AEROSPACE

SAFETY • MAGAZINE FOR AIRCREWS

MARCH 1979

IN THIS ISSUE: **Illusions and Flight**

MORE ABOUT WIND SHEAR HAZARDS

Wake Turbulence

The P.R.I.C.E. Is Right

A1C Arthur B. Hermanson
Physiological Training Unit • USAF Hosp. Ellsworth • Ellsworth AFB, SD

So there you are, a Physiological Training Specialist, a Chamber Ranger. You have innumerable hours of ''flight'' time inside the chamber. You are considered by your fellow workers to be one of the best in the field. And the classes you teach get critiques back saying how well you conduct classes and praising your ability to make everyone feel at ease inside the chamber.

So now you are inside the small compartment of the altitude chamber. The main flight is over and your group of refreshers are getting ready for their rapid decompression.

Everyone is settled down and has their equipment ready. The door is closed, the chamber has started up to 8,000 feet, and you have started your lecture. At 8,000 feet, you have once again explained the situation and procedure they must follow after a Rapid Decompression.

The Rapid Decompression has been fired. Everyone is getting their equipment hooked up to their faces. Everything is going smooth. A quick check with everyone, thumbs up, they are all okay. You tell the lock operator everything is all right and start for ground level.

About that time you notice something is wrong. There is a slight restriction to your breathing. Someone tells you your face is turning red, and you then notice some of your signs of hypoxia. You do a quick check of your equipment, and there is your problem. Your CRU-60/P is not fully mated to the supply hose. You connect the CRU-60P properly and prepare yourself for some ribbing from your fellow workers.

The above incident actually happened. It is embarrassing, especially since you work with the PRICE check and hypoxia almost daily.

The PRICE check is set up to work along with the aircraft's Dash One. It is a very effective little check, and it does not take more than just a couple of minutes to do. It could save you some embarrassment some day, and it might even save your life.

One final point, and you have heard it many a time before. ''It can't happen to me.'' It can, it even happens to those who teach safety habits in their daily routine. ★

PRICE CHECK

P — Pressure	gauge check.
R — Regulator	Perform blowback check on regulator hose in both normal and 100% positions, little or no resistance to blowing indicates a leaking diaphragm.
I — Indicator,	with diluter in 100% position, check blinker.
C — Connections,	check all connections, connector and quick-disconnect.
E — Emergency,	check emergency oxygen supply and connections.

UNITED STATES AIR FORCE

AEROSPACE

SAFETY MAGAZINE

MARCH 1979 AIR FORCE RECURRING PUBLICATION 127-2 VOLUME 35 NUMBER 3

AFRP 127-2
Entered as a controlled circulation rate publication (USPS No. 447-810) at Terminal Annex, Los Angeles, CA.

RIVER RAT REUNION
Contact: Col Bob Gadd
C/O Rat Reunion
P.O. Box 105
Randolph AFB, TX 78148
(512) 652-4171, (AV) 487-4171


page 2


page 6

page 14

SPECIAL FEATURES

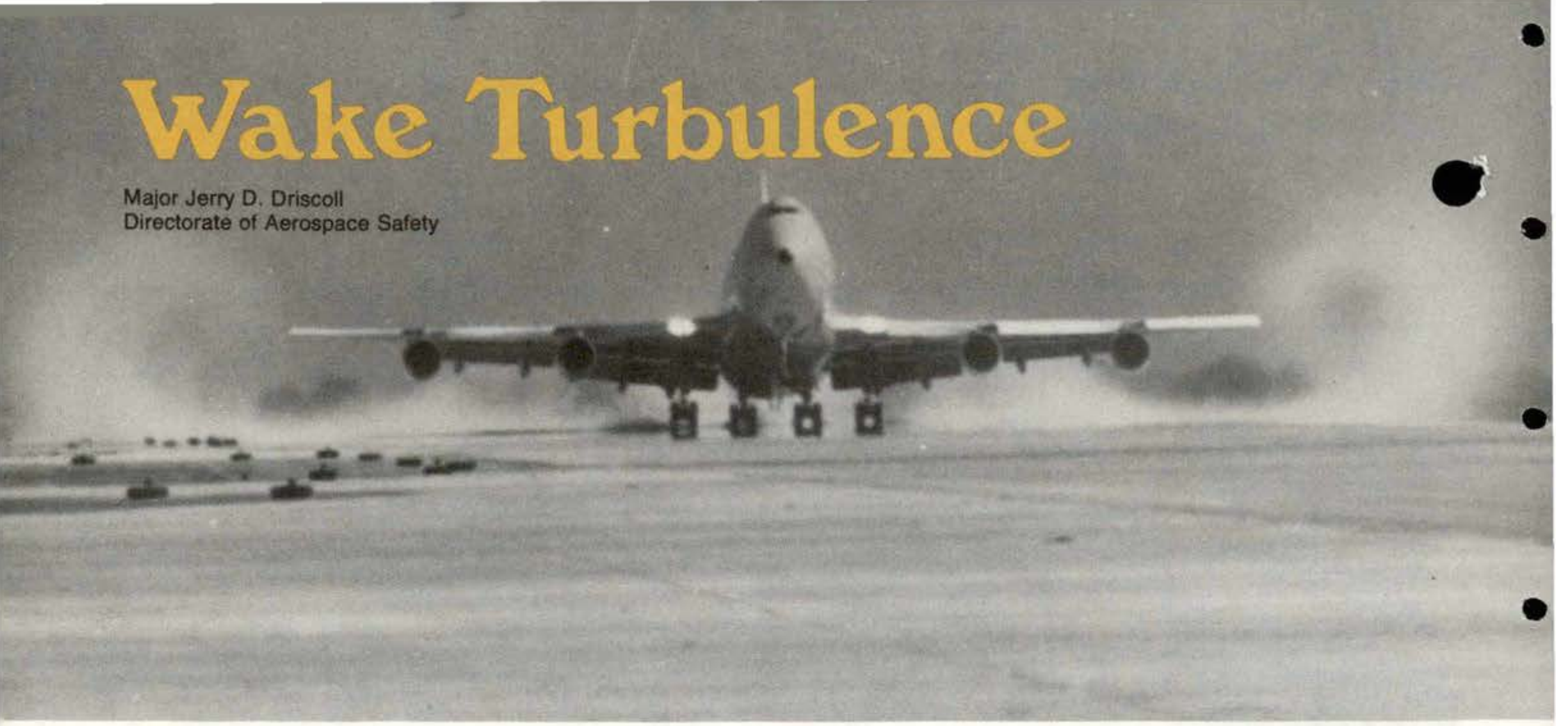
REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

SUBSCRIPTION—AEROSPACE SAFETY is available on subscription for $12.00 per year domestic; $15.00 foreign; $1.00 per copy, domestic; $1.30 per copy, foreign, through the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Changes in subscription mailings should be sent to the above address. No back copies of the magazine can be furnished. Use of funds for printing this publication has been approved by Headquarters, United States Air Force, Department of Defense, Washington, D.C. Facts, testimony and conclusions of aircraft mishaps printed herein may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the AEROSPACE SAFETY Magazine. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, AEROSPACE SAFETY Magazine, Air Force Inspection and Safety Center, Norton Air Force Base, California 92409. The Editor reserves the right to make any editorial change in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from AEROSPACE SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use of material. Such action will ensure complete accuracy of material, amended in light of most recent developments. The contents of this magazine are informative and should not be construed as regulations, technical orders or directives unless so stated. Authority to publish this periodical automatically expires on 26 Jan 1980, unless its continuance is authorized by the approving authority prior to that date. Distribution: 1 copy for every 3 aircrew and aircrew support personnel.

Wake Turbulence

Major Jerry D. Driscoll
Directorate of Aerospace Safety



Since the advent of the jumbo jet, there has been an increased awareness of a phenomenon known as wake turbulence. Studies/tests performed by FAA using colored smoke showed some of the turbulence caused by the heavies. Since 1973 we've had a decrease in major accidents and reported incidents where the cause factor was wake turbulence. We had only one major accident where the wake turbulence was caused by a heavy, in this case a DC-10. In the recent past, however, there seems to be a possible trend involving—you guessed it—wake turbulence. The following major accidents have occurred since 1973:

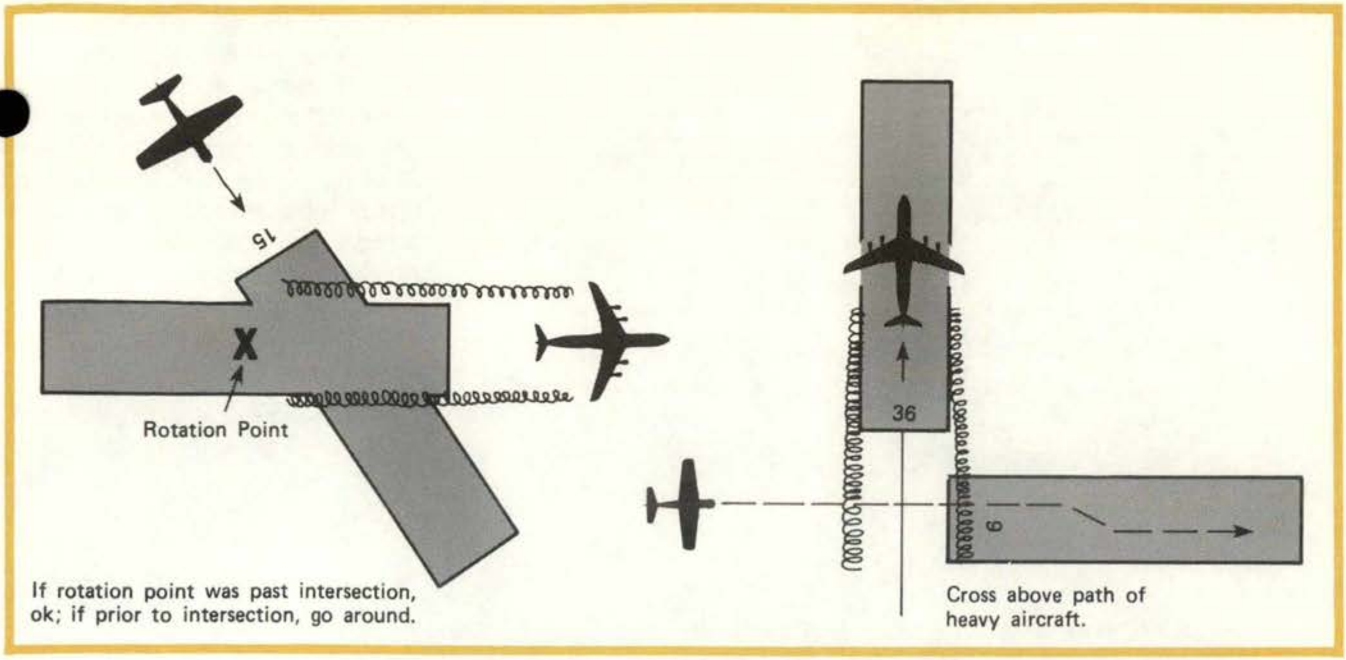
• T-38A. During a TACAN low approach in UPT, the aircraft was number 2 behind an L-382 (civilian stretch C-130). After reporting the FAF at 1.5 to 2 miles behind the L-382, the aircraft was observed to abruptly roll left to a 60 to 90 degree bank, slightly nose-low. The aircraft flew through some small trees, became airborne, then crashed, killing the crew.

• T-39B. During a transition training mission, the accident aircraft was making a VFR closed pattern at a civilian airport when a DC-10 was cleared for "the option" (touch-and-go or full stop landing) to the same runway. The T-39 was cleared as number 2 in traffic behind the DC-10 and turned final about 3 miles behind the DC-10. About 2 miles from the runway, after the tower operator cautioned of wake turbulence, the aircraft experienced a rapid roll to the left of about 120 degrees of bank. After recovery, the aircraft again rolled quickly to the left and descended. The pilots again recovered level flight, but too late to avoid impact with the ground.

• F-101F. While performing a formation takeoff, number 2 (who was down wind) dropped back because of being heavier and having a dissimilar configuration. As he dropped back, his aircraft became airborne in a semi-stalled, out-of-control condition. The left wing stall caused the aircraft to turn left, cross behind lead and become involved with lead's jet wash/engine exhaust. The aircraft exceeded the angle-of-attack limit, pitched up and crashed.

Related incidents included an F-106 that experienced wake turbulence from lead just prior to landing and crunched the tail section. An F-15 had a similar experience with wake turbulence on final and damaged the right tire, wheel and strut assembly, and an F-111 was also the victim of lead's wake turbulence. An F-105 made a hard landing on its aft section when it encountered wake turbulence generated from numerous C-130 takeoffs and landings. Flying through the jet wash of one fighter by another in air-to-air engagements can cause an over G condition, e.g., an F-4 recorded 8 Gs during a gun tracking position on another F-4; an F-5 pulled 10 Gs while tracking an RF-4, but the one that received the heaviest load and lived to tell about it was an F-15 that came back with an estimated *12 Gs* encountered during a gun tracking engagement. All three examples occurred as a result of flying through the jet wash in a loaded-up condition.

As you can see, most of the above damage was from fighters encountering turbulence generated by other fighters. It's a subject that should be continually covered at fly safe meetings and in flight briefings. The experience



If rotation point was past intersection, ok; if prior to intersection, go around.

Cross above path of heavy aircraft.

with wake turbulence from the big jets has been widely emphasized and has not been as big a problem as originally thought. However, since wake turbulence can have dire results for any aircraft, here is a review just in case you've forgotten.

Wake turbulence is primarily a product of lift and takes the form of vortices rolling off the wingtips and trailing behind the aircraft. The heavier, slower and cleaner the bird, the stronger the vortices. As the aircraft moves forward the vortices are left behind and descend at about 400 to 500 feet per minute to about 900 feet below the generator's flight path. They gradually dissipate, an action hastened by atmospheric turbulence, but tests have shown that in still air behind a cruising aircraft the vortices may exist at ranges up to 15 miles.

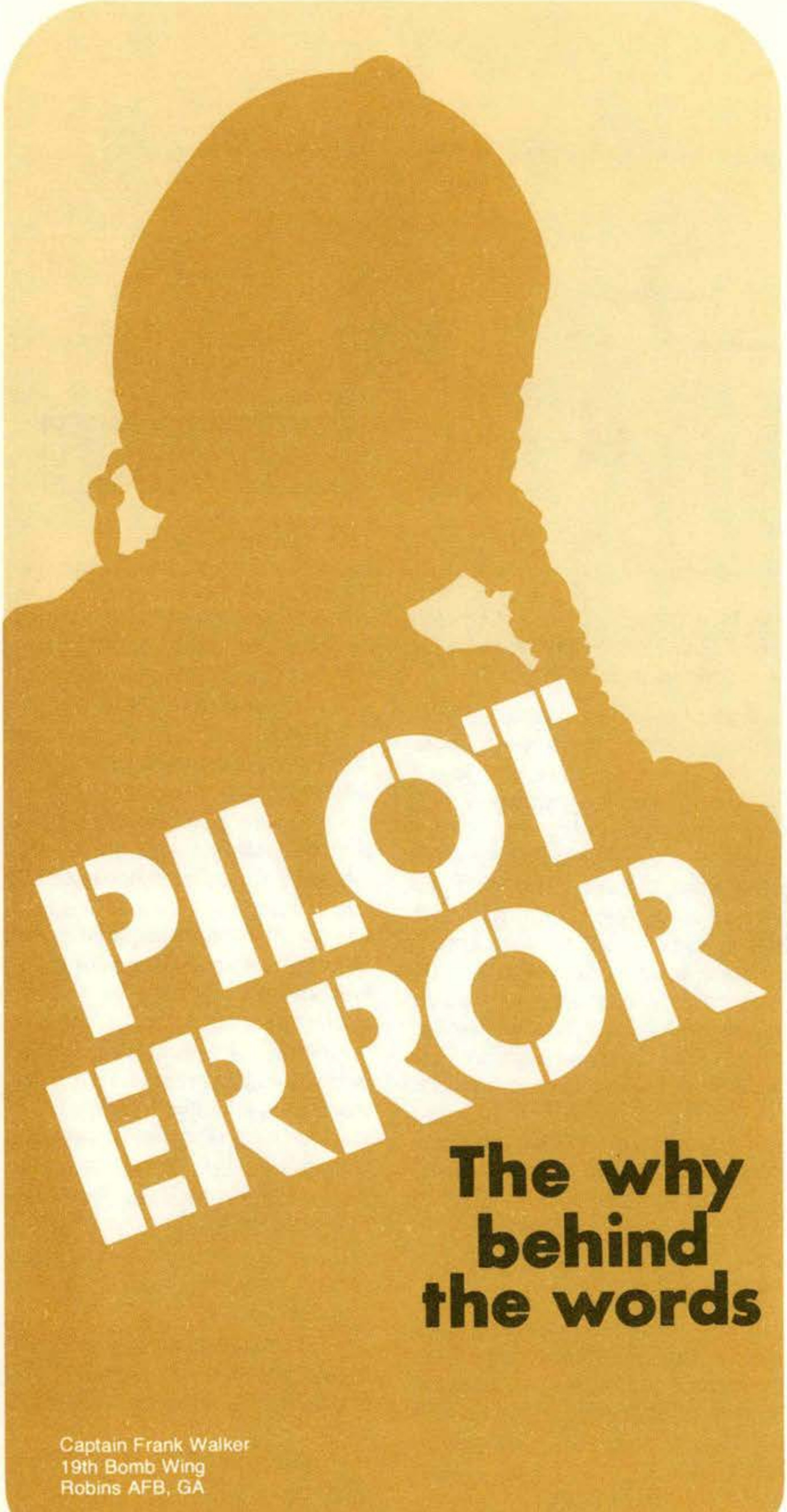
At low altitudes the vortices may not have time to dissipate and will sink until they reach ground effect where they move laterally outward at about five knots in still air. Remember that a cross wind could cause the upwind vortex to remain on the runway and move the downwind vortex to a parallel runway. Or a tail wind could move the vortices of a preceding aircraft forward.

If you fly across dissipating vortices you may feel only a couple of mild bumps; however, wake turbulence can be extremely violent. So violent, in fact, that a light plane encounter could result in structural failure. The primary hazard for fighters and trainers is the possibility of loss of control. In tests at Edwards AFB an F-104 was rolled inverted and thrown down and out of the vortex so rapidly that response time was inadequate to arrest the reaction. In the traffic pattern this could be disastrous. NASA data records one case in which a nearly 100 degrees-per-second left roll rate was generated while the pilot was holding more than half right stick deflection.

While structural damage may result from a violent wake turbulence encounter, the biggest hazard when flying up the core of a vortex is induced roll. Long span aircraft have the best of it here in that if the ailerons extend beyond the vortex, counter control would be more effective than for short span aircraft which may have the entire wing span within the vortex. In the latter case, counter control capability may not be great enough to stop the roll.

To avoid wake turbulence, the following procedures are recommended:

- Vortex generation begins with the rotation and ends when the nose wheel touches down. So take off and land prior to the rotation point of aircraft on takeoff. Take off and land beyond the touchdown point of a landing aircraft. (See illustrations.)
- When a heavy aircraft has landed on an intersecting runway, cross above its flight path.
- When landing behind a heavy jet departing on a crossing runway, note his rotation point. If it was past the intersection you're okay; if it was prior to the intersection, stay above his flight path, or go around.
- At cruise altitude avoid flight below and behind a heavy jet, and/or offset laterally, preferably upwind.
- Avoid helicopter (1) downwash and (2) trailing vortices.
- Be alert to controller's warnings and obey all instructions pertaining to separation. ★



PILOT ERROR

The why behind the words

Captain Frank Walker
19th Bomb Wing
Robins AFB, GA

Although the author uses the phrase "Pilot Error" in this article, the Air Force has replaced that classification with "Operations Factor, Operator." Now that's a handful, especially if it is used frequently in a short article. Therefore, we are retaining the author's "Pilot Error" for which the reader may infer "Operations Factor, Operator."

A commercial airline crew crashes while handling a minor emergency . . . ; an ATC IP lands with the gear up . . . ; the crew of an AF transport flies into the side of a mountain . . . .

What do they all have in common? They all resulted from pilot error. Yet what is pilot error? The words themselves have a negative connotation. To most pilots and crew members, it's a scapegoat phrase used to place blame for a mishap when no other reason for it can be found. The purpose of this article is to show what Pilot Error is and what a crew can do to avoid it.

The brain is an extremely complex organ – we still don't fully understand all of its capability. But for a pilot, the brain can be likened to a computer; it receives a sensory input, analyzes it based on information stored in its memory bank, and then produces an answer. While this may be a simplified view, it will explain how a simple input can be misinterpreted or blocked out. The result can be another unexplained mishap labeled "PILOT ERROR."

The brain depends on stimuli transmitted from one of the five senses in order to make the decisions that the pilot needs in flight. With numerous inputs every second, the brain sifts the inputs that it receives and prioritizes them; the stronger the stimulus, the better chance it has of getting through. Once the stimulus is received, it remains until it is replaced by another stimulus. Normally, this occurs when we change our attention to something else. For example, all of us at one time have been engaged in conversation at a party when we see a really attractive member of the opposite sex enter the room. Although we are still listening, our ability to comprehend what is being said disappears – a stronger stimulus has replaced the original one.

In the above case, one stimulus suppresses another that is still physically present. If the person walks away, our attention will return to the conversation. In the next example, the stimulus is never received to begin with. A classmate of mine in pilot training was notorious for his final turn gear check call – made while the gear warning horn was beeping in his ear. The concentration on a visual stimulus under the stress of being solo and wanting to perform well completely blocked out all other sensory perceptions. The result was that he really never "heard" the horn.

I mention stress – this is really the heart of pilot error. The stimuli received by an individual under stress are normally heightened and sharpened. This is usually good, because it assists the individual to work beyond his capabilities. But stress can also intensify the problems that were noted above. Extreme concentration on an emergency can completely block a stimulus from reaching the brain. If the entire crew is absorbed by the same stimulus, it is possible for no one to notice the aircraft deviating from its flight path. And if the stress becomes great enough, the individual may react to no inputs and completely freeze up. The results are equally disastrous.

At this point many of you are saying: "Aw, that could never happen on a crew aircraft where at least one person would catch a mistake." Perhaps the following example will make a believer of you as it did me.

I was flying an "over-the-shoulder" flight on a B-52 crew returning to Guam after a 30-day stateside rotation. The copilot and navigator were lieutenants and the rest of the crew were majors, lieutenant colonels, and a tech sergeant. The copilot was making numerous mistakes during the flight and was becoming flustered since it was his first flight with the crew. The pilot briefed the TACAN approach and told the copilot that, when they intercepted the localizer, the copilot would fly the ILS and land.

As we intercepted the ILS, transfer of the controls was made and the copilot verbally acknowledged control of the aircraft. As we started down the glidepath, I mentioned to the copilot that he was getting a little bit low on the glide slope. When we passed one dot low, I again told him he was getting low. No one else had said anything to him until then. At this point the pilot said "get your nose up." The copilot looked at him and said, "I thought you were flying the aircraft." The pilot then muttered something unmentionable and landed. Weather was VFR the entire approach and I doubt we would have crashed, but had we had an emergency or been making an instrument approach, we might have been another undetermined mishap chalked up to pilot error.

We've seen so far that stress can accentuate the tendency of the brain to block or misinterpret stimuli but what can we do to avoid it? The first thing, of course, is awareness and that is what this article has tried to do. Following are some other ideas that a crew can use to ensure that it doesn't happen to them.

The best method to keep from concentrating on a single stimulus is to keep changing the stimulus periodically. One example is for the crew to clue the pilot flying the approach as to altitudes, headings, etc., and for the pilot to RESPOND ON INTERPHONE. This will make him break away from a visual stimulus to an aural one and will keep his cross-check from stagnating. Especially on a weather approach to minimums, a pilot should verbally inform the crew in order to keep from concentrating solely on one stimulus. And if it gets quiet for a long time, someone ought to say something, especially if a deviation is noted.

Another thing to avoid is saying things or doing things by rote without really concentrating on what it is we're saying. Many an ATC IP has heard his student say, "handle, horn, lights, light, pressure" in the T-37 and not have a down and locked indication because the IP pulled the gear indicator circuit breaker. After doing things the same way flight-after-flight, we see what we expect to see, whether it's really there or not. So take the time to really check a switch position or a light rather than to make a hurried glance. Because if you're concentrating on something else, what you think you saw may not be what you've got.

Probably the touchiest subject to talk about to a pilot is transferring control when things really go to hell. Every pilot should make sure that his copilot is aware of circumstances that would require a transfer of controls. The airlines use a "two communication rule." If the pilot flying the aircraft fails to respond to two communications in a row, whether they are internal or external communications, the other pilot is supposed to take control of the aircraft. No copilot should ever fear retaliation for taking the aircraft if he feels the pilot is not responding. It's a lot better to argue about it on the ground than to have him sit there and watch the pilot fly it into the ground.

Pilot Error will exist as long as we fly and only by acknowledging its existence and dealing with it can we avoid having our name listed in an accident report that reads CAUSE: PILOT ERROR. ★

Illusions and flight

After going around because the aircraft was high and fast, the pilot made another landing attempt. Again high and fast, but he elected to land. Subsequently, the aircraft went off the runway and sustained major damage.

The investigation board listed six causes, all of them Operations Factor, on the part of the A/C and the copilot. An item considered by the board, but rejected as a cause was a 1,700 ft obstacle within 4 NM of the runway. The copilot, who made the landing, apparently saw the obstacle as a greater hazard than it was. Nevertheless, he thought he had to stay high which led to a short, fast descent on final.

Most articles on illusions are confined to landing and takeoff problems. It is possible, however, for pilots to be deceived by various factors during other phases of flight. Most hazardous, possibly, is an illusion that affects a pilot's judgment during low level flight, particularly during weapons delivery and recovery. It is extremely difficult for a pilot to accurately judge height above the surface at high speed over calm water or featureless terrain such as some desert areas present.

The following material has been presented in some form in several publications including *Aerospace Safety*. But because accidents caused or contributed to by illusions continue to occur, we recommend all pilots read and heed. It deals with landing but holds for the other phases of flight mentioned above.

Visual illusions during the landing approach may be caused by one or any combination of the following features:

- Sloping approach terrain
- Sloping runways
- Runway width
- Rain on the windscreen
- Featureless approach terrain
- Runway lighting intensity
- Shallow fog
- Rain showers

SLOPING APPROACH TERRAIN

Normally, when a pilot makes a visual approach he subconsciously judges the approach path from a combination of the apparent distance of the aircraft from the runway and its apparent height above the approach terrain. If the ground under the aircraft slopes upwards towards the threshold an illusion may be created, particularly during the early stages of the approach, that the aircraft is too high (see Figure 1). Conversely, ground which slopes downwards towards the threshold gives the impression that the approach path

Figure 1. UPSLOPE TERRAIN

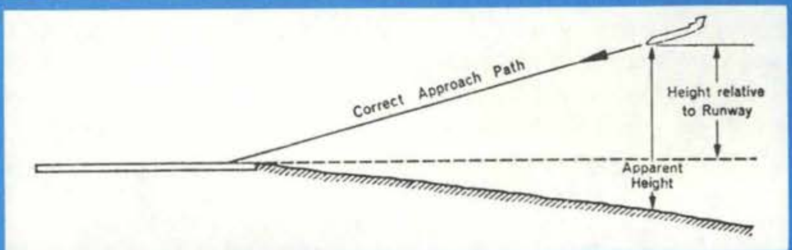
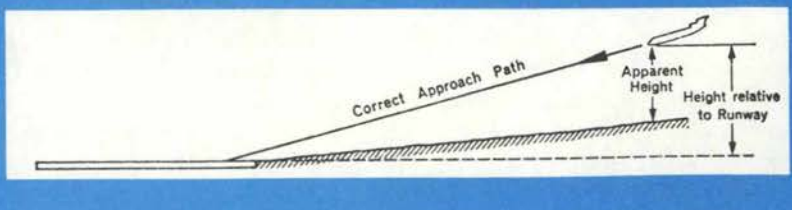


Figure 2. DOWNSLOPE TERRAIN



is too flat (see Figure 2).

SLOPING RUNWAYS

Through the regular use of ILS glide paths and VASIs pilots become accustomed to a 3° glide slope and the complementary angle of 177° between the runway and the aircraft (see Figure 3). Additionally, from experience pilots come to know with considerable accuracy the amount of power required to maintain the correct approach path to the point of touchdown. If, however, the runway slopes upwards from the landing threshold and the 177° relative angle is used, a visual approach will be lower than it should be (see Figure 4) and the "usual" power setting will be inadequate to meet the requirements of the flatter approach. If the runway has a down-slope, the converse applies (see Figure 5), so that by maintaining the 177° angle relative to the down-sloping runway, the approach to the touchdown point will be steeper and the "usual" power setting in excess of that required.

In summary, an up-slope in either the runway or approach terrain produces a "too high" illusion; conversely, a down-slope in either produces a "too low" illusion.

RUNWAY WIDTH

The ability to use the apparent convergence – due to perspective – of two parallel lines to estimate their length is well known. Increasing or decreasing the distance between the lines, however, can create the illusion of shortening or lengthening them. On the approach, a pilot bases part of his judgment on a mental comparison of the runway before him with the "normal" view of the runways to which he is accustomed. Variations in the runway width, therefore, can be misleading. For example, the wider the runway, the shorter it appears; moreover, the width can also have an effect upon the apparent height of the aircraft in relation to the runway, a wider runway making an aircraft appear lower than it is.

RAIN

Heavy rain can affect the pilot's perception of distance from the approach or runway lights by diffusing the flow of the lights and causing them to appear less intense. This may lead him to suppose that the lights are farther away than in fact they are. On the other hand, only a little scattering due to water on the windscreen can cause runway lights to bloom and double their apparent size, with the result that the pilot believes that he is closer to the runway than he actually is, leading possibly to a premature descent. Similarly, rain on the windscreen can cause illusions as a result of light-ray refraction. For instance, even though an aircraft is correctly aligned on the approach path it can appear to the pilot to be above or below the correct glide slope or left or right of the runway center line depending upon the slope of the windscreen or other circumstances. The apparent error might be as much as 200 feet at a distance of one mile from runway threshold.

FEATURELESS APPROACH TERRAIN

Visual descents over calm seas, deserts or snow, or over unlit terrain at night, can be hazardous even in good visibility. The absence of external vertical references makes judgment of height difficult and the pilot may have the illusion of being at a greater height than is actually the case, leading to a premature or too-rapid descent. Height above the runway is also made more difficult to judge if, because of snow for example, there is no contrast between the runway surface and surrounding terrain. The problem is compounded if the descent is made into sun or in any conditions which reduce forward visibility.

RUNWAY LIGHTING INTENSITY

Because bright lights appear

Figure 3. LEVEL RUNWAY

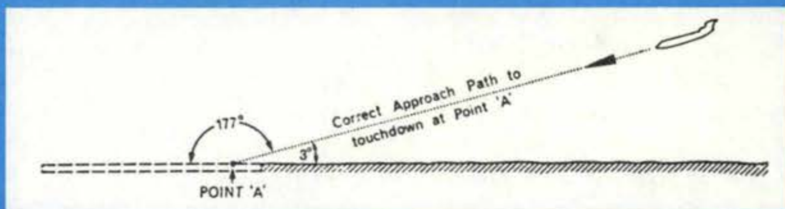


Figure 4. RUNWAY WITH UPSLOPE

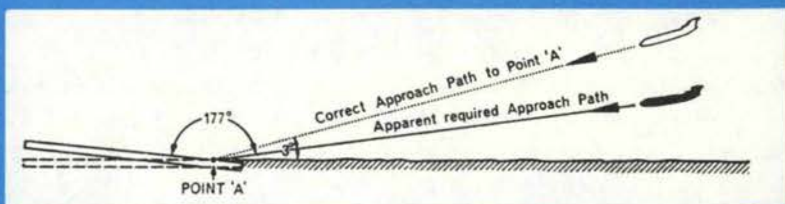
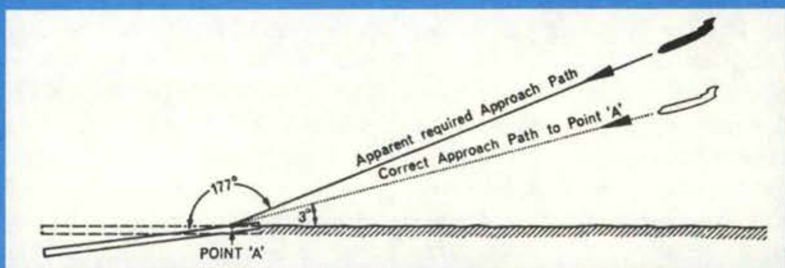


Figure 5. RUNWAY WITH DOWNSLOPE



closer to the observer and dimmer lights farther away, the intensity of the approach and runway lighting can create illusions. Thus, on a clear night, the runway lights may appear closer than they actually are, particularly when there are no lights in the surrounding area.

SHALLOW FOG

In shallow fog conditions, especially at night, the whole of the approach and/or runway lighting may be visible from a considerable distance on the approach even though Runway Visual Range or meteorological reports indicate the presence of fog. On descent into such a fog layer, the visual reference available is likely to diminish rapidly, in extreme cases reducing from the full length of the approach lights to a very small segment. This is likely to cause an illusion that the aircraft has pitched nose up, which may induce a pilot to make a corrective movement in the opposite direction. The risk of striking the ground with a high rate of descent as a result of this erroneous correction is very real.

RAIN SHOWERS

A weather feature which may reinforce a pilot's visual indications that he need not apply power to reach the runway or to arrest a high rate of descent is an isolated rain shower. A heavy rainstorm moving towards an aircraft can cause a shortening of the pilot's visual segment—that distance along the surface visible to the pilot over the nose of the aircraft. This can produce the illusion that the horizon is moving lower and, as a result, is often misinterpreted as an aircraft pitch change in the nose-up direction. The natural response by a pilot would be to lower the nose or to decrease, not increase, power.

Although it is essential to appreciate the nature of visual illusions which adversely affect judgment of the landing approach, pilots should also be aware of other illusory phenomena which may occur during level flight. False perceptions of attitude or misinterpretation of external visual cues can be induced by:

Horizons formed by layer clouds
Autokinesis
High altitude
High speed flight

HORIZONS FORMED BY LAYER CLOUDS

A pilot flying between layers of cloud with no natural horizon visible may tend to use the clouds as a substitute horizon. Since cloud layers often lie at a considerable angle to the earth's surface, the aircraft may be aligned with a false reference and fly with one wing low.

AUTOKINESIS

This illusion occurs when a small source of light is viewed against a uniformly dark background. It is not related to either the motion or the acceleration to which the observer is subjected and takes the form of an aimless wandering of the light source. At night this could be interpreted by a pilot as the movement of another aircraft. Consequently any steady fixation of the light source should be avoided; movement of the eyes, head and body greatly reduce the effect of the illusion.

HIGH ALTITUDE

At high altitude, where there is often little or nothing in the distance on which to focus, the eye tends to adopt its normal resting level and focus only a few feet ahead. In order to re-focus the eye at infinity and search successfully for an, as yet unseen, aircraft, it is not enough simply to look into the distance because this can never make the eye muscles relax sufficiently; on the contrary, it is likely to have the opposite effect and bring the point of focus even nearer than the normal resting level. The only sure way of focusing the eye at infinity is to interrupt the distant scanning by looking at a definite external object (such as clouds, vapor trails, the ground, even wing tips if visible, etc.) which is at least 20 feet away, and this should be done every 3 or 4 seconds during the search pattern.

Other high altitude flying problems include the fact that the horizon is depressed with respect to the true horizontal, so that orientation to this false reference may result in the aircraft being flown with one wing low or in a nosedown attitude. In addition, objects such as the moon or stars which a pilot normally expects to see above the horizontal at night may appear below it and so engender a false perception of the aircraft's attitude.

HIGH SPEED FLIGHT

As the speed of flight increases, it is no longer valid to think in terms of an instantaneous visual picture. The elapsed time between initial perception of an external object and its recognition becomes significant and in the case of collision courses additional time will be required to alter the aircraft's line of flight. The problem becomes more serious at high altitude where it is difficult to judge distance, relative speed and size of an object when it is seen against an empty visual field.

A pilot's susceptibility to the illusions described above will depend largely on the amount and nature of his flying experience, although other factors such as fatigue, poor night adaptation and the absence of glideslope guidance tend to exacerbate the problem. Careful preflight planning, including checks of the availability of visual and instrument approach aids at the destination aerodrome, the physical characteristics of its runway(s) and the nature of the surrounding terrain will do much to overcome the hazards, as will the maintenance of instrument flying competence. *(British Airways* Air Safety Review.) ★

AIR·CREW DIC·TION·AR·Y

Major David V. Froehlich • Directorate of Aerospace Safety

We'd like to pass on some handy one-liners which could prove useful to aircrew members. Feel free to use them (no charge) the next time you shirk responsibility, take a short cut, skip a procedure, or "don't have time."

WITTY SAYINGS JUST BEFORE AN ACCIDENT

- **"We don't do things that way here!"**
- **"That rule (procedure) doesn't apply to us."**
- **"I'm not the regular crew chief." (Time worn but still often used.)**
- **"I wasn't here then; the guy before me must of . . ."**
- **"It looks O.K. to me."**
- **"I think it will be all right."**
- **"It's VFR today anyway."**
- **"We'll get a late takeoff if we wait to have it fixed."**
- **"They didn't write it up on the last flight."**
- **"You do the inside and I'll do a quick walkaround."**
- **"Don't sweat the details."**
- **"That shouldn't bother us."**
- **"2500 hours in this bird; I don't need the checklist anymore."**
- **"Let me show you the way we used to do it in the old days."**
- **"It'll be close, but we can make it."**
- **"I haven't had much time to hit the books."**
- **"This bird can take it."**
- **"We've got plenty of gas left."**
- **"If I wore all that cold weather junk, I'd really be uncomfortable in the cockpit."**
- **"We'd never get done if we did everything the book says."**
- **"We'll probably get a vector anyway."**

QUICK ANSWERS FOR THE ACCIDENT BOARD:

- **"The weather was supposed to come up."**
- **"But the tower told me to expedite!"**
- **"But I've done that thousands of times."**
- **"There was plenty of fuel at the fix."**
- **"I'm sure I looked at the lights . . ."**
- **"The runway didn't look wet (icy)."**
- **"I didn't have time to run (finish) the checklist."**
- **"We've never done that before, and we haven't lost one."**
- **"Uh, a new dash one change (FCIF item); I don't think I saw that."**
- **"I was sure we could make it."**
- **"It wasn't in the forms."**
- **"It was VFR, so I took it."**

We know that the above won't cover all possible foul-ups, but we're sure that aircrew imagination will fill the gaps. Seriously, we pass these on in the hope that the next time you catch yourself cutting corners, you remember this article and maybe you won't become a statistic! ★

SLICK RUNWAYS

Several incidents and Class B/C mishaps lately have revolved around a combination of wet/icy runway problems and heavy rubber deposits. A good point for aviators – RCR measurement *is not* and *never will be* an exact science. It is an average of readings and, therefore, cannot possibly reflect the conditions on every portion of the runway. Rubber deposits under water/slush/patchy snow can greatly affect your stopping ability toward the end of the concrete slab. The RCR "measurer" may not have driven over that one spot that will getcha!

Moral – obtain all possible info before your approach (a good peek or low approach and a few PIREPs may prevent a slide) and then use all recommended wet/icy runway or min run procedures as prescribed for your machine. Don't be too proud to go somewhere else. "But he said the RCR was a 12," won't keep it from being "OPERATOR ERROR."

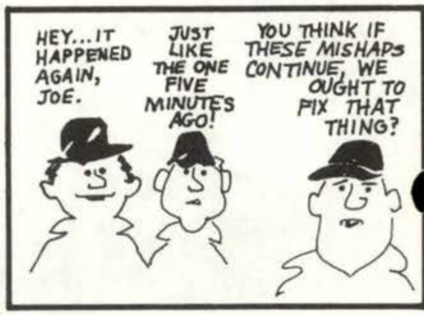
COCKPIT FOD

Following a low approach from a PAR, the pilot was repositioning for a TACAN approach. As he placed the control stick to the left, he noted a slight momentary binding as the stick passed half travel in his intended 30 degree bank turn. The pilot investigated and noted that there appeared to be no screws securing the control stick cover assembly; he performed a flight control check, but the binding was not again immediately noted. As the pilot initiated a left turn to RTB he noted that the stick "froze" in a 20 degree left bank position. Looking down at the base of the stick, he saw that the cover had slipped down around the base causing the binding. He reached down and vigorously moved the cover around, finally freeing it, and was able to retain control of the aircraft and accomplished a successful approach and landing. Could've been a mishap!

MIDAIR PREVENTION

We have had several requests for ideas on how to generate a local campaign to prevent midair collisions. Our folks are aware of the potential consequences of a collision between an AF aircraft and a civilian plane. Lt Col Bob Gardner's article on how to have a fly-in, *Aerospace Safety,* December 1978, gave some pointers. Here's another idea and the action that prompted it. One of our F-4s was on down wind for a touch and go when he spotted a civilian plane, slightly low on his right and making a climbing left turn. The F-4 pilot took evasive action and notified the tower. The aircraft was identified and the pilot contacted. He said he knew F-4s would be active in the area and he looked for them. Upon spotting one he took necessary evasive action. Both aircraft were operating IAW existing rules and procedures. The incident happened because both aircrews failed to see each other in time to avoid a near miss.

Now back to ideas on how to help prevent such incidents. The civilian pilot, an IP at a nearby airport, and another instructor were invited to the base where they were briefed on F-4 operations and patterns. Also, a detailed public briefing was scheduled for all operators at the general aviation field. If you have any ideas that you think others could use, let us hear from you. We'll pass them on. *Aerospace Safety: AUTOVON 876-2633.*



THREE FOR ONE

One mishap is bad enough, but three – within 30 minutes – same cause – three different aircraft – same place?

The missions were similar – ". . . routine local training mission," ". . . a training mission," ". . . local pilot proficiency sortie." The aircraft were two C-130's, one from another service, and a C-9. All struck a loose BAK-13 arresting cable. All received damage to antennas. Barrier maintenance personnel were standing beside the runway waiting to cross to tighten the cable; however, heavy traffic precluded their crossing. Rather than drive around the runway, they continued to wait. Policy at this base *now* is for the runway to be closed when there are arresting gear problems until they are corrected.

OPS TOPICS

F-4 EMERGENCY BRAKE VALVE

A recent F-4 mishap has identified the need for additional training for both crew members and maintenance personnel in the operation and correct positioning of the emergency brake control valve. In this incident the emergency brake handles in the cockpit appeared to be in on preflight. However, on landing only emergency braking was available which resulted in blown tires. Only through the pilot's skill did the aircraft remain on the runway.

The consequence of inadvertent emergency brakes being selected could be far more serious than one or two blown tires. The importance of understanding the operation of and the correct position of the emergency brake control valve cannot be overemphasized. This valve is located on the upper left side of the nose wheel well (see Fig 1) and the position of the valve arm must be checked to ensure it is in the *aft position* for normal braking.

Once the emergency brake handle has been pulled, the control valve is positioned for emergency operation and then can *only be reset from the nose wheel well*. It is often possible for the cockpit brake handles to be pushed back in but you will still not have normal braking unless the valve is manually reset.

Additional training for both crew members and maintenance personnel using a static aircraft is highly recommended to ensure that all are completely familiar with the required position of the valve to be checked for on each preflight.

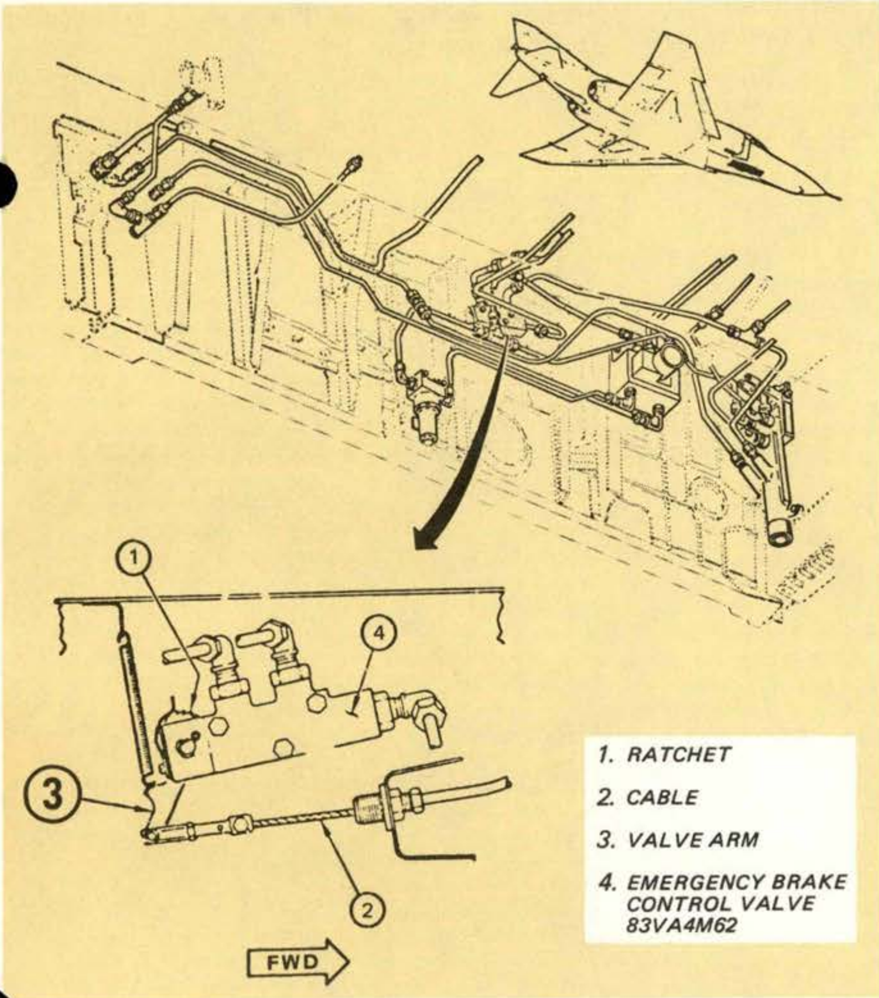


Figure 1. Emergency Brake Control Valve Rigging

FAA/NOAA TEST LOW-COST AUTOMATED WEATHER SYSTEM

The Federal Aviation Administration and the National Oceanic and Atmospheric Administration have begun testing a low-cost airport weather information system that uses a computer generated voice to brief pilots on wind conditions and provide them with accurate altimeter settings.

Called WAVE – for Wind, Altimeter, Voice Equipment – the system consists of sensors that collect data on wind speed and direction and barometric pressure readings in the vicinity of the airport. This data is fed into a small computer and a weather announcement is generated for broadcast once each minute over a radio navigation aid.

When airport personnel are on duty to provide the information, the broadcast also will include a recommendation of the best runway to use under existing wind conditions.

En route pilots can hear the weather report when they fly into the range of the Frederick, MD, Airport VOR navigation aid, an antenna which transmits in all directions on 109.0 VHF. ★

THE PROFESSIONAL APPROACH

Air Force Communications Service • Scott AFB, IL

The care and feeding of three Air Force publications, AFM 51-37, Instrument Flying; AFR 60-16, General Flight Rules; and AFP 60-19, Pilots Annual Instrument Refresher Course, has been delegated to Air Training Command (ATC). The following are some instrument related questions which have come to ATC and their answers:

Q. Am I expected to continue to comply with altitude restrictions associated with a Standard Instrument Departure (SID) when vectored off the SID?

A. No. FAA Handbook 7110.65A, Air Traffic Control, provides the following guidance to air traffic controllers: "When route or altitude in a previously issued clearance is amended, restate all applicable altitude restrictions." The pilot, however, should pay attention. If the controller states "Expect to resume (route, SID, STAR, etc.,)" keep the SID or STAR handy! Later, the controller may instruct you "Resume SID/Transition/STAR/Procedure." If the controller adds," . . . Comply with restrictions" you will be expected to comply with all route/altitude restrictions associated with the SID/etc. This guidance will be further explained in the next revision to AFM 51-37, Instrument Flying, expected in midyear 1979.

Q. When flying an approach such as the HI-TACAN Rwy 15, or ILS/DME, Kelly AFB, when can I descend from the 4,000′ mandatory altitude on the arc? (See Fig 1)

A. An arc or radial altitude restriction only applies while established on that segment of the approach. Once a lead point is reached, and a turn to the next segment is initiated, the pilot may descend to the next applicable altitude restriction. This may be especially important to facilitate a reasonable rate of descent to final approach fix altitude. The obstruction clearance provided is more than adequate for descent prior to being established on the next segment unless your lead point has been grossly miscomputed. This guidance will be further explained in the upcoming revision to AFM 51-37.

Q. I am enroute at 8,000′ MSL with radio failure. The minimum enroute altitude (MEA) for the next route segment is 12,000′ MSL. Where do I begin my climb and what rate of climb am I expected to maintain to assure obstruction clearance?

A. The pilot should not begin a climb to the next route segment MEA when radio out until beginning that route segment, unless the aircraft is not capable of the following climb rates while going from one MEA to another:

Sea level through 5,000 feet	**150 feet per Nautical Mile**
5,000 through 10,000 feet	**120 feet per Nautical Mile**
10,000 feet and over	**100 feet per Nautical Mile**

If a greater climb rate than those mentioned above is required for obstruction clearance, the enroute chart will specify a Minimum Crossing Altitude (MCA) at a particular fix to facilitate obstruction clearance. ★

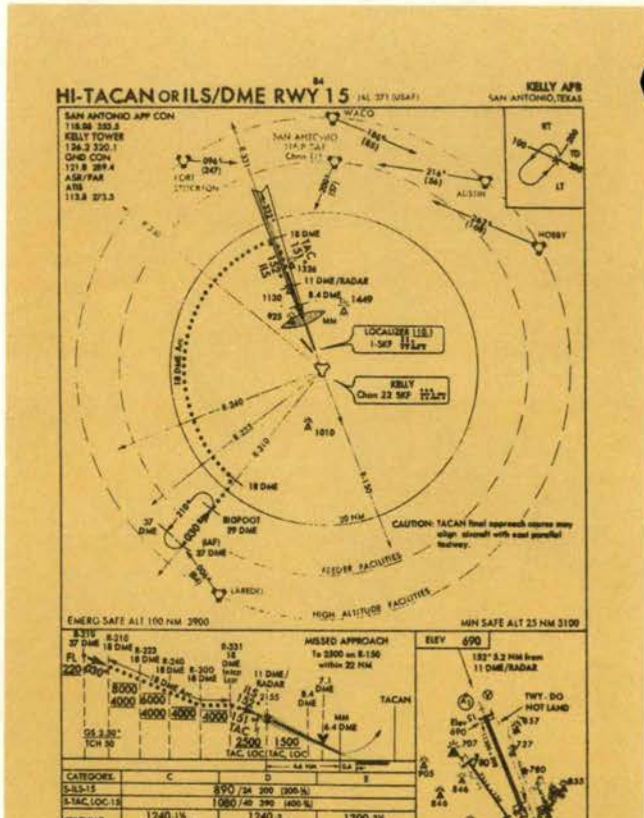
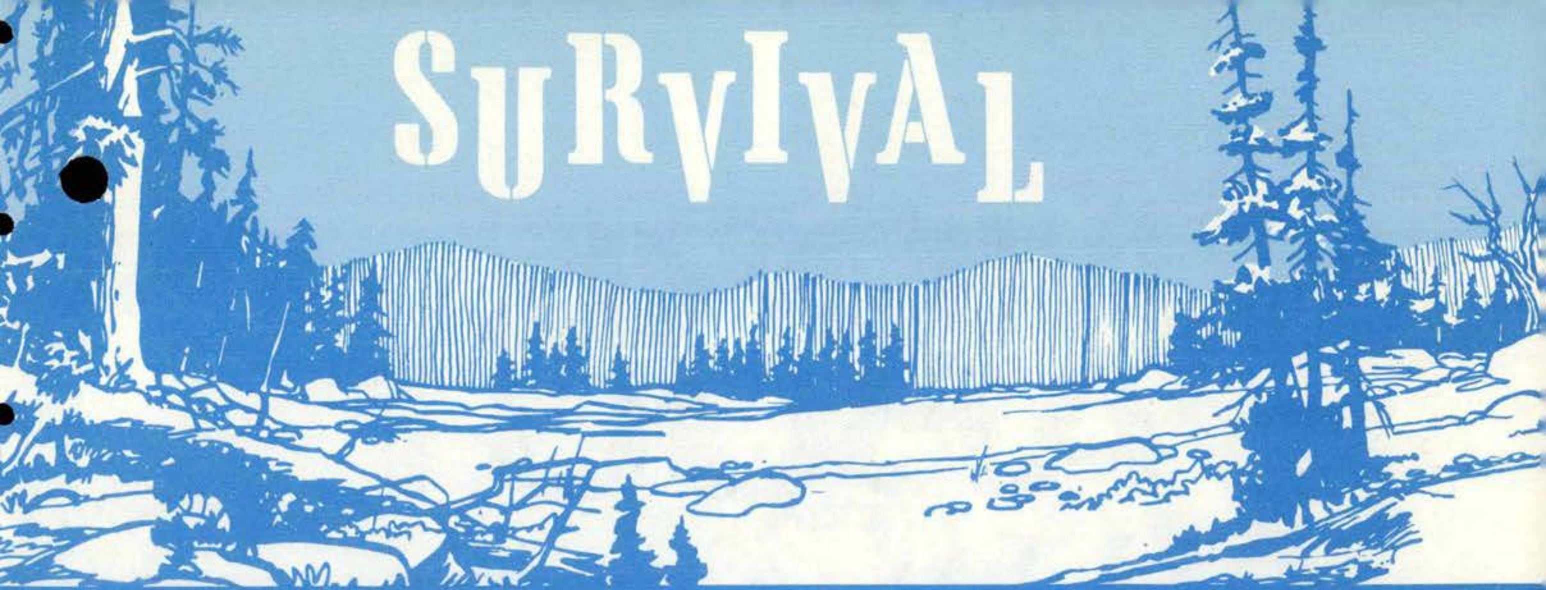


Fig. 1



Evasion of Another Kind

SSgt William R. Beier
Instructor Training Branch
3636th Combat Crew Training Wing • Fairchild AFB, WA

Generally, when aircrew members think of "evasion," they envision themselves hiding under vegetation, sneaking through the trees or finding something that will conceal them from the enemy. They see themselves as miserable or downright uncomfortable, to say the least! This perception isn't surprising for that's the way evasion was practiced – and successfully – by many in Southeast Asia. However, we need to remind ourselves, "THAT was Southeast Asia." What about a new and different hostile environment? Hiding behind rocks, trees, or under leaves may not always work; then you could find yourself dealing with an indigenous group of Assisted Evasion Force (AEF) personnel.

During the joint service exercise, Brave Shield, many Air Force aircrew members participated in an operational assisted evasion force scenario. Due to resources, time, and safety, the AEF portion of the exercise was limited; however, the intent and meaning were obvious. Many personnel found themselves in a position of not knowing what to expect next, and asking themselves, "What am I supposed to do?" For the majority, this was a new experience as it dealt with unconventional guerrilla warfare and not merely moving from point "A" to point "B" via flight boot express. Instead, it fell within the framework of being transported from one place to another by indigenous personnel under some very unusual circumstances. The very few of us who had prior experience or knowledge of AEF soon realized how very fortunate we were, for we recognized the disastrous consequences which could result from being ill-prepared. The greatest lesson we learned as participants was that ignorance of your personal responsibilities could spell disaster for you, the AEF personnel, and their system.

What are your responsibilities if you find yourself in an AEF net? Your best reference is AFM 200-3, Joint Worldwide Evasion and Escape Manual. Because of its classification, this manual will most likely be found only in the local intelligence library. However, if you're in a position where time seems to be a rare commodity, here are a few helpful hints from Army FM 21-76, Survival Evasion and Escape. *First,* remember there's no rush. Delays within the AEF system can and should be expected. This promotes the concept that a sure move is a safe move. Impatience on your part could endanger all concerned.

Second, orders from AEF must be followed explicitly, for AEF personnel will protect your identity or attempt to conceal you among the indigenous population (reference *Aerospace Safety,* Oct 78, The Great Escape). However, you must always use sound judgment for you are accountable when all is said and done.

Third, have a *personal plan* for escape in case the enemy disrupts the system. In some very rare cases, AEF personnel might even have to make it look like they *captured* you and turn you over to the enemy in order to preserve the system so it can save other lives. *Last,* but not least, anything you see or hear must be protected, especially if you are captured by the enemy while working with the AEF. However, you can be sure AEF will tell you only what you need to know. And you'll have little to say to the AEF people with the exception of helping to establish your identity and making requests to ensure your health and welfare.

In the next conflict, AEF may be a reality. It differs a great deal from the one man "Sneaky Pete." If you know your responsibilities within the AEF system, you'll be ready for "evasion of another kind." ★

MORE ABOUT WIND SHEAR HAZARDS

By Paul R. Higgins and Donald H. Patterson

Wind shear during approach and takeoff continues to be of serious concern to all segments of aviation. New findings in meteorology have added to our understanding of this hazard. The following article adds to our knowledge of how to best control the aircraft in a severe downdraft. Although it deals specifically with the Boeing 727, the basic procedures would apply equally to other aircraft. We are reprinting this article from the* Boeing Airliner *in the belief that it will add to our understanding of the wind shear phenomenon and how to deal with it. The article is purely educational and nothing in it should supersede Dash One provisions or any other Air Force/Command directives. Our appreciation to the authors and the Boeing Aircraft Company for reprint permission.

Some readers have voiced disagreement with certain of the conclusions reached by The Boeing Commercial Airplane Company relative to flying in severe wind shear conditions. The intent of the *Boeing Airliner* article of January 1977, entitled, "Hazards of Landing Approaches and Takeoffs in a Wind Shear Environment" was to provide pilots with a few ideas for consideration, which, if implemented would aid in avoiding catastrophe if their aircraft were inadvertently caught in some combination of severe downdraft and/or severe wind shear that resulted in high rates of descent and/or severe loss of airspeed, especially when within approximately 400 feet of the ground.

Discussions of both the way to recognize a wind shear environment and the proper control of an aircraft in a severe wind shear or downdraft after the environment has been recognized can be complicated and controversial. The general subject is difficult to explain when using the simplified aerodynamics usually presented in pilot training courses. It is necessary to go one step further in order to acquire a better understanding of the best procedures to use unless a pilot has already acquired that knowledge through flying in such conditions. Today's aircraft can usually fly over or around such conditions, so the possibilities of getting experience by forced penetration through the lower levels of thunderstorms at 10,000 to 20,000 feet of altitude are rare compared to 30 years ago.

Since the opportunities to gain flight experience in severe wind shear are rare, and since those opportunities now appear to exist only at times when the aircraft is on approach to landing or in the process of takeoff, it is desirable to provide supplementary data and training to crews so that their first encounter will have a successful con-

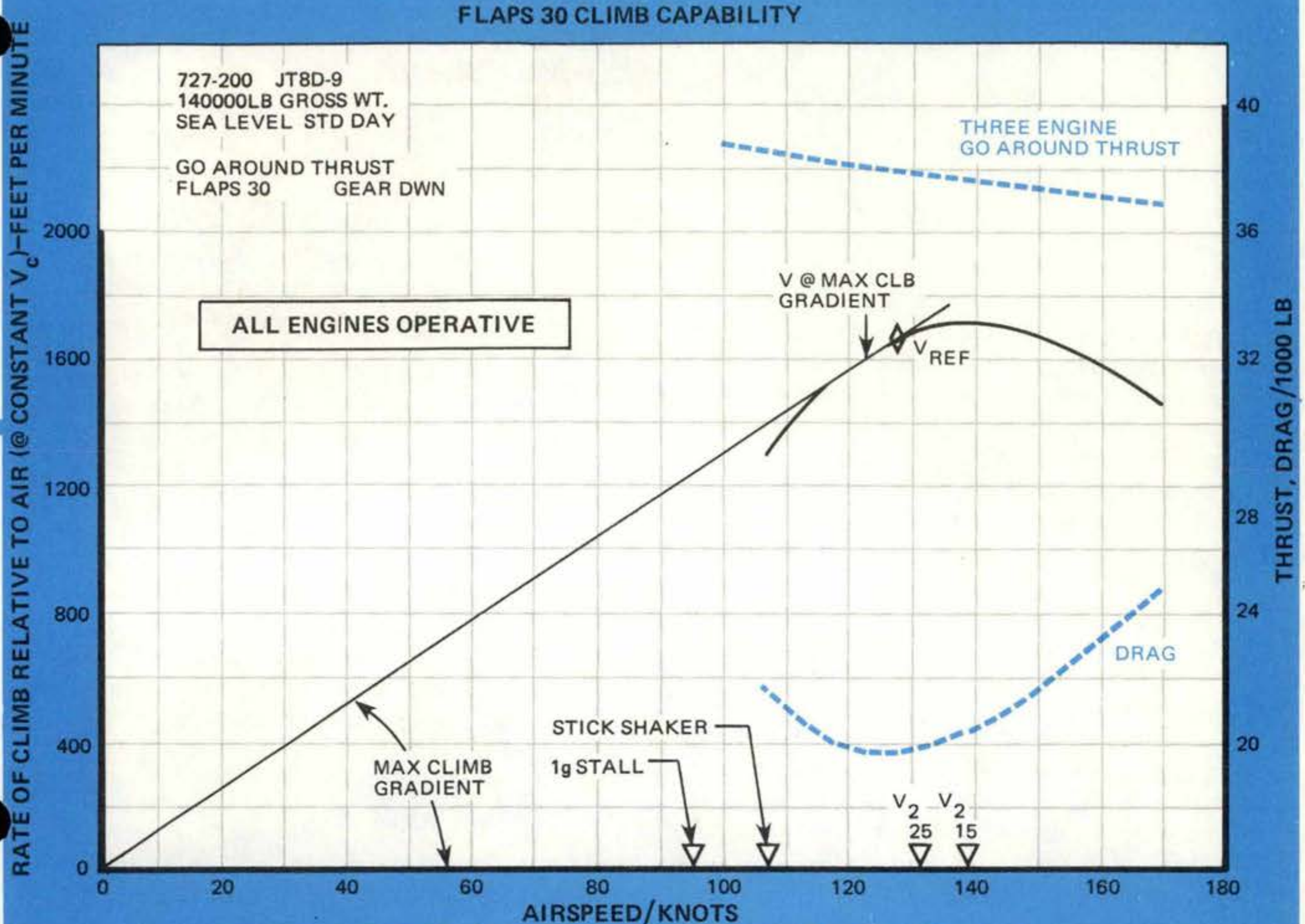


Figure 1. FLAPS 30 CONSTANT SPEED CLIMB CAPABILITY

clusion. The previous *Airliner* article was a step in that direction to assist the crews in acquiring a better understanding, but it appears that some pilots may yet be having difficulty in agreeing with the Boeing concepts. Additional supplementary discussion and examples of airplane performance have been prepared to help pilots understand the data and concepts presented in that article.

BASIC PERFORMANCE CONSIDERATIONS

Pilots are familiar with thrust, drag, and rate of climb and how these quantities vary with airspeed. Figure 1 shows the rate-of-climb capability at various airspeeds of a 727 with JT8D-9 engines at 140,000 lb gross weight on a sea level standard day. The airplane is in its normal landing configuration with gear down and flaps at 30°. It will be noted that if a straight line is drawn from the zero airspeed point and the zero rate-of-climb point up to where it becomes just tangent to the rate-of-climb curve, there is apparently only one speed at which it is possible to attain the maximum angle of climb. At any other speed, the angle of climb is going to be less than for that speed. However, it should also be apparent that for other speeds that vary from stick-shaker speed of about 108 knots all the way up to maximum rate-of-climb speed and a little bit above, the angle of climb does not change greatly. This confirms one of the main points of the previous *Airliner* article, which emphasized the good climb performance available at stick-shaker speeds.

Also shown in Figure 1 are the go-around thrust and drag variations with airspeed. The drag that is shown is that which the airplane would experience in stabilized 1-g flight at a constant speed while travelling on any straight flight path on which it is possible to stabilize at the constant speed, be it up, down or level. The rate-of-climb capability exceeds the 1-g flight drag. It is apparent that the maximum difference between the drag and the thrust occurs in the region where the maximum angle of climb occurs, at about 124 knots, a speed slightly less than the minimum drag speed. In addition, because the rate-of-climb depends on the product of thrust-minus-drag and airspeed, (T-D)V, the maximum rate of climb occurs where that product is greatest, in this case, at 140 knots.

AIRPLANE ENERGY MANAGEMENT CONCEPTS

Most pilots will probably find the 727 airplane easiest to fly in the approach condition at flaps 30 at about 40 knots, which is about 12 knots above V_{REF}. This follows from the fact that if there are any airspeed changes due to gusts (at least for a small gust of ± 10 knots), the airplane would want to return to the original speed. This characteristic results principally from the shape of the drag curve at 140 knots as shown in Figure 1. If a speed increase occurs due to a gust, the drag would also increase and tend to decelerate the airplane back to the original speed. Similarly, with an airspeed decrease, the lower drag of the reduced speed would accelerate the airplane back to the original airspeed.

The airplane is described as having speed stability in this region, and pilots like to fly in this region because it is easier. There are those who use the energy management concept discussed above and the argument of speed stability to support a viewpoint that airplanes should be flown faster during the approach. Some degree of speed stability is desirable, but it is far overrated as a necessary flight characteristic and is certainly not important enough to warrant imposing the risk of an overrun on all landings.

However, there is another way to look at airplane energy management that is helpful. This concept asks the pilot to constantly keep in mind the aerodynamic viewpoint that the elevators are the means of controlling airspeed. Aerodynamically, the elevators and the stabilizer trim determine the angle of attack, and so they fix the speed at which the airplane will fly under stabilized conditions in calm air at constant thrust. In addition, it is the thrust setting that determines whether the airplane climbs or descends. Remembering that the elevators control the airspeed and that thrust controls the rate of climb or descent makes it relatively easy to fly on the back side of the drag curve. That philosophy is also quite easy to use on the front, or high-speed side of the drag curve and makes it easier to relate to the basic instruments in the airplane because airspeed and elevators go together and rate-of-climb indicators and thrust levers go together. To the experienced jet transport pilot, it will be obvious that this is an oversimplification and many might argue that such an oversimplification has no merit. However, this energy management concept is not new and is part of a total concept for instrument flying promoted years ago by the Air Force. The success of that program established that a pilot had fewer problems in accomplishing his energy management task under this concept.

To avoid criticism for gross oversimplification when using the latter concept, it must be remembered that thrust changes are made for the purpose of changing the rate of climb or the vertical direction (angle) of the flight path. A *temporary* elevator deflection is necessary on jet aircraft to change the direction of the flight path. On the old propeller types, some of this small change in flight path came about automatically as a result of the change in the wing lift behind the propeller slip stream. The relationship between flight path angle and thrust change is discussed quantitatively in a later paragraph.

The question now arises as to what the difference is between the two concepts if they both require elevators to control the rate of climb. Is the difference just one of semantics? In Boeing's opinion, the difference is that the adoption of the latter concept will tend to force a pilot to be more conscious of rate of departure from the glide slope, or rate of climb or descent. *He will be motivated to check more frequently on all instruments on his panel.* Being more conscious of rate information available from the glide slope, altimeters, and rate-of-climb indicators, and how the rates can be controlled by thrust, he will more quickly assess the true state of the environment in which the aircraft is flying.

MANEUVER MARGINS

Note in Figure 1 that the stick-shaker speed and the 1-g stalling speed are indicated along the airspeed axis. The drag curves and the rate-of-climb curves have not been carried any lower than the stick-shaker speed because accurate information is lacking for lower speeds. No performance information is required for operations at lower speeds, and as a consequence, data collection in the lower speed region has a low priority. However, the rate-of-climb performance does not suddenly go to zero at stick-shaker speed. It will probably go to zero at some speed close to the 1-g stall speed. The 1-g stalling speeds have been shown because some recent literature has questioned how much real margin exists for maneuvering when flying at stick-shaker initiation speeds. Taking the stick-shaker speed of about 107 knots and the 1-g stall speed of about 95 knots and the ratio of one over the other and squaring that ratio produces a quantity equal to 1.27. This is the load factor that is available for maneuvering the airplane discussed in the plots at stick-shaker speeds. That load factor corresponds to what would be experienced in a turn at a 38° bank angle. The data confirm that at stick-shaker speeds, it is possible to maneuver up to 38° bank angle before experiencing a 1-g stall. As that bank angle is approached, the airplane will start to shake because of the initiation of stall buffet. However, the maneuvering capability is adequate at stick-shaker initiation speeds for normal airline maneuvers.

ANGLE-OF-ATTACK CONSIDERATIONS

Next, examine the effects of thrust on rate-of-climb capability and how airplane attitude in a climb will vary with the amount of thrust that is used in the climb. Figure 2 shows the climb capability at various thrust quantities, such as go-around thrust, 75% thrust, thrust for level flight, thrust for a 3° glide slope at V_{REF}, and idle thrust. Also shown are lines of constant wing angle-of-attack and body attitude. As an overall initial observation, it is interesting to note that as thrust decreases, the speed at which maximum rate of climb or minimum rate of descent occurs, decreases. In general, this will always be the situation as an airplane becomes performance-limited, either because of higher drag or low thrust.

From the lines of constant angle of attack, it is obvious that the angle of attack does not change much with thrust setting at a given speed. At high thrust settings and low airspeeds, there is some small effect on the angle of attack required for 1-g lift. This is caused by the lift component generated by the thrust which is directed upward relative to the flight path at high airplane angles of attack. It is clearly apparent that either angle of attack or airspeed can be used as a reference for flying the airplane during thrust changes. However, since most of the Boeing airplanes are not equipped with angle-of-attack indicators, flight procedures are generally written around the use of the airspeed indicator and the attitude indicator.

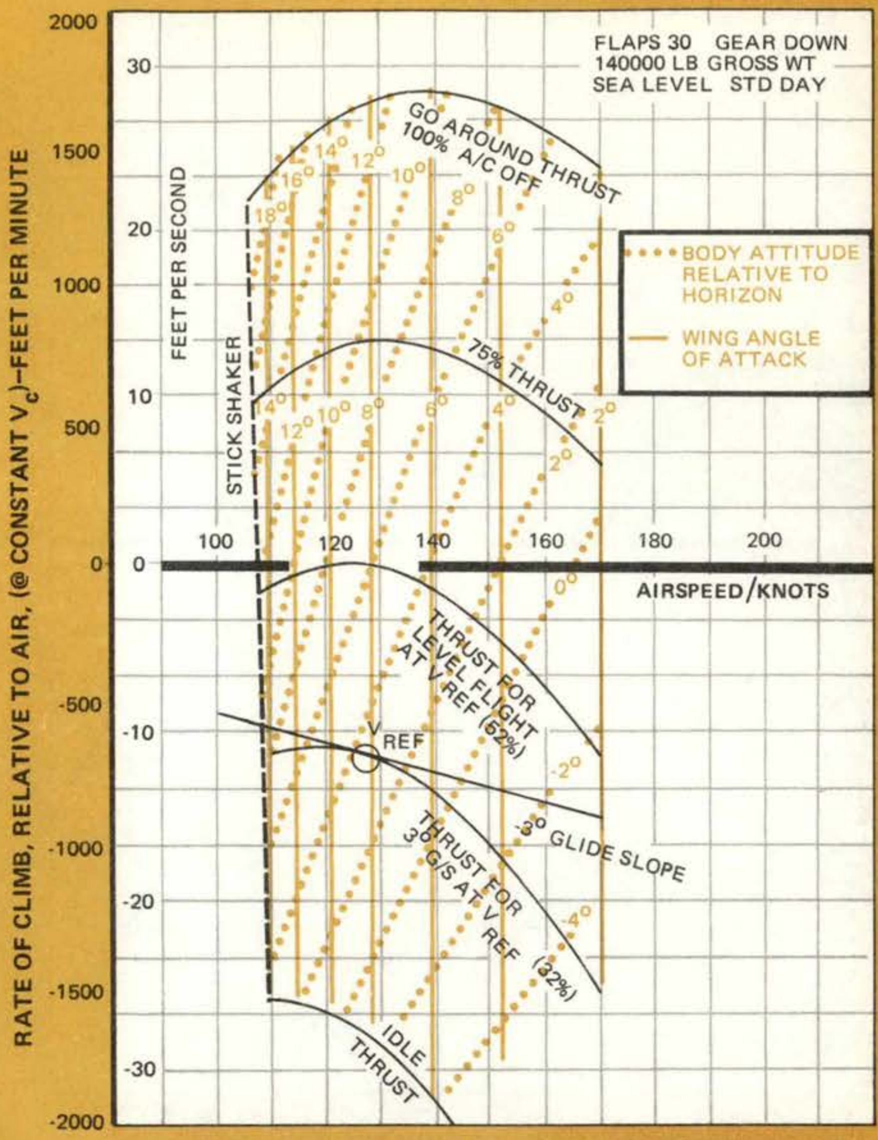


Figure 2. FLAPS 30 RATE OF CLIMB FOR VARYING THRUST SETTINGS

ATTITUDE CONSIDERATIONS

It is also possible to make some interesting observations from the lines of constant attitude. For instance, if the airplane is flying on a 3° glide slope at V_{REF}, the airplane attitude would be in the order of 3.5 degrees. If the go-around is made by adding go-around thrust, and the speed is held constant, the airplane attitude would have to go up to about 14°. If the original attitude of 3.5 degrees is held during and after thrust is applied, it is obvious that the airplane will tend to accelerate and eventually stabilize at a higher speed where the rate of climb will be less than that which would occur if the airspeed had been held constant. The data of this chart show that there is a definite attitude associated with each power setting and with each speed. The data establish the point that if airspeed is held constant during a thrust change, it is necessary to change the attitude to accomplish the intent of changing the thrust if the greatest benefit is going to be realized from the thrust change in terms of rate of climb or rate of descent. If it is desired to attain the rates of climb relative to the air that are shown on this chart, it is necessary to establish the attitudes and the thrust that are shown regardless of whether the airplane is travelling in an upward-moving current of air, a downward-moving

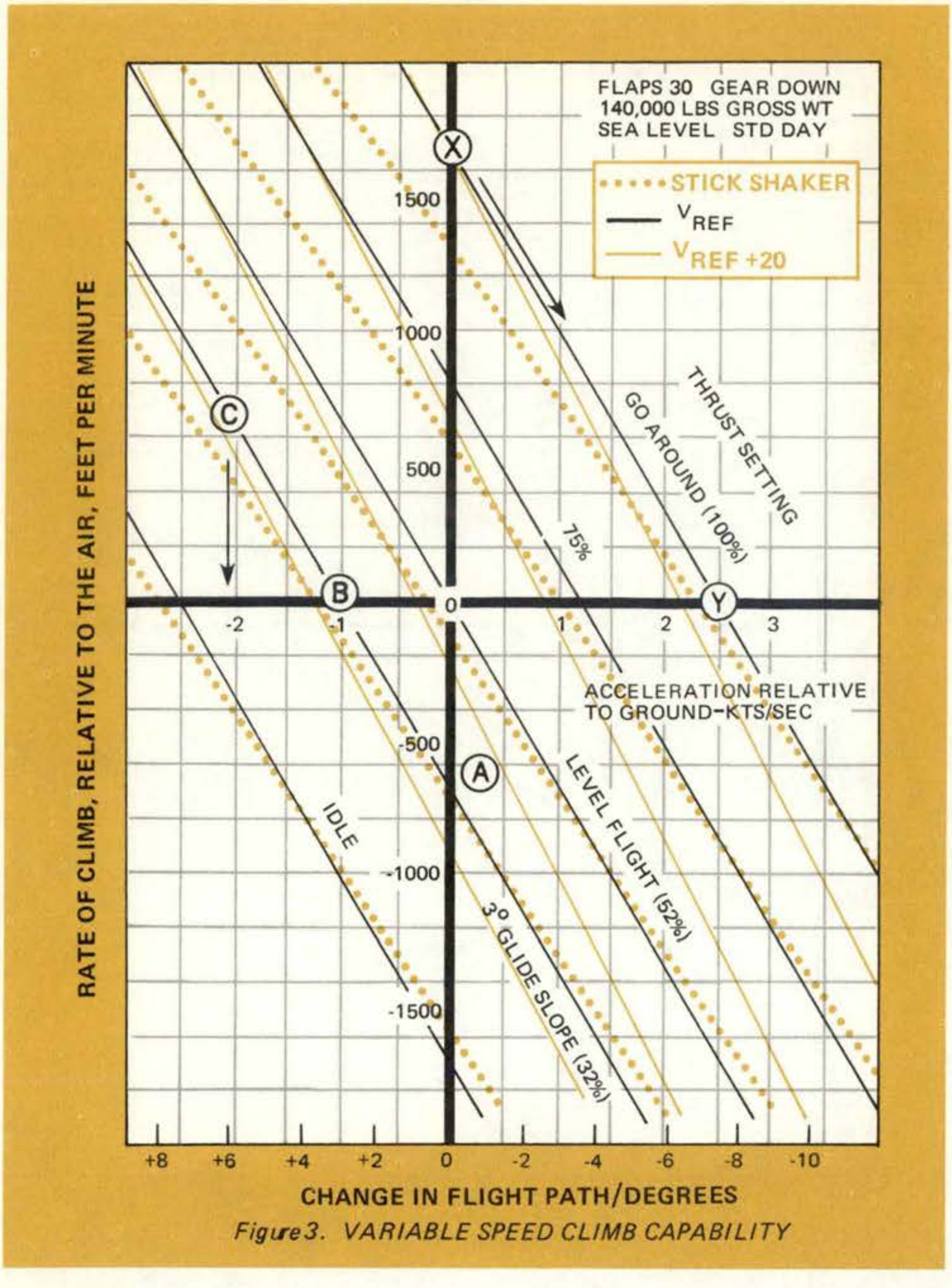


Figure 3. VARIABLE SPEED CLIMB CAPABILITY

WIND SHEAR HAZARDS continued

current, or is flying in still air. These data illustrate why the previous article stated that very high attitudes may be required in order to establish positive rates of climb if a wind shear is encountered that reduces the airpseed to near stick-shaker speeds.

PERFORMANCE EFFECTS OF ACCELERATION ALONG THE FLIGHT PATH

Only the climb capabilities of the airplane at constant speed have been discussed so far. Since an airplane is not always flown at constant speed, it is desirable that pilots understand the quantitative effects of acceleration and deceleration on the climb capability of the airplane. The effects of acceleration of the airplane, *relative to the ground,* on climb and descent capabilities of the airplane *relative to the air* are shown in Figure 3. These effects are presented for three typical speeds: stick-shaker, V_{REF}, and 20 knots above V_{REF}. The thrust levels are the same as were shown on Figure 2 where the effects of rate of climb for several thrust levels were illustrated. A given point on any one of these lines indicates what the rate of climb or rate of descent would be if the airplane were stabilized at the speed, thrust, and acceleration selected for the point of interest. The values of rate of climb for the zero acceleration case should be the same as those values shown on the previous charts. In other words, since zero acceleration represents the constant speed case, the constant speed climb capability can be obtained simply by looking at this chart for the zero acceleration case.

At a given power setting and a given airspeed, it is possible to get an acceleration of the airplane only by changing the flight path, so there is a direct relationship between the acceleration that is shown on the horizontal axis and the change in path required to obtain a given acceleration. That change in path for a given acceleration is shown on a scale at the bottom of the chart. This chart is significant in that it helps the pilot to understand what the energy trades are in flying an airplane. For instance, if the airplane were on a 3° glide slope at a constant speed and a rate of descent of about 680 ft/min with the thrust required to maintain the 3° glide slope (A), the airplane could be leveled off to a horizontal flight path (zero rate of climb) and the airplane would experience a deceleration of approximately 1 kt/sec (B). By this 3° change in the flight path, the airplane attains a deceleration of 1 kt/sec. The flight path could have been further changed another 3° and the airplane would have a rate of climb of about 680 ft/min (C). While on this new flight path, the airplane would be decelerating at the rate of approximately 2kt/sec. An understanding of this chart helps the pilot to realize that he has a very powerful way of augmenting the climb performance, if necessary, without having to make a thrust change. That is particularly important at a time when there is no more thrust to add.

Another significant point to be made from the use of this chart is to show the effect of trying to accelerate the airplane back to the original airspeed after having encountered wind shear that reduces airspeed. For instance, assume that the airplane is established in a climb with maximum thrust at constant airspeed where it has about a 1650 ft/min rate of climb (X) and then encounters a wind shear that reduces airspeed 20 knots. If the pilot reduces the flight path down to the point where an acceleration of 2.5 kt/sec, occurs, (Y) the climb capability will be cancelled out completely, Zero rate of climb would exist under such conditions. Under these circumstances, it would take eight seconds to recover the original airspeed. This situation wouldn't be particularly bad unless at the same time a downdraft of 20 ft/sec was also encountered. The airplane would then lose 160 feet of altitude in the downdraft while it was accelerating back to the original airspeed. Now if the aircraft were relatively close to the ground or to some high obstacles when this occurred, the altitude loss could be critical.

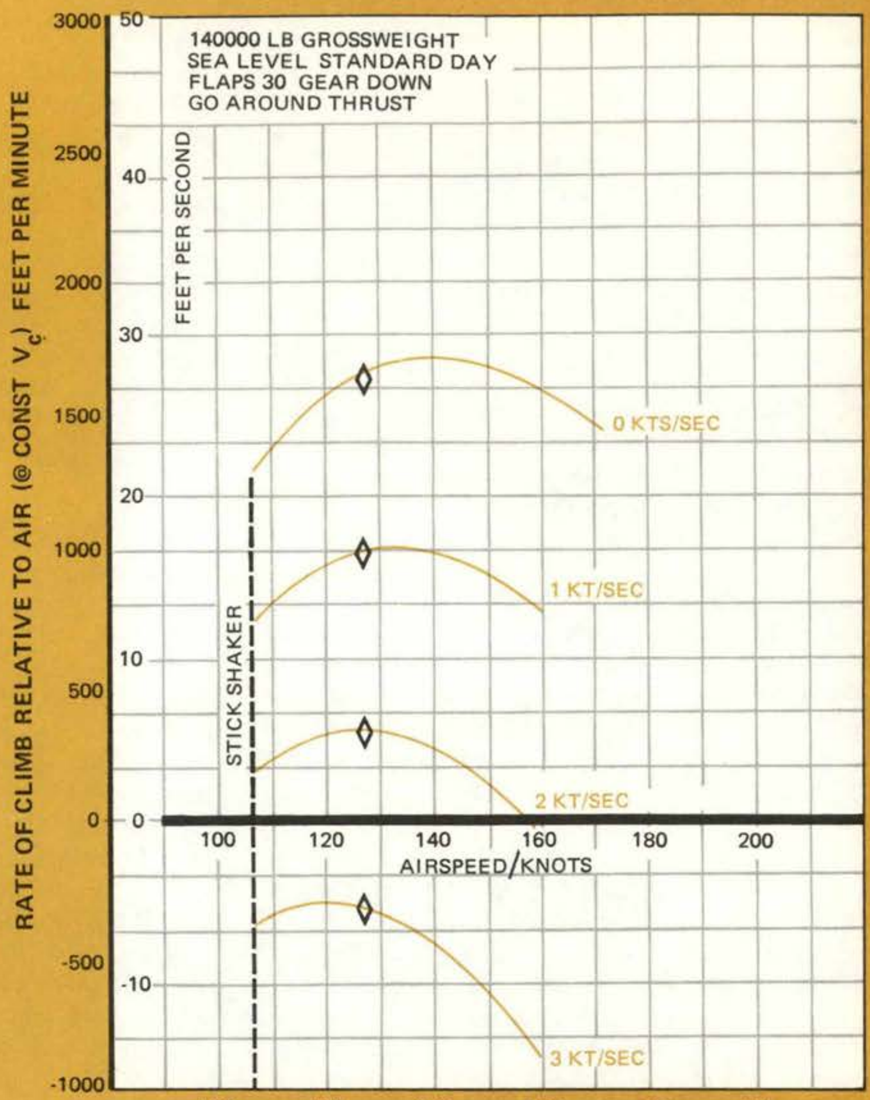


Figure 4. EFFECT OF ACCELERATION TO COMPENSATE FOR WIND SHEAR

A similar example can be given for the approach case. Assume that the aircraft is stabilized on a 3° glide slope, at 680 ft/min and simultaneously encounters a wind shear that reduces the air speed 20 knots and a downdraft of about 20 ft/sec. If the pilot tries to accelerate the airplane without adding thrust, i.e., by putting the nose down an increment of about 3°, where it is possible to get an acceleration of 1 kt/sec, it would take 20 seconds to regain the original speed. During that 20 seconds the aircraft would fall 600 feet below the 3° glide slope due to the downdraft and the acceleration.

There are those who will say that no sane pilot would fly that way, but the examination of flight records has revealed instances where it is obvious that the aircraft was indeed going down a 3° glide slope with the thrust idle and a deceleration of 1.5 kt/sec. Figure 3 shows that this is possible, but fortunately the airplanes did not encounter any wind shear and apparently the pilots did manage to get the thrust back up again prior to the time of landing flare. However, if those aircraft had encountered a wind shear of the nature just discussed, they also would have crashed, as some other airplanes are known to have done, if the attitude had been lowered to gain speed while the engines were coming up from idle thrust.

Figure 3 is also valid for determining the deceleration available while bleeding-off airspeed along a fixed glide path at a particular thrust setting.

The impact of acceleration is also shown in Figure 4, which again is a rate of climb versus airspeed plot for different levels of acceleration. This is for a 140,000 lb. gross weight airplane on a sea level standard day with go-around thrust and with the air conditioning turned off. The data are shown from stick-shaker speeds upward to essentially flap placard speeds. This illustrates for the flaps 30° case what will happen to the rate of climb if the airplane is accelerated at various rates, such as 1 kt/sec, 2 kt/sec, etc.

Assume that the airplane is flying at V_{REF}, which is indicated by the diamonds on the plot, at about 128 knots, and that a wind shear is encountered that reduces the airspeed to stick-shaker speed. Assume, for this illustration, that engines are at go-around thrust and that the airplane has been stabilized at the rate of climb which corresponds to 128 knots. Also assume for the illustration that the pilot had become aware that the airspeed was decreasing and that he was increasing the angle of attack of the airplane so as to hold 1-g flight. It is apparent that, should it happen, the rate-of-climb capability would decrease from about 1650 ft/min. to 1320 ft/min. This means that it would be possible to maintain level flight in a downdraft of around 22 ft/sec. downdraft at about the time it reaches stick-shaker speed. What course of action should be taken? Should the aircraft be accelerated back to the original airspeed? It is obvious that if it is accelerated too rapidly, at anything more than 0.5 kt/sec., it would start to lose altitude. At that rate of acceleration, 40 seconds would be required to regain speed. The point illustrated here is that there may be times, such as in this example, when a pilot has no choice. He has to fly, at whatever reduced speed results from a wind shear encounter, until a time comes when it is possible to accelerate without loss of altitude. In this case, if the pilot is close to the ground or some nearby obstacles, he simply cannot afford to accelerate the aircraft at a very high rate at the expense of losing altitude. This is one of the major points that Boeing was trying to emphasize in the original article.

The point is still valid even if higher speeds are being carried. For instance, assume that the pilot has been making his climb at 148 knots, i.e., a maximum 20 knots above V_{REF}, as presently recommended, and encounters the same speed-reducing wind shear of 20 knots. The twenty-knot shear would reduce his airspeed to 128 knots. He would still be in the region of maximum rate-of-climb capability and he could accelerate again at about 0.5 kt/sec. and fly level in a downdraft of 22 ft/sec. The downdrafts that were experienced in an accident at New York (JFK) in 1975 are believed to have been of this order of magnitude.

The same principles apply no matter what speed is being carried. Don't accelerate so rapidly that the desired flight path cannot be maintained in the presence of a downdraft. The point should be made that, if the airspeed gets reduced to stick-shaker speed, it could be very detrimental to put the nose of the airplane down in order to accelerate rapidly back to the original speed. Such action may not produce the desired results.

PERFORMANCE EFFECTS DURING FLAP RETRACTION

Climb performance improves as the flaps are retracted from the landing configuration at Flaps 30 or 40 to the go-around setting at Flaps 25 or 15. Consequently, if a wind shear is encountered when the aircraft is in the landing configuration, it may be advantageous to retract the flaps to 25 or 15. However, if the flap retraction is done in a manner which allows the aircraft to accelerate, the benefit of improved climb capability at the selected flap setting may not be attained. The impact on acceleration and rate of climb using attitude, angle of attack, or airspeed as a reference during flap retraction are considered in the following discussion.

a. Using Attitude Reference

Rate-of-climb capability is shown in Figure 5 for flaps 40 – gear down, flaps 30 – gear down, flaps 25 – gear up, and flaps 15 – gear up. The location of V_{REF} for flaps 40 and flaps 30, V_2 for flaps 25 and flaps 15, and the 1-g stall speed for flaps 15, 25, 30 and 40 have been shown for reference purposes.

Figure 5 will be used to emphasize points about angle of attack, airplane attitude, and flap retraction during wind shear encounters. If the airplane were on a 3° glide slope at 30° of flaps, the body attitude would be about 3.4° nose up at V_{REF} speed (A). Figure 5 shows that if go-around is initiated using go-around thrust, and speed is held constant at V_{REF}, the attitude must be changed to 14° (B).

This is quite a change, but nevertheless, not an unusually high attitude. Figure 5 also shows that if the attitude is held constant at 14° and flaps are retracted from 30 to 25, the airplane will accelerate to about 140 knots (C) before stabilizing. If flaps are further reduced to 15 at that same 14° attitude, the airplane will accelerate to 170 knots (D) before stabilizing. All of those speeds are reasonable for the flap positions selected. In fact, the 14° attitude will take the airplane to maximum rate-of-climb speed at flaps 15 – gear up. Now holding a constant attitude will, as previously stated, program in an acceleration. Based upon the previous discussion on what effects of acceleration are, the intended purpose of improving perfromance by retracting flaps could be defeated, since any acceleration could certainly result in not getting the full benefit of the constant-speed climb capability that goes along with the particular flap position that had been selected.

The data show that it is possible to maintain a constant rate of climb in a downdraft of 28ft/sec., but if too much acceleration is allowed during the retraction period, and there is no way to limit the acceleration if the attitude is held constant at 14°, the airplane will not climb at as high a rate as existed at the original climb speed that went along with flaps 30 at VREF.

Therefore, it is not clearly black or white whether flaps should be partially retracted under all conditions when wind shear is encountered; any benefit would depend on the procedure used. It is obvious, however, that during the flap retraction, it is possible to go to a higher body attitude, even up to 18°, if a 15° flap position is selected. This results in less acceleration during the flap retraction period, and it might be that under such circumstances that flap retraction would be beneficial. At least at the time when a stabilized speed was reached at the 18° attitude, the rate-of-climb capability will be 40 ft/sec. relative to the air. This is adequate to overcome most downdrafts experienced to date in regions within approximately 400 ft of the ground. The discussion above further substantiates the reasons for the emphasis on high attitudes in the previous *Airliner* article.

In consideration of the discussions, it should be emphasized that the airplane attitudes shown in these charts are valid for stabilized 1-g flight conditions at constant indicated airspeed for the airplane weight shown. If pilots make use of any of the specific attitudes from these charts as a guide for operations of a 727, those attitudes should be treated only as initial targets. Flight in severe wind shear is a dynamic or constantly changing situation and confirmation that any given attitude is adequate for any given situation comes from instrument readings which show that the aircraft is responding in a satisfactory and desirable manner.

b. Using Angle of Attack

The question "Why all of this emphasis on attitude when what we really need is an angle-of-attack indicator?" has been asked many times. Most airliners do not have angle-of-attack indicators but they do have good artificial horizons' that is why attitude has been emphasized. However, by using Figure 5, it is possible to evaluate the angle-of-attack situation when flying in the conditions just discussed. It can be seen that the angle of attack that goes along with VREF at flaps 30, is about 8.4°. Obviously, then, there wouldn't be any difference in angle of attack flying on a 3° glide slope or whether maximum go-around thrust had been applied.

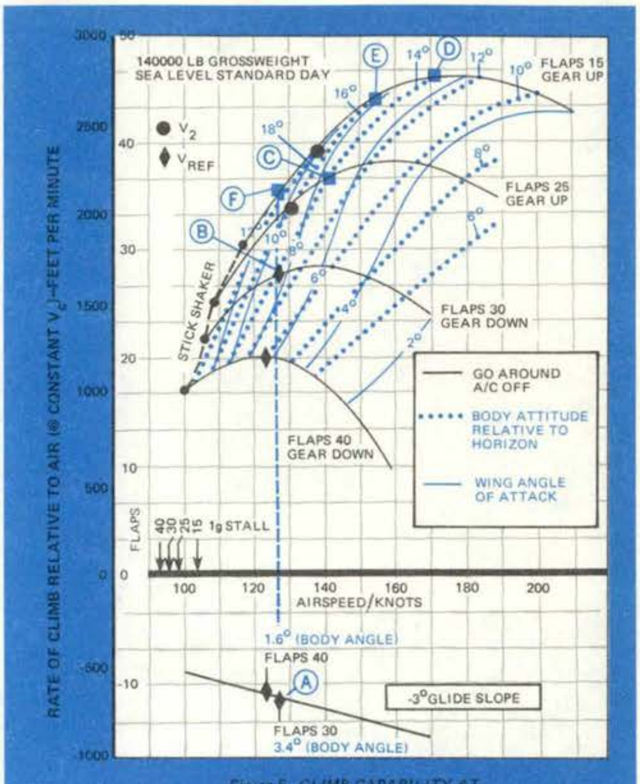


Figure 5. CLIMB CAPABILITY AT CONSTANT AIRSPEED

Now consider what would happen if flaps were reduced while the angle of attack was held constant. If this were done, an acceleration would occur as flaps were partially retracted. The airplane would accelerate much in the same manner as when holding constant attitude; however, the final stabilized airspeed (E) would not be as great, so the reduction in climb capability during the acceleration period would not be as great as for the constant-attitude case previously discussed.

c. Using Airspeed Reference

As a better alternative, it is possible to increase the angle of attack to 11° (F) and hold speed constant during flap retraction. If the speed is held constant, it is possible to realize the benefits of the increased rate of climb resulting from the reduction of drag during the complete flap retraction period. The same thing could be done through the attitude indicator by increasing the attitude from about 16° to 20°. Speed could be held constant during flap retraction to 15 degrees without encountering stick-shaker for the flaps 15 – gear up case. The constant-speed technique would be the most simple method of attaining the rate-of-climb improvement from the use of the lower flaps 15 position. However, this would result in flying on the back side of the drag curve for the flaps 15 case. As can be seen from this discussion, there is merit

continued on page 29

CHAIN TO D

Major Kenneth S. Harvell
20th Bomb Squadron, Carswell AFB, TX

It all happens one step at a time. In reading mishap reports, one can almost hear the links of the death chain clank together. That's what happened several years ago to a B-52G crew.

They had flown a normal training mission which included a taxi-back landing to pick up a standboard IP to complete a check ride for the copilot. During the second takeoff, shortly after passing 70 knots, the aircraft veered sharply to the right and departed the runway. The departure angle and sideslip increased, and the main gear became airborne leaving only the right tip gear on the ground. The tip gear failed and the right external tank contacted the ground and ruptured resulting in the initial explosion and fire. Progressive structural failure, fire and explosions ensued as the aircraft came to rest in a ninety degree sideslip.

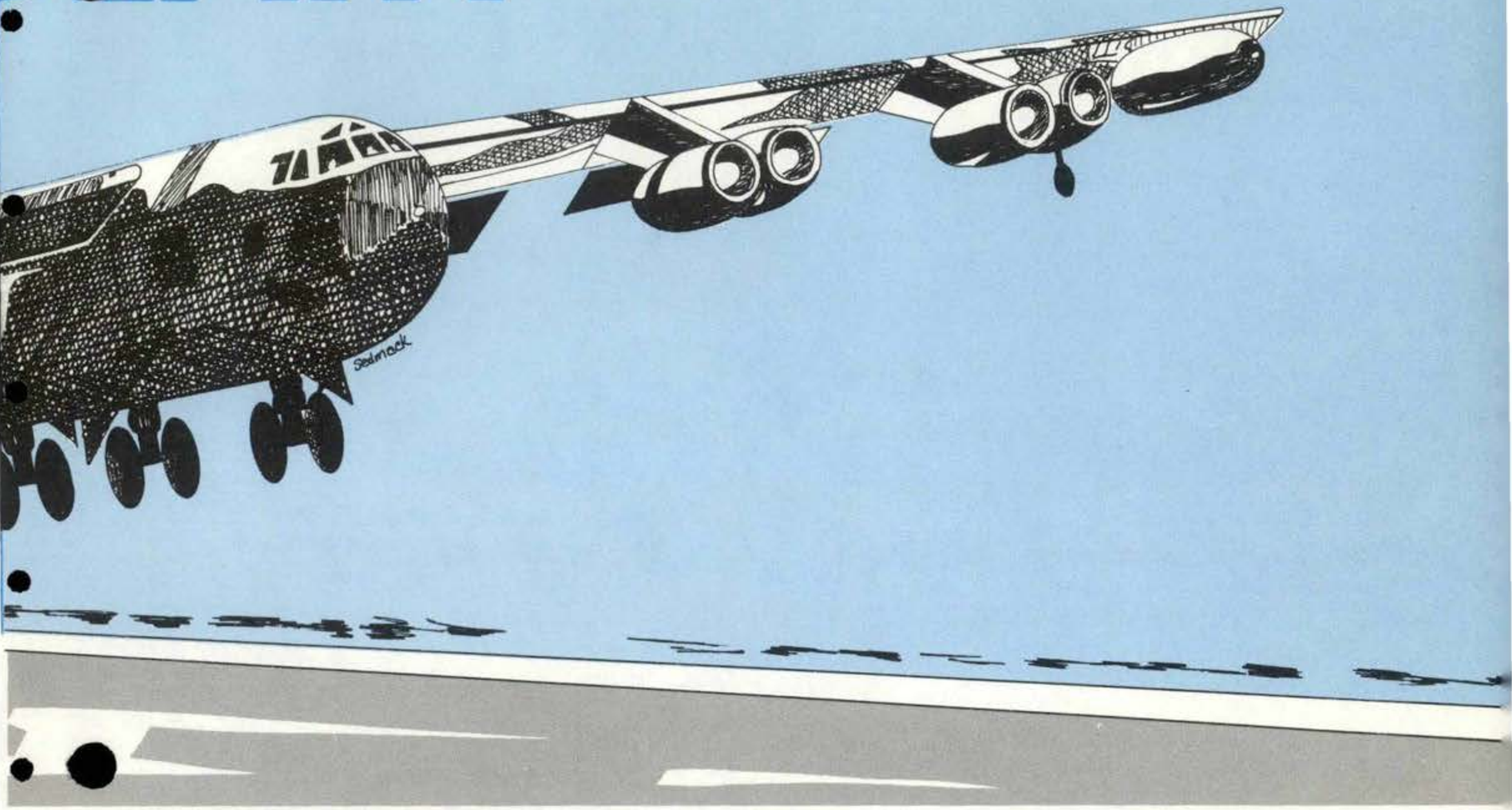
All crew members except the pilot perished in the wreckage. The pilot survived for several hours after the mishap, but died from the burns he received.

You have all seen the mishap chain that depicts a sequence of events that lead up to a mishap. If one link is broken, the mishap is averted. The links in this mishap chain were very pronounced.

The B-52G fuel management procedures call for the engine crossfeed manifold valves to be opened when fuel in the main tanks drops to specific levels. The G model main tank gauges are marked with a green band to indicate this level, and the Dash One and checklist specify that the engine crossfeed valves, for this airplane

Chain of events that led to this mish Breaking one link would have prevented the mishap.

DEATH



numbered 9, 10, 11, and 12 should be open. In this case, however, THE COPILOT FAILED TO OPEN THE CROSSFEED VALVES.

By failing to open the crossfeed valves, specifically number 12, the only source of fuel for engines 7 and 8 was the fuel in number four main tank. There was still sufficient fuel in the tank for full engine operation if all systems were operating normally. Unfortunately, this was not the case. There are four boost pumps in each of the B-52G's main tanks with one of the pumps located in the sump. In main tank four, boost pump 19 was in the sump. PUMP 19 WAS INOPERATIVE.

As the aircraft accelerated for takeoff, the fuel shifted aft covering only pump 19. Without an alternate source of fuel provided through the crossfeed valves, air was drawn into engines 7 and 8 and they flamed out. The aircraft was below the minimum speed for directional control, so departure from the runway was inevitable.

Back to the mishap chain of events. The mishap was caused by a combination of crew error and materiel failure. Notice I did not say copilot error. The crew error link in the chain can be expanded to three links. First, the copilot did not set the fuel panel in accordance with the Dash One amplified directions. Second, the pilot did not cross-check the fuel panel as he was supposed to do, and third, the evaluator also failed to check the fuel settings. All should have seen this discrepancy. An operative number 19 boost pump, the fourth link in the chain, could have compensated for the three pilots'mistakes.

Like so many aircraft mishaps, the crew error was not a failure to respond to a multiple emergency under adverse conditions; it was a simple failure to accomplish a routine checklist item that proved to be the critical difference between life and death.

As a result of this mishap, the B-52G Dash One was changed to specifically require the pilot to cross-check the copilot's actions in setting the fuel panel, but checklists cannot be expanded for every contingency. They would be far too cumbersome.

The responsibility for systems knowledge and the proper use of tech data lies with us as crew members. If we don't follow the guidance learned from the experience of others, we may not be fortunate enough to feel the weight of the chain in time to break free. ★

LOCK THE BARN DOOR

We are all very good at locking the barn door behind the cow. (Never did figure out whether that cow was going in or out). Here is an example, but in this mishap, the actions to prevent the cow's movements reflect some positive thinking from which we can learn.

A KC-135 was preflighted since it was to be a spare. It wasn't needed, however, so the pitot covers, tail stand and engine inlet covers were installed. Next morning the aircraft was on the schedule, but since less than 24 hours was to elapse before flight, a maintenance preflight was not required. When the flight mechanic arrived at the aircraft, he loaded some equipment and ran his preflight checklist. It was dark and raining so he returned to the crew operations building to complete his paperwork.

Finally the crew assembled at the aircraft, made the checklist inspections and started engines. When they were ready to taxi, the ground crew acknowledged with the standard phrase, "pitot covers removed."

It was still raining when the aircraft started rolling for takeoff and the AC adjusted the wiper knob setting in an effort to increase visibility. Then he noticed that both airspeed indicators were indicating 55-60 knots, although engine power and acceleration appeared normal. Ahah! Something wrong with the airspeed indication. Abort!

With 8,000 feet of runway remaining, the aircraft started eating it at a prodigious rate – seeming not to be responding to brakes, speed brakes and power reduction. When it became apparent that the aircraft would not stop on the runway and, in fact, would cross a busy highway, the AC decided to turn. The aircraft turned, left the runway and plowed up some 300 feet of mud and grass. Damage was in the $21,000 area.

Okay, so this story is practically a re-run of hundreds almost like it. We haven't prevented them yet, so how are we going to do it now? Here's how this unit responded.

- The pitot covers were standard – dark red made darker by dirt and grease – streamers likewise, and hard to see. Now they are international orange with longer streamers.
- A red cross when a work card item has to be reaccomplished prior to flight whenever the aircraft is preflighted but not immediately flown.
- A call out by the pilot at 90 knots to provide a positive crosscheck.
- Flight mechanic must report to pilot that "six ground safety locks and pitot covers stowed."

This won't be the last of aircraft attempting takeoff with pitot covers or control locks installed. But the positive measures listed above might help your outfit avoid such a mishap. ★

NEWS FOR CREWS

Information and tips to help your career from the folks at Air Force Military Personnel Center, Randolph AFB, TX.

Major Bob Casey
Rated Officer Career Management Branch • Air Force Manpower and Personnel Center

RATED OFFICER CROSS FLOW

Rated Crossflow is a subject receiving increasing attention through the USAF rated force. As used here, rated crossflow means pilots or navigators changing major weapons systems and/or major weapon system group (e.g., going from B-52s in the Bomber Group to F-4s in the Tactical Fighter Group). Most of you are aware of some current crossflow opportunities – exchange programs, ATC instructor duty, and others – but would like to see even greater opportunity. Because the continuing interest at all levels is based on the belief that crossflow, specifically increased crossflow, would benefit both the individual and the Air Force, it is certainly worth discussion. To balance the discussion, though, we have to look at both the benefits and the constraints on achieving those benefits. Finally, we can look at "what's happening now." First the benefits.

Perhaps the biggest benefit of increased rated crossflow opportunity is happier aircrews. That alone makes the AFMPC resource managers' job easier, so we like it right off the top. At the same time, though only one variable affecting retention, if crossflow makes aircrews happier a seemingly direct payoff of increased crossflow should be improved retention. ("Seemingly" is used because the impact on retention depends on the amount of increased crossflow – a small "rich-get-richer" program for some could produce backlash.) Any improvement, however, will increase total force capabilities. Another payoff is that increased crossflow helps the overseas imbalance problem. We could fill the overseas fighter jobs (currently about 60% of the total fighter requirement) from a wider pool by using pilots and navs crossflowed from other weapon systems. Finally, increased crossflow may promote better future leadership. Captains and majors moved between weapon systems today will provide a larger base of officers with broadened experience in the 1980s and 1990s. So far, crossflow looks good.

But there are constraints that now prevent opening the crossflow gates, and the constraints are all heavy hitters: Ops unit experience levels, new pilot absorption, the readiness implications of both factors, and training costs. These are constraints far different from the environment of Southeast Asia days, when an overall goal was to satisfy the general policy of no involuntary second combat tours. These constraints are not designed to "lock aircrews into their original weapons system and prevent crossflow." Instead, a combination of ops, personnel, and budgetary factors are the basis for the conscious, collective (Air Staff and MAJCOM) decisions which dictate the assignment actions affecting you. The guidance calls for allocating new inputs and managing available aircrews to (1) satisfy the need for experienced aircrews, (2) build the rated inventory towards total active force requirements, (3) maintain no less than established minimum experience levels in operational units, and (4) do it all with minimum training resources. The fact that crossflow – by definition – commits us to double training any individual crossflowed, is an obvious problem made worse by the prevailing desire to crossflow to fighters, the most expensive system from a training standpoint. But an even bigger impact is the experience/absorption problem. Even without crossflow, in the early 80s, we will be absorbing double our current rate of UPTs and maintaining MAJCOM-established minimum unit experience levels will be even tougher than it is now. Crossflow aggravates the problem in two ways – by putting a further drain on our already limited training resources, and by moving experienced officers from one system and making them "inexperienced" in the new system. Finally, sizeable crossflow can generate a middle management problem. Those crossflowed would enter the squadrons with appropriate rank for flight commander or other supervisory positions, but without the weapon system experience to provide that supervision.

Despite the foregoing, crossflow opportunities definitely exist for those rated officers (principally pilots) who are interested in going – temporarily or permanently – where the Air Force requirements are, and whose major weapon system can best withstand their loss. During the last year, 456 pilots crossflowed from one major weapon system to another, for a variety of reasons: To systems requiring high experience (C-5, FB-111, U-2, SR-71); to alleviate "closed system" problems (F-106 to F-15, RF-4 to F-4); to convert helo pilots to fixed-wing systems; as part of inter-MAJCOM exchange programs; for ATC IP duty; and to provide current weapon system experience for individuals with outdated weapon system experience (C-7, C-123, C-119). While these examples may not fit into your personal definition of crossflow, they do satisfy individual desires to fly another aircraft and simultaneously meet Air Force requirements. For its obvious contribution to the career intent and development of our aircrews, we strongly support crossflow. All

continued on page 26

Mail & Miscellaneous

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

TERMINATION OF EMERGENCIES

A recent occurrence at Eglin AFB brought to light a situational dilemma during an inflight emergency which I feel may be of interest to other flying units. It is not necessary to expound the situation in its entirety but briefly the following occurred.

After declaring an emergency for an onboard electrical fire, the aircraft commander determined to his satisfaction that the fire was extinguished and requested taxi to parking. At the same time he attempted to cancel the emergency with the tower.

The base fire chief, who had responded to the emergency, felt that further inspection by qualified crash personnel was necessary and would not allow the emergency to be terminated. During the ensuing moments quite a bit of confusion resulted as the fire chief attempted to get the crew to shutdown and the crew attempted to taxi back!

Air Force Regulation 92-1, paragraph 4-8a, specifies ". . . the senior fire department supervisor on the scene decides when to terminate the emergency. . . ." At the same time it is realized that the aircraft commander is ultimately responsible for both his crew and aircraft. The solution obviously lies somewhere in between for most occurrences and in most situations. What we don't want to neglect is that everyone involved has the same goals; that being the protection of life and property. For any given emergency situation there exists a delicate balance of teamwork between aircrew and crash personnel, complicated by a lack of direct communication from one to the other.

It's obvious that there is enough inherent complication without the added misunderstanding of who can or will cancel the emergency. To that extent, we at Eglin have encouraged cross-talk on this subject between aircrews and the fire department. This is usually accomplished at an appropriate aircrew meeting or flying safety meeting. It allows the fire department personnel to explain their vested interests and why they may choose to hold an emergency open contrary to the wishes of the aircrew.

This has proven to be a fairly simple and painless process for everyone involved. It fits well on the agenda of most any flying safety meeting. Hopefully, it will help eliminate a misunderstanding at a later date when time and teamwork may be the crucial element!

JOHN R. WITTMEYER, Capt, USAF
Flight Safety Officer
Armament Development and Test Center
Eglin AFB, FL

NEW LESSONS LEARNED SHOW

It's new show time again! The safety people here at the Center have just completed a 35mm slide/tape show titled "Aircrew Coordination," another of the Lessons Learned series. It should be available for distribution in late March.

This 19-minute show discusses five phases of flight — takeoff and climbout, rendezvous/air refueling, low level, cruise, and approach. In each phase of flight an actual mishap is reviewed from the standpoint of systems knowledge, situation awareness and crew coordination. Of course, we had 20/20 hindsight and could see exactly how the mishap could have been averted. By viewing this show you, the crew member, can gain some valuable lessons learned and increase your chances of survival.

To get this slide/tape show, free of charge, have your base film library order AVR 195, "Aircrew Coordination." Don't forget to bring the popcorn.

FAA TAKEOFF PROCEDURE

A two-segment takeoff procedure for jet aircraft designed to reduce airport noise levels has been recommended by the FAA for use by operators of large jets.

Aircraft using the new two-segment procedure will climb under full power to 1,000 feet, then reduce climb angle to pick up speed and permit retraction of flaps and other high-lift devices before continuing climb to 3,000 feet under reduced power. They can then follow a normal departure procedure.

The agency did not make the procedures mandatory because there will be times when the pilot may need to disregard them for safety considerations.

NEWS FOR CREWS from page 25

of us have to recognize that the size of any crossflow program must be consistent with readiness and resource constraints – the "heavy hitters" mentioned earlier. Nevertheless, senior USAF leadership is well aware of your interest in crossflow and we continue to seek expansion of opportunities in that direction.

As a last thought to brighten your prospects for varied rated experience we'd like to point out that diverse job opportunities – many involving flying a new airplane – exist within nearly every major weapon system group. New airplanes or new models, varied missions, instructor or other specialized aircrew duty – they're all there, and most fliers are surprised to discover the scope of assignments available to them. Give us a call.

ABOUT THE AUTHOR

Major Bob Casey is chief of the Rated Distribution and Training Management (RDTM) Analysis Section at AFMPC. He is a graduate of the University of Wisconsin. His prior tours have included duty on the Air Staff (Studies and Analysis), and as an F-4 Instructor Pilot.

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.

CAPTAIN
Billy S. Schricker

TSGT
Paul G. Hannel

16th Tactical Airlift Training Squadron
Little Rock Air Force Base, Arkansas

CAPTAIN
John L. Carkeet
16th Special Operations Squadron
Hurlburt Air Force Station, Florida

On 7 March 1978 during a C-130E Phase I training sortie, Captain Schricker, Captain Carkeet (Phase I student), and Sergeant Hannel, were at 15,000 feet when the control column suddenly pitched full forward and the aircraft went into a very steep dive. Runaway trim procedures and full electrical isolation of the trim system had no affect on elevator operation. Using physical force, the pilots overcame the extreme control pressures and returned the aircraft to level flight. Almost immediately, the control column went full aft. Again they overcame the control pressures and leveled the aircraft. During the ensuing period of stable flight, Sergeant Hannel made a visual check of the elevator actuator and found no discrepancies. Then without warning, the control column again went full forward. The utility and booster system hydraulic boost packs were individually turned off and on without discernible effect. Captain Schricker then directed all hydraulic assistance removed from the elevator and electrical power restored to the trim system. Physical force, with trim assistance, returned the aircraft to level flight. During the uncommanded pitch changes, the altitude varied between 12,000 and 18,000 feet MSL with vertical velocities of plus/minus 6,000 fpm. An emergency was declared. A controllability check revealed that the aircraft could be landed so at 2,000 feet MSL another controllability check was performed and the crew elected to fly the approach with zero flaps at 140 to 150 KIAS, with the pilots manually overriding the extreme air-loads on the elevator and the engineer adjusting power to control airspeed and the rate of climb/descent. Three miles out on final approach, a wind shear caused the airspeed to suddenly decrease 20 KIAS resulting in an immediate nose-down attitude. The pilots were physically unable to recover from the dive, but Sergeant Hannel applied full power, causing the nose of the aircraft to rise enough to recover. As they climbed through 300 feet AGL, 2.5 miles from the runway, the engineer slowly retarded the throttles to decrease the now high airspeed and pitch attitude. At the runway threshold, the airspeed suddenly decreased and the nose pitched down again. Full power was reapplied. Just after the nose passed through level flight, the aircraft contacted the runway in a nose-high attitude and with a descent rate of approximately 1500 fpm. The landing roll was completed without further incident. Post-flight inspection of the aircraft revealed only minor damage to the tailskid. Skill, knowledge of aircraft systems and procedures and exceptional crew coordination saved a valuable aircraft and lives. WELL DONE! ★

LETTERS TO REX

I've been in one form of aircraft operations or another for almost 25 years and am about to retire. During that quarter century I've seen the transient aircrew problem from both sides of the windscreen. There is no pat answer, but I'd like to pass on my feelings and observations.

Some years ago, a young operations NCO and his equally young operations officer made a concentrated effort to get the Rex Riley Transient Services Award. They coordinated with local motel owners for reduced room rates. They contacted the Chamber of Commerce and prepared maps, tourist information, and other handouts. They developed Transient Aircrew Questionnaires and the base commander got involved when services were below par. At last they felt their program was ready for Rex Riley.

One Friday evening at about 1730 local, Rex and his saberliner came whipping in. From touchdown to wheels up, things went astray. First TA parked Rex on taxiway 42 when four spots in front of Base Ops were vacant and nobody inbound. The motor pool driver, who was a new guy, went out to the wrong T-39. Inside Base Ops, the coke machine kept Rex's quarter but didn't give up a coke. Rex asked to go to the BOQ but had to wait for transportation since the first car had gone back to the motor pool. When Rex got to the BOQ, he asked to see a typical room that a transient crew might be billeted in. The room he saw had not been made up and the window air conditioner was not only running full blast but had also leaked a large puddle of water onto the rug. Finally, the Officer's Club gave him a rough time about eating dinner while wearing his flight suit. Needless to say, Rex didn't recommend that particular installation. The events that happened above are not unique. Transient crews frequently get lost in the shuffle when a base allows the system to take over and fails to put forth the personal efforts that are essential to a good transient services program. In the security of our own little worlds, it is easy to forget that many aircrews spend much of their lives living in transient facilities, dragging bags around the world or eating out of vending machines. While it is not necessary to lead transients around by the hand, it is important that when a crew member crawls back into his machine, he is not upset because he couldn't eat, had to walk in the rain or slept in a room where the thermostat was stuck on 95 degrees. Air Force aircrews have enough concerns flying those million dollar airplanes. Let's don't let them down through a lack of concern or poor attitude while they are on the ground.

One Who's Cared . . .

Many aviators frequently get confused when a base is designated PPR (Prior Permission Required) or OBO (Official Business Only). PPR indicates that an airfield is closed to transient military aircraft unless prior permission is obtained from the base concerned. The purpose of PPR is not to prohibit transients but rather to sequence and control traffic. PPR must be obtained before departing to a PPR airfield. OBO is another matter. An airfield designated as OBO cannot be used by transient aircraft to obtain clearance, servicing or other items pertinent to itinerant operations. The pilot (or passenger) must be on official business. Written orders, including flight orders, or prior written notification that state the purpose of the visit, at or near the base concerned, is authority to use a base designated as OBO.

The above rules are established so that the airfield manager can assist the transient, not hinder him. The airfield wouldn't be designated OBO or PPR unless there was a reason, i.e., no parking, limited servicing, exercises, etc. Before a base can be designated as PPR for more than one day, approval must be obtained from the appropriate major command. Of course there are exceptions. Special air mission aircraft carrying VIP code 6 or higher are exempt. Also these restrictions do not prevent the use of a base by a military aircraft in an emergency or as an alternate for IFR flights. But don't abuse the exception for an emergency. Case in point: An aviator was on the west coast flight planning when he discovered that one of his key refueling stops was OBO. He called the Base Ops concerned and was told by the dispatcher that they couldn't handle him. Next he called the Airfield Manager—same answer. Finally he called the Chief Ops and Training—no joy. He launched out of his west coast TDY base and when he got near the OBO base he declared an emergency and landed. He was met by the base commander who directed transient maintenance to make a complete inspection of the aircraft. They found no problems. The pilot finally admitted maybe he really didn't have an emergency but if he didn't get home soon "his wife was going to kill him." A violation was filed against the individual with copies being forwarded to the Air Force IG and the pilot's MAJCOM headquarters. PPR and OBO: Don't leave home without it!

Concerned

Dear Concerned,

Thanks! A good review!

I drive the back seat of a white rocket most of the time, and in the 8 years or so that I've been riding behind UPT studs, I haven't seen much change in airfield attitudes until recently.

My last two cross-country excursions produced noticeable service and attitude changes at three bases where we usually scratch and claw for info or assistance. On the walls of all three bases were brand-new Rex Riley certificates, mounted and displayed proudly. One ops counter had new printed info sheets for aircrews which carried the headline "_________ Air Force Base has just received the Rex Riley Transient Services Award. We are proud to have the award and firmly believe that aircrew service is our only business. If we can assist you in any way, please ask!" It sure is great to drag a tired bod out of a machine and be met by folks who care.

We think you're headed in the right direction. Keep up the good work!

Appreciative IP

Dear Appreciative,

Thanks for the positive strokes! We know what you mean and hope we've made some headway!

After seeing message traffic concerning some TA folks who either caused or contributed to an incident/mishap, we wondered what the Rex policy is toward that sort of thing. That has to be a pretty positive and measurable indication of aircraft servicing capability.

TA Foreman

Dear TA Foreman,

Good point! Our OI says that a base will be removed from the Rex list when "Transient Alert Personnel cause a mishap or allow a safety of flight mishap item to go uncorrected." We currently have two related occurrences under investigation in our files. We don't want to go half-cocked with a sharp knife and start slashing bases from the list. On the other hand, if we come up with conclusive negligence, we will do some administrative surgery to remove the guilty. Thanks for the inquiry! ★

WIND SHEAR HAZARDS continued from page 21

to reducing the flap position if the pilot is willing to go to the high attitudes or higher angles of attack necessary to realize the benefits, and holding constant speed is the simplest way to realize the full benefit. Otherwise, it might be better to stay at the original flap position until the hazard has disappeared. Also, it can be concluded from the above discussion that using speed as a reference is just as good as, possibly better than, angle of attack, and a new instrument is not necessarily required.

The *Boeing Airliner* article of January 1977, entitled "Hazards of Landing Approaches and Takeoffs in a Wind Shear Environment" recommended operational techniques to be considered by pilots whose aircraft may inadvertently be caught in a severe wind shear and/or downdraft. The key points of those recommendations have been reviewed and the concepts behind them discussed.

- When forced to fly at speeds near stick-shaker because of wind shears, good climb performance and maneuver margins still exist. Rapidly accelerating the aircraft away from stick-shaker could result in a significant loss of altitude.
- High attitudes are required at stick-shaker speeds and go-around thrust to attain the maximum climb capability of the aircraft.
- Rapidly accelerating to maintain V_{REF} or V_2 airspeeds during a wind shear will severely reduce climb capability. Conversely, decelerating to stick-shaker speeds can provide added climb capability to compensate for large downdrafts.

ABOUT THE AUTHORS

Paul R. Higgins is Technology Chief for 707, 727, and 737 Production Programs for the Boeing Commercial Airplane Company. Higgins, a graduate of Oregon State University with a BS degree in Mechanical Engineering, has been employed by Boeing since 1944 and has been assigned to the BCAC Technology Staff since 1959. His assignments have included technical support of the Aerodynamics, Structures, Weights, Controls, Systems, Powerplant, Acoustics and Materials and Processes staff to the 707, 727, and 737 engineering design projects.

Donald H. Patterson is a lead engineer in the 707/727/737 Aerodynamics staff at Boeing. He graduated from Pennsylvania State University in 1965 with a degree in Aeronautical Engineering. During his thirteen years in the Aerodynamics staff at Boeing, he has participated in several airplane programs involving wind tunnel and flight testing, certification of new models, and customer support. Recently, he has been actively involved in accident investigations and the assessment of the impact of wind shears on airplane performance. ★

☆U.S. Government Printing Office: 1979—683-011/4