. NM/MIN = Mach number x 10
NM/MIN = .7 x 10 = 7 NM/MIN

By the USAF Instrument Flight Center
Randolph AFB, Texas 78148

b. $\text{Pitch change to level off} = \dfrac{VV}{NM/MIN \times 100}$

$\text{Pitch change to level off} = \dfrac{4200}{7 \times 100} = 6^\circ$

NOTE: An easy way to approximate this level of pitch change is to divide the Mach number into the VV (not taking into account the decimal point).

2. Descent Gradients (Enroute, Hi or Low altitude penetrations)

$\text{Required Pitch Change for Descent} = \dfrac{\text{Altitude to lose}}{\text{Distance to travel} \times 100}$

This can be simplified to:

$\dfrac{\text{Altitude to lose in ``flight levels''}}{\text{Distance to Travel}}$

EXAMPLES:

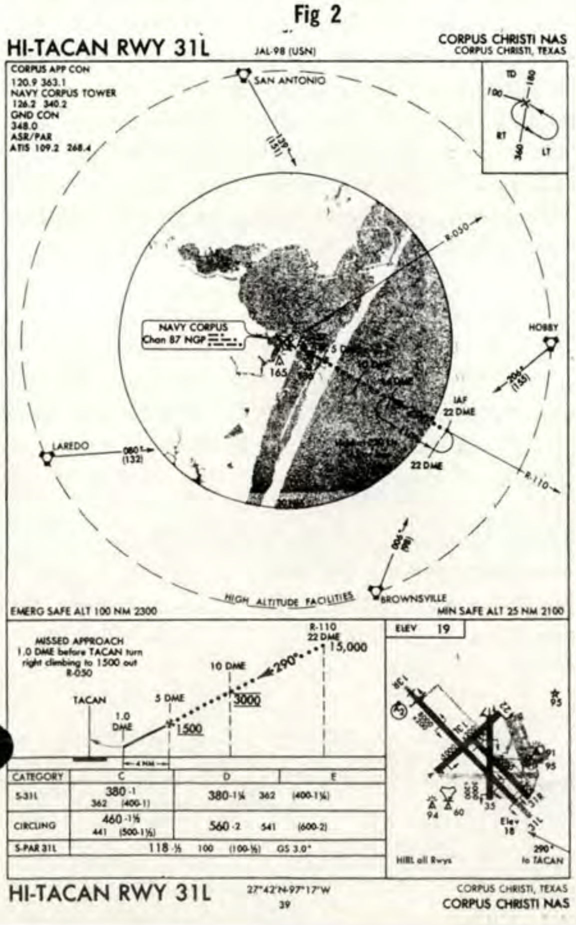
a. You want to lose 20,000 ft in 40 NM. What pitch change do you make?

$\text{Pitch Change} = \dfrac{\text{Altitude to lose in ``flt levels''}}{\text{Distance to travel}}$

$\text{Pitch Change} = \dfrac{200}{40} = 5^\circ$ pitch change to descend

b. A straight course penetration with an IAF at 22 DME and an IAF altitude of 15,000 ft, has a mandatory altitude of 3000 ft at 10 DME (see Figure 2). What pitch change is necessary to make the mandatory altitude?

Fig 2



$\text{Pitch Change} = \dfrac{\text{Altitude to lose}}{\text{Distance}}$

$\text{Pitch Change} = \dfrac{150 - 30}{22 - 10} = \dfrac{120}{12} - 10^\circ$ pitch change to descend

Since the wind can throw off your computations as you proceed with the descent, an occasional recomputation of the required descent angle will tell you if you are progressing properly. NOTE: These computations should be made as easy as possible, that is, ROUND OFF numbers so that you can do the computations while flying. You can also check to see if you are holding the desired descent angle (in degrees) by using the "level off" formula from above:

$\text{Descent Angle} = \dfrac{VV}{NM/MIN \times 100}$

EXAMPLE: You are descending at .6 Mach number and your desired descent angle is 5°. You check the VVI and it is indicating 2400 FT/MIN. To crosscheck to see if you are holding the desired 5°, what formulas do you use?

$NM/MIN = \text{Mach number} \times 10 = .6 \times 10 = 6\ NM/MIN$

$\text{Descent Angle} = \dfrac{VV}{NM/MIN \times 100} = \dfrac{2400}{6 \times 100} = 4^\circ$ descent

So, your actual descent is 4°, but your desired descent is 5°. You will have to make an additional pitch change on the attitude indicator of 1°. How much will that 1° additional pitch change increase your VV? 600 FT/MIN. . . . Remember, 1° VV = NM/MIN x 100. So the total VV should read 2400 FT/MIN + 600 FT/MIN = 3000 FT/MIN, after making the 1° pitch correction. NOTE: You cannot, however, maintain this VV during a constant IAS descent because as the TAS (NM/MIN) decreases, the vertical velocity will decrease. Maintaining the pitch attitude on the attitude indicator and crosschecking the pitch angle by dividing the NM/MIN into the VV will help maintain your desired pitch angle and correct for any precession.

Another way to check your descent angle and to see if you are going to make your desired altitude at the desired distance (if you are flying directly to or from a TACAN or VORTAC) is to watch your al-

IFC continued

timeter movement in 1 NM of DME movement. This gives you the descent rate in "FT/NM," which can be converted to degrees, because 1° of pitch (regardless of speed) will equal 100' for every NM. Therefore, if you check your altimeter and it moves 500' in 1 NM, your descent angle is 5°. To check to see if you will make an altitude restriction, multiply this FT/NM by the miles to go.

EXAMPLE: You check your descent and it is 500 FT/NM. If you have 10 NM to go to your altitude restriction and 4000' to lose, check to see how much altitude you will lose by multiplying the FT/NM by the miles to go:

Altitude lost = FT/NM x NM = 500 x 10 = 5000'

Therefore, if the 5° descent is maintained, you will reach the altitude restriction prior to the DME restriction.

3. Precision Glidepath (PAR or ILS)

a. The glidepath angle published for an approach (i.e., 3°, 2½°, etc.) will be the same for every aircraft. Therefore, a pitch change approximately equal to the published glidepath can be made on the attitude indicator when intercepting the glidepath.

b. Remember, True Airspeed has no effect upon the pitch change when intercepting the glidepath. Speed only affects the time on final and your rate of descent (VV).

c. Prior to glidepath interception, you should compute what your vertical velocity (VV) will be for your groundspeed (since you are flying off of a ground based glidepath transmitter), crosscheck that VV after making the initial pitch change after glidepath interception, and correct as necessary. The required VV can be computed in a number of ways:

(1) One way to determine the required VV is to refer to the "Rate of Descent Table" in the front of the FLIP Terminal Instrument Approach Procedure Books.

(2) Another way, is to use the basic VV formula mentioned earlier:

VV = degrees of pitch x NM/MIN x 100

EXAMPLE: T-39 on a 3° glidepath at 120 KTAS

$$\text{NM/MIN} = \frac{\text{TAS}}{60} = \frac{120}{60} = 2\ \text{NM/MIN}$$

VV = degrees x NM/MIN x 100 =
3 x 2 x 100 = 600 FT/MIN

(3) A third way to approximate the VV for a 3° and a 2½° glidepath is by using the formulas:

$$\text{VV for } 3^\circ \text{ glidepath} = \frac{\text{Groundspeed x 10}}{2}$$

For the VV for a 2½° glidepath, subtract 100 FT/MIN from the 3° glidepath formula.

EXAMPLES: T-38 with a groundspeed of 180 kts is flying a 3° glidepath.

$$\text{VV for } 3^\circ = \frac{\text{Groundspeed x 10}}{2} = \frac{180 \times 10}{2} = \frac{1800}{2} = 900\ \text{FT/MIN}$$

VV for 2½° = 3° VV − 100 =
900 − 100 = 800 FT/MIN

You have just been given two weeks of training in five minutes, so if you are a little overwhelmed, it's natural. These relationships will become easier to work with after a little practice. It's best to start out practicing them in a "non-hurried" environment, such as during pre-flight planning or perhaps in your simulator. Although it may seem like an increase in workload at first, proficiency in the "60-to-1 Rule" techniques will save you time, help you become a smoother and more efficient pilot, and give you some more tools with which you can instruct more effectively.

If you desire to see a further breakdown on the formulas and proofs, we have a limited number of copies of "The 60-to-1 Rule Discussion," an IPIS handout, available. A copy will be sent to you upon request. If additional copies are needed, they may be reproduced locally. Your request should be addressed to:

USAF Instrument Flight Center/FSD
Randolph AFB TX 78148

If you have any instrument related questions, feel free to call us at AUTOVON 487-4276/4884. ★

THERE IS A WAY

Annually the Air Force recognizes a given number of individuals, units and commands for outstanding performance in safety. However, competition is keen and not all win major awards. To recognize all of those, AEROSPACE SAFETY is featuring one or more in each edition. In this way we can all share in recognizing their fine performance and, perhaps, learn some valuable lessons.

NOMINATED FOR THE CHIEF OF STAFF INDIVIDUAL SAFETY AWARD

Major James D. Ferry
14 FTW, Columbus AFB, MS

Major Ferry was nominated for this award for his outstanding contributions to improve safety within the organizational maintenance function.

His personal involvement and imaginative approach to safety made his use of the command developed safety program truly exemplary. Recognizing the need for credibility in the weekly safety briefings, Major Ferry involved the young, newly assigned airmen in preparation and presentation of the safety briefings. In this way the younger members of the squadron became knowledgeable and articulate on safety matters, increasing the influence of the safety program. As a further improvement, he went beyond merely using the material provided by the wing safety staff to developing and presenting items peculiar to the organizational maintenance squadron. This gave the members of the squadron a feeling that the program was truly theirs.

Recognizing that briefing guides rapidly become outdated, Major Ferry developed a method whereby the squadron Pre-departure Briefing Guide is frequently updated—to include data from recent mishaps.

One of Major Ferry's most popular and successful programs was a private automobile inspection. This inspection was performed by squadron mechanics using locally created checklists. The inspections were timed to coincide with the heavy Christmas leave and travel period. More than 200 vehicles were inspected and many serious defects were identified, especially badly worn tires. The accident prevention benefits to such a program are obvious.

Major Ferry's many contributions led to a significant reduction in squadron mishaps for 1976, reversing a previous adverse safety trend.

Mr. C. J. Moore
AFMTC, Lackland AFB, Texas

Mr. Moore was nominated for the Chief of Staff Individual Safety Award for his many contributions to safety as manager of the Air Force Military Training Center (AFMTC) explosives safety function. Following are some of his accomplishments: Forklift drivers working inside munitions bunkers were "passing out" when gasoline engines on the forklifts were operating. Mr. Moore found the problem to be poor ventilation and recommended corrective action that included operational changes, better supervision and, long range, replacement by electric forklifts to eliminate carbon monoxide.

Several M-16 rifles were found with split barrels. As a result of action by Mr. Moore, a series of M-16 barrels were condemned and replaced and improved life expectancy standards for the barrels have been implemented.

Mr. Moore established a Center Explosives Safety Committee, comprised of representatives from each organization which utilizes or stores explosives. Benefits include greatly improved rapport, cooperation, and ease of coordinating matters relating to all explosives safety operations for which the AFMTC safety function has responsibility.

Mr. Moore's contributions resulted in upgrading the AFMTC Explosives Safety Program to superior status. ★

ACE High

MAJOR JOHN E. RICHARDSON
Directorate of Aerospace Safety

Ask an aircraft commander what he feels is the most important factor in doing his job and he will probably tell you, "the ability to make timely in-flight decisions under stress." This quality has always marked successful aircraft commanders no matter how many engines or how large or small the crew.

But, the ability to perform well under stress is not natural to most of us. It is something we learn as we gain experience and get to know our tasks. While true of all fields this is particularly relevant to flying. Only through continued flight experience can a young pilot develop the decision-making skills which will fit him or her for a role as aircraft commander.

Such flight experience, to be effective, must involve the pilot in actual decision making. This must be coupled with a chance to practice and improve the basic flying skills originally learned in undergraduate pilot training.

Obviously, this is one function of training flights. The pilots and other crew members sharpen their skills in the particular mission for which they are trained. Yet this may not be the most effective way to develop such skills. A young pilot assigned to a tactical fighter has an advantage in developing his decision-making skills. Every time he flies, he is the aircraft commander. He must make all the decisions and perform all the functions required of the commander. Thus, his development of flying skills and abilities proceeds at a regular pace. Such an opportunity is not as readily available for the copilot on a multiplace aircraft. First his tasks are not the same. Since there is a designated aircraft commander, the copilot is not the primary decision maker on the crew. Granted the copilot will fly a portion of the mission, but the decisions are still those of the aircraft commander. The result is slower development of a copilot's decision-making ability.

This delayed development is particularly critical today because national economic factors and resource conservation have dictated a reduction in flying hours in certain mission aircraft. This means that copilots are less able to quickly develop the necessary skills to perform effectively as aircraft commanders—a situation which has serious implications for the future of the Air Force. The solution then would seem to be some way of providing flying opportunities at low cost for low experience pilots.

Such a program is in being. It is called the Accelerated Copilot Enrichment (ACE) Program, and it is a significant departure from the traditional Air Force approach to training.

ACE originated in the Low Cost

Aircraft Test Program initiated in the fall of 1975. This test consisted of Air Training Command aircraft and instructors working with SAC, TAC, and MAC aircrews. The program was conducted at four locations: Mather, Cannon, Eglin and Barksdale AFBs. The purpose of the test was to investigate the capability of a low cost aircraft to improve a pilot's basic flying skills and thereby enhance confidence, judgment and ability to make proper in-flight decisions even under stress. The test was terminated in May 1976 after proving that a low cost aircraft would be beneficial, in particular to SAC, in helping copilots prepare for the demanding role of aircraft commander.

On June 1, 1976, the ACE Program came into being as a joint ATC/SAC effort. By the end of October 1976, there were operating locations at fifteen bases where SAC B-52/KC-135 organizations were located. By October 1977, all SAC CONUS units will be participating in the ACE Program.

How does the Program work? When a pilot in SAC is assigned to duty as a copilot on a numbered crew, in either the B-52 or KC-RC-EC-135, that pilot is entered into the ACE Program.

Since all the copilots have been previously qualified in the T-37 and T-38 aircraft, they need only a short checkout based on proficiency and crew availability. Once they are qualified, the goal of the program is for each copilot to fly five sorties per month. At least half

The ACE of today's Air Force is not necessarily a pilot with five enemy aircraft to his credit. A new program sponsored jointly by ATC and SAC is giving SAC copilots a chance to broaden their flying and decision-making skills in T-37 and T-38 aircraft. This program complements the SACM 51 series training each copilot receives in the assigned aircraft and improves the upgrade process to aircraft commander.

1Lt Steven Young, right, 323 FTW Flight Examiner and 1Lt Jerry Gontarek, 320 BW, 441 BS, looking over AFTO 781 Series Checklists.

1Lt Dan Schellinger, 28 AREFS copilot (right): "The ACE Program is great, fantastic. It should be continued. It gives you valuable experience in instrument flying as well as confidence and decision-making ability."

of these sorties will be "team" (with another ACE copilot). All flight operations are conducted in a relatively unstructured environment. Since the purpose of the program is to provide SAC copilots greater opportunities to develop judgment, decision-making ability and self-confidence, direct supervision and "canned" profiles are kept to a minimum. ACE Pilots are responsible for all preparations for the flight, and cross-country trips are encouraged. Although there is a minimum of direct supervision, there are highly qualified instructors readily available to provide assistance when it is requested.

The program currently has over 650 SAC copilots enrolled. More than 600 are qualified in the aircraft at any one time. This is due

Instrument procedures practice in a high performance aircraft like the T-38 is a very good way for a young pilot to build his flying skills and judgment.

The competent instruction given by ATC IP's gives the SAC copilots the maximum benefit from every flying hour.

At SAC bases across the country new sounds are heard—the roar of a T-38 or the scream of a T-37, as ACE copilots build the skills to help them be better pilots and aircraft commanders.

to the dynamic nature of the force. As a copilot upgrades to aircraft commander or is assigned to other duties outside the crew force, that person is replaced by another authorized copilot. Once the programmed expansion is completed in October of 1977 there will be over 1,000 SAC copilots participating.

ACE, despite its short life has had some real payoffs already. The young men in the program are learning valuable lessons in flying. While the worth of this experience will not truly show until they start to upgrade to aircraft commander, even as copilots their increased knowledge can only reap benefits. The cost of training is probably the biggest immediate payoff. It costs about $4,000 per hour to fly a B-52 and over $2,000 per hour for a KC-135. In contrast, a T-38 costs ⅛ as much as a B-52 to fly and a T-37 1/10 of the cost of a KC-135.

There is another benefit not originally considered in the program development. This is the experience afforded the ATC IPs who are assigned to the ACE Detachments. The detachment commander, for example, is receiving valuable experience in managing a "mini" squadron. The knowledge gained will benefit the Air Force later in providing men with wider experience in leadership and management. For the IPs, like the SAC pilots, the chance to fly in an unstructured environment, different from the home ATC base format gives these men the opportunity to grow in knowledge and experience.

The ACE Program is a dynamic approach to the old problem—*How do we get the most value for every hour of flight training?* The real advantages are long term and, in a sense, intangible. The only real measures will be the future performance of those pilots who once were ACE's. ★

FIRST USAF WOMEN PILOTS GRADUATE

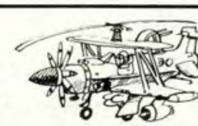
On September 2, 1977, the first class of women pilots graduated from UPT at Williams AFB AZ. This is the first of a test group of twenty women in two UPT classes. After graduation the new pilots will report to operational assignments in MAC, SAC, and ATC.

The graduates and their assignments are:

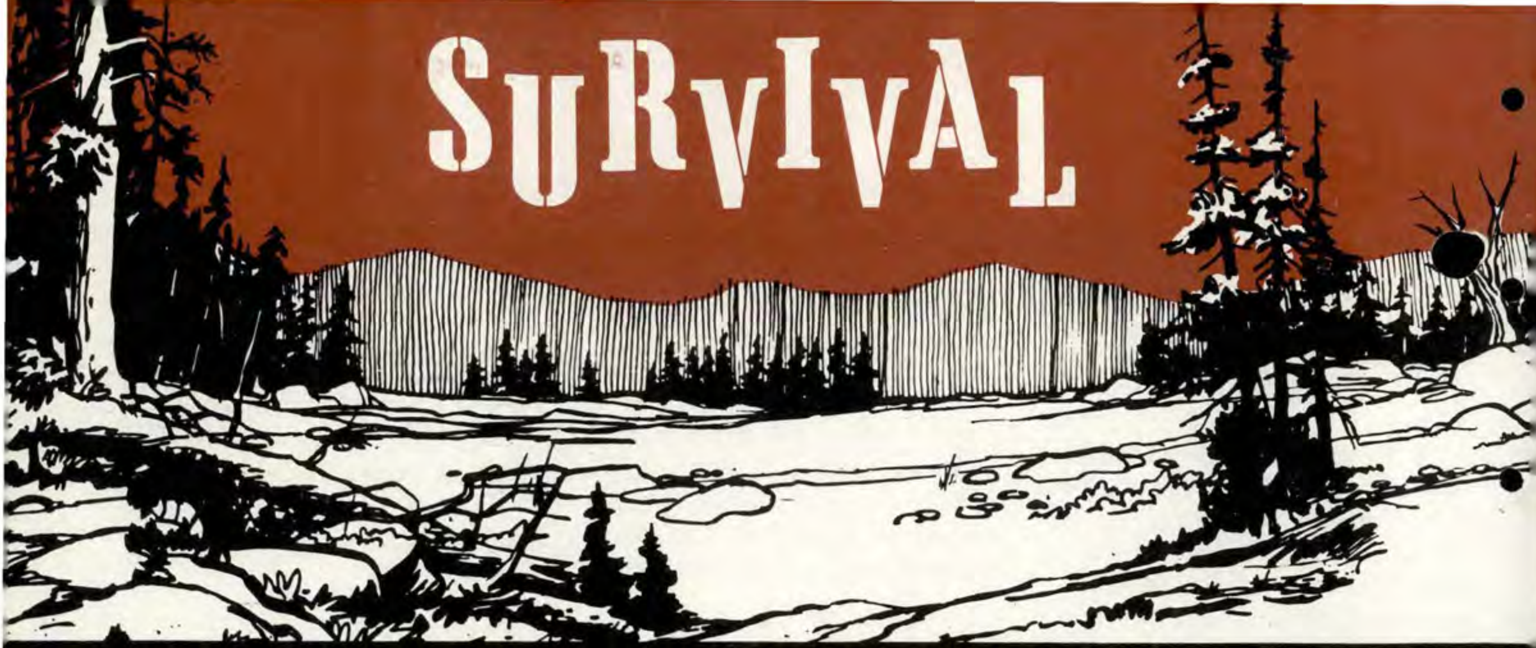
Capt Mary E. Donahue	KC-135	Seymour Johnson AFB NC
Capt Connie J. Engel	T-38	Williams AFB AZ
Capt Kathy La Sauce	C-141	Norton AFB CA
Capt Susan D. Rogers	C-9	Scott AFB IL
1st Lt Victoria K. Crawford	T-43	Mather AFB CA
1st Lt Mary M. Livingston	T-37	Columbus AFB MI
1st Lt Christine E. Schott	C-9	Scott AFB IL
1st Lt Sandra M. Scott	KC-135	Mather AFB CA
2nd Lt Carol A. Scherer	WC-130	Andersen AFB Guam
2nd Lt Kathleen Rambo	C-141	McGuire AFB NJ

The second group of women pilots is scheduled to graduate in February 1978.

Name That Plane



This all metal follow-on to the P-26 eventually evolved into one of the most famous fighters of World War II. One export model of this aircraft gave US pilots quite a time since it was put into service with Swedish instrumentation and markings.



How to get lost without really trying

TSGT CHUCK ARNOLD
3636th Combat Crew Training Wing (ATC)
Operations and Requirements Branch
Fairchild AFB, WA

Jim was feeling queasy as he pulled himself up the rock ledge. His stomach was knotted and the impulse to vomit was almost overpowering.

It had been seven hours since he had come to the frightening conclusion that he was lost. He had initially felt quite confident that he could find his way back to his parked camper, but the early self-assurance was slowly ebbing as he crouched on the rocky slope attempting to gain a better view of the surrounding terrain.

The day had begun so beautifully. Jim and his family decided to take a drive into the mountains in search of some new areas to explore. He had parked the camper at the end of an old logging road where it intersected a mountain stream created by the melting snowpack.

The whole family ate lunch together and then went their separate ways in search of the new and unusual. Jim decided to follow an animal trial. It was well defined and had a number of fresh tracks that held the promise of some excitement if only he had a little luck.

It seemed but a short distance from where the camper was parked when a large deer bolted from a stand of buckbrush and bounded up the hill. Wanting to gain a better view of the animal with the hope of getting a good picture of it, Jim took off in pursuit.

The deer was a magnificent creature whose rack numbered at least six points by Western counting methods, and weighed approximately 350 pounds. Getting a picture of such an animal would be a feather in Jim's cap and it would provide ideal subject matter for the round table discussions at the next meeting of his amateur photography club.

The buck was a crafty critter who obviously had experienced pursuit in the past, for Jim never managed more than a glimpse of the animal in its headlong flight.

It had been approximately twelve thirty in the afternoon when Jim jumped the deer, and the first shadows of darkness were just creeping across the treetops when he decided to give up the chase. Not knowing how long he had been engaged in pursuing the buck, Jim became concerned as to his exact location. Not so much because he thought he was lost, but more from the standpoint of what was the shortest and quickest route back to the camper and his family. He knew his wife would be worried, and his excuse was pretty flimsy considering the amount of outdoor experience he had. To make matters worse, Jim was always lecturing the entire family not to travel too far from the camper and never to travel alone.

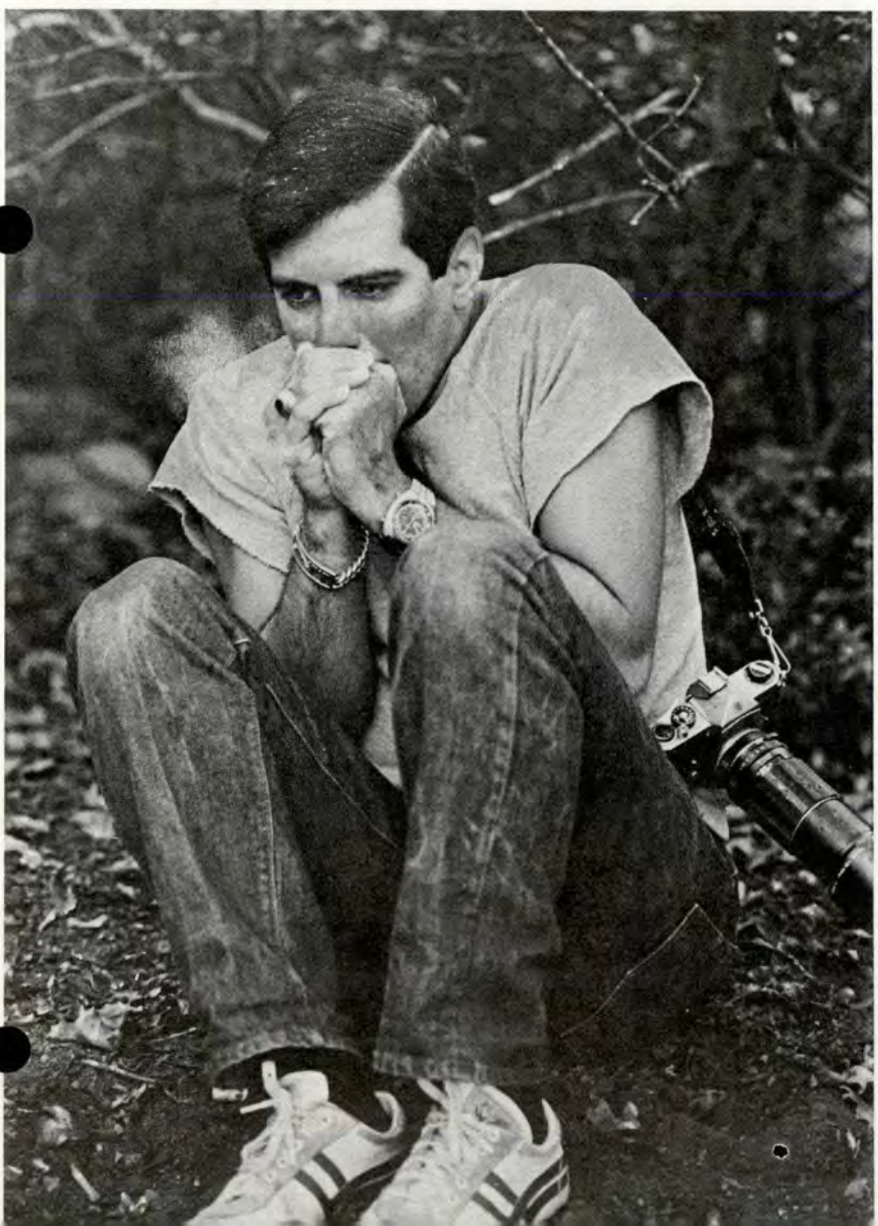
Having violated every rule he had ever preached only served to motivate Jim to pursue his impulses rather than his good sense. Acting accordingly, Jim began retracing his footsteps. The terrain was rocky and this effort soon fizzled. He couldn't remember how many ridgelines he had crossed or even in which direction he had been traveling when chasing that elusive ck.

Exhaustion and frustration were becoming paramount in Jim's emotional makeup as darkness settled on the rolling hills and blotted out the last visible landmarks. Panic now gripped every muscle in his body and it took every bit of personal fortitude he could muster not to run helter skelter in search of his family.

Conditions now began to worsen. The temperature had plummeted to near freezing and a drizzle had begun to pelt the landscape—typical late spring weather. This served to alert Jim to the plight he was facing. He was dressed only in jeans, sweatshirt, and tennis shoes. He had no protection from the elements other than his own ingenuity. Jim was an experienced outdoorsman who had an abundance of knowledge and skill, but it was the unexpected swiftness with which he had become lost that now caused his thoughts to rush through his mind like an unending kaleidoscope.

As Jim huddled in the recesses of the trunk of a large fir tree to seek some respite from the biting cold, he wondered how he could have gotten into such a predicament. The cold was numbing and his thoughts were slowing until everything, even the steady drip of the falling rain, appeared to be held in suspended animation. . . .

Where did Jim go wrong? How did it come to pass that a person who is experienced in the out-of-doors becomes a victim of the environment he is supposed to understand so well?



The first mistake Jim made was taking off without informing his family about the direction he was going or even what his intentions were. Second, he failed to prepare himself for any eventuality by wearing, or at least taking along, enough protective clothing and equipment in the event of a sudden change in the weather. His third mistake was traveling alone, particularly when he was in unfamiliar terrain. "Never travel alone," is a vital factor to keep in mind, because so many unfortunate accidents can happen. An unexpected slip on a wet rock can result in a twisted or broken ankle rendering any unwary hiker vulnerable to his surroundings. The final ingredient was his disregard for noting prominent landmarks that could be used to guide his return route. Relying entirely on his own instincts and a false sense of confidence, Jim felt little need to waste time orienting himself to the terrain. Besides, he might lose any chance he had of getting a picture of the animal if he stopped. Any one of these factors could probably be overcome. But the trick is not to bet on the odds. Just don't take chances with your life.

The search party found Jim after a bleak, cold night of drizzle. He was still curled up in the trunk of that fir tree and his clothes were soaked clear through. The mistakes he had made were now coming to a final head as the search team carried him back to his original campsite on a stretcher.

Questions or comments on this article should be referred to 3636 CCTW/DOTO, Fairchild AFB WA 99011, or call AUTOVON 352-5470. ★

Mail & Miscellaneous

Send your ideas, comments, and questions to:
Editor, Aerospace Magazine
Norton, AFB, CA 92409

437TH MAW WINS FIRST SICOFFA AWARD

The 437th MAW is the first winner of a new prestigious flight safety award. This award (shown on the back cover) is presented by the System of Cooperation among American Air Forces (SICOFFA). The award is designed to recognize outstanding accomplishments in accident prevention by units in each air force of the Americas.

The criteria for the USAF award are similar to those for the Colombian Trophy. The difference is that eligibility for the SICOFAA Trophy will be limited to wings or groups operating in North and South America which have not had a Class A aircraft mishap over which they had control.

The 437th MAW's outstanding record makes the unit a fitting recipient of the first SICOFAA flight safety award.

SHORT SNORTERS

I would like to ask your help in publishing an article in the **Aerospace Safety** magazine.

As I understand it—during World War II and maybe at other times, dollar bills were signed by members of a crew and these were called short snorters. I have one of these dollar bills with several signatures and would like to publish this in hopes one of the individuals might read the article and contact me. I feel someone would really like to have this.

I have done my best in deciphering the signatures and they appear on the attached copy.

Not knowing much about this, I hope you may have someone in your agency that could furnish some information to put in an article with a copy of the bill.

If you can pass this on to other DOD agencies or suggest another method of publication I would appreciate it very much.

Thanking you in advance.

Mrs. Dorothy O'Brien
519 Humboldt St. #7
Reno, Nevada 89509

Mrs. O'Brien has sent us a copy of this bill, which is irreproducible, and the names which indicate that it was signed in 1943 at Prestwick, Scotland by the following:

1. ?
2. Norman Rowe
3. Francis Adams
4. Lt Fred J. ?uckert
5. Sgt George J. Goldman
6. Cpl John G. Taylor
7. Cpl Gilbert Schoenboth
8. Capt S. J. Coughman
9. Joe R. Brown

—ed.

CONTROLLER WEATHER ADVISORIES

What may I as a pilot, expect in services from air traffic control personnel, in relation to weather? The question is addressed primarily to thunderstorm activity and areas of heavy precipitation. FAAH 7110.65, para 521 states: "Issue pertinent information on radar observed weather and chaff areas and suggest radar navigational assistance to avoid these areas. Provide this assistance only when the pilot requests it, whether or not you have previously suggested it. Do not use the word 'turbulence' in describing a condition in connection with weather echoes since radar scopes do not show areas of turbulence."

The above quote from the handbook may provide a sense of security. However there are other areas that must be addressed. What about the areas of precipitation that are not observed on radar? Yes, this is a possibility. Through the use of Circular Polarization and Moving Target Indicator there are areas of weather activity that are not observed by radar controllers. When using these features, particularly Circular Polarization, only the most severe buildup areas will be received. This consequently will result in precipitation being present without the controller knowing it. The major mission of both the controller and pilot is to have safe flight operations from takeoff until landing. With the combined efforts of both the pilot and controller this can be achieved. However, it is the responsibility of the pilot to initiate a request for vectors around ar[eas] of weather.

RICHARD M. GREEN, Captain, USAF
Chief, ATC Operations

"YOU AND THE D.A.," AEROSPACE SAFETY, JULY 1977

1. I read with interest the subject article. In general it is excellent, however, one additional factor influences the density altitude, the moisture content of the air. Significant differences in the density altitude can and do occur with different moisture contents.

2. Using the criteria in the article, pressure altitude, 500 ft, and outside air temperature, 30°C, the density altitude was recalculated using a CP-718/UM Density Altitude Computer. The recalculation, assuming the air to be dry, yielded a density altitude of 2320 ft ± 5 ft. If we assume the air to have moisture, which it normally does, the density altitude increases. If the dew point is 52°F, the density altitude would be 25[..] ft; if the dew point is 85°F, the density alti[tude] would be 2750 ft.

3. The calculations in para 2 are not intended to dispute the density altitude as derived from a flight computer (I obtained the same results using a CPU-26A/P computer). The purpose is to show that moisture also increases density altitude, or put another way, wet air is less dense than dry air. Thus, if a 2200 ft density altitude increases take off roll of many aircraft by approximately 20%, then the up to 500 ft increase in density altitude caused by moisture would also increase the take off roll. Putting all above in simple terms, if a pilot were operating in a desert, the density altitude from his flight computer may not be greatly in error, but if he were operating in the tropics, a factor should be added to compensate for the increased moisture in the air.

TERRY R. WARNER, Major, USAF
Commander, Det 10, 5 WS
Ft Benning, GA 31905

☆U.S. GOVERNMENT PRINTING OFFICE 1977 789/855/50

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 Accident Prevention Program.

First Lieutenant

RONALD L. KUKURUDA

112th Tactical Fighter Group
Greater Pittsburgh International Airport
Pittsburgh, Pennsylvania

On 22 January 1977, the 112th Tactical Fighter Group was redeploying from Davis-Monthan AFB, Arizona. Runway conditions at Greater Pittsburgh International Airport necessitated recovering all the A-7D aircraft at Rickenbacker AFB, Ohio. Lieutenant Kukuruda was number three in a three ship flight. The flight was uneventful until, three miles out on initial at Rickenbacker (300 KIAS and 2500′ MSL), Lieutenant Kukuruda's aircraft engine started to compressor stall. The engine hot light illuminated and TOT indicated 800°. He quickly retarded the throttle to lower the temperature; however, TOT increased rapidly at any attempt to advance throttle position. Lieutenant Kukuruda retarded the throttle again and selected manual fuel. Once again the TOT went out of limits when the throttle was advanced. He returned the throttle to idle and concentrated on making the runway. With airspeed and altitude decreasing, Lieutenant Kukuruda did one "S" turn, lowered the gear and flaps at approximately 240 KIAS, and landed halfway down the runway. He secured the engine just prior to engaging the departure end BAK-12. An initial investigation revealed a considerable number of turbine blades missing. Subsequent TDR findings determined a missing bolt in the airflow regulator caused improper inlet guide vane scheduling, resulting in a massive over-temperature condition. Lieutenant Kukuruda's correct analysis of this critical emergency under the pressure of minimum altitude and time, and his superior airmanship saved a valuable aircraft. WELL DONE! ★

THE SICOFFA AWARD

TRAVELING TROPHY

New Inter-Americas Flight Safety Trophy Honors The 437th Military Airlift Wing

CHARLESTON AFB, SOUTH CAROLINA

The 437th Military Airlift Wing, first to receive new Flight Safety Award. Designed and presented jointly by the air forces of the Americas, the award is similar to the USAF Colombian Trophy.

PERMANENT PLAQUE AWARDED TO RECIPIENT (ENGLISH TRANSLATION)

SYSTEM OF COOPERATION AMONG THE AMERICAN AIR FORCES

Be it known that the 437 Military Airlift Wing, Charleston AFB, S.C. achieved outstanding success in the Flight Safety Program during 1976. In recognition of this accomplishment, the system of cooperation among the American Air Forces' Flight Safety Award is presented to this distinguished unit.

Given in Punta Del Este, Uruguay
Chairman Conjefamer