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WIND SHEAR

CAPT DAN WHITE, USAFIFC
LT COL WARREN R. HORNEY and
CAPT TED THOMPSON
Directorate of Aerospace Safety

The purpose of this article is to provide some suggested techniques for detecting and coping with certain wind shear situations. We will expand upon methods that will allow the pilot to predict wind shear, including its magnitude. Knowing shear is present is an important step toward being able to handle a dangerous situation. We want to make it clear that the following techniques work **only** on precision approaches and only for wind shear situations caused by fronts or the low level jet. This may sound like a very limited application to a lot of people, but we feel that something is better than nothing.

The first objective in dealing with wind shear is the ability to detect it. If the runway surface wind is reported as calm but your indications at the outer marker (via INS, Doppler or VVI) tell you that a 20-knot headwind exists at your altitude you will expect to lose 20 knots of Indicated Airspeed somewhere on final. If the wind shears out gradually, no problem—you will gradually decrease power and blame it on a bump in the glide path. But if the shear zone is very narrow the aircraft will abruptly lose indicated airspeed equal to the shear differential. Of course, the lower you encounter this shear the more critical your response becomes. The first two steps in our suggested technique will enable you to detect a possible wind shear situation.

ON APPROACH Using groundspeed during the approach is important because it ensures flying airspeed at all times, even in abrupt wind shear situations. During a recent NTSB accident investigation, a highly experienced airline captain stated that using the groundspeed method was the only thing that allowed him to avoid disaster when his DC-8 encountered a wind shear while on final approach. FAA tests have shown that groundspeed is just as important as indicated airspeed when flying through a wind shear.

That is a radical departure from the school of thought that says a stabilized and constant indicated airspeed with very small power changes will result in the best precision approach. Under wind shear conditions the latter technique can result in a severe energy deficiency with catastrophic results. The groundspeed technique is a new concept in airmanship. It may require abrupt power changes, and accepts relatively radical indicated airspeed changes, and accompanying aircraft attitude changes (without trim) to maintain a minimum groundspeed; hence the kinetic energy to allow the aircraft to experience a sudden loss of indicated airspeed (LIFT) but still have sufficient airspeed (LIFT) to maintain safe flight.

The technique is to compute an "over the fence" groundspeed using the reported surface winds and

WIND SHEAR
continued

Knowledge of surface wind and wind at your altitude will alert crew to possible shear condition.

then fly the approach at that groundspeed, or faster if required, but never slower. This means we now have **two** minimum approach speeds to worry about: a minimum indicated airspeed, **and** a minimum groundspeed (the computed "over the fence" groundspeed). Therefore, in order to maintain the minimum approach **airspeed**, the groundspeed during the approach may be well above the "over the fence" groundspeed we computed. Conversely, in order to maintain minimum approach **groundspeed**, the indicated airspeed may be well above normal. Notice that in no case do we allow either speed to be low! For people who have INS, Doppler, or groundspeed indicators, it is as easily done as said. What about the rest of us? Simple. We will resort to our superior skill and cunning AND our VVI to come up with an "approach groundspeed indicator."

There is a direct correlation between groundspeed and the VVI when the aircraft is stabilized on the glide slope. Let's quickly examine this relationship. A 3° glide slope descends 318 feet per nautical mile. For every nautical mile we track over the ground, we must descend 318 feet in order to stay on the glide slope, i.e., for a groundspeed of ONE NM PER MINUTE, the VVI will be 318 fpm if we stay on the 3° glide slope; for a groundspeed of TWO NM PER MINUTE, the VVI will be $2 \times 318 = 636$ fpm. Those who are mathematically inclined will readily see that:

$$\frac{\text{VVI Readout When Stabilized on Glide Slope}}{\text{Descent Gradient on Glide Slope}} = \text{Groundspeed in Nautical Miles Per Minute}$$

So we get stabilized on glide slope and then divide our VVI readout by 318 (or 265 for a 2½° glide slope) to get our GROUNDSPEED in nautical miles per minute and then multiply by 60 to get groundspeed in knots. TIME OUT! Even though all of the above may be accurate, it may also be too cumbersome to be useful to the pilot in the cockpit. What we can use is a simple method that will give a good approximation of our groundspeed while we are on the glide slope. The following is such a method.

AFM 51-37 requires that we determine an initial descent rate. The easiest way to do that is by using the Rate of Descent Table in the front of the High or Low Instrument Approach Procedures book. Note that a 3° glide slope and 120 kt groundspeed give a descent rate of 635 ft per minute. (So they are off by 1 ft per min). But looking at the Rate of Descent Table we see that we can also enter with descent angle and vertical velocity to get our actual groundspeed. We are now ready to use a 3-step approach to work the wind shear problem:

Step 1. Determine expected VVI (from table).

Step 2. Use actual VVI to get groundspeed (from table, after stabilizing on precision final approach).

Step 3. Adjust airspeed, if required. Notice that with a headwind the airspeed adjustment will bring the VVI to the expected value from Step 1.

Now let's run through a couple of simple examples to make sure we have it down pat. First, suppose we are going to fly a 3° glide slope at a final approach airspeed of 160 KIAS. From the reported surface winds we "wag" a headwind component of about 10 kt, so our "over the fence" groundspeed is 150K.

From Step 1 we now expect a VVI of 795 fpm (let's use 800). However, once stabilized on final approach, we note an actual VVI of about 650 fpm. Step 2 tells us that our groundspeed is really only about 120 kts, or a difference of 30 kts from what we expected. So now, since we want to maintain a minimum groundspeed of 150K, Step 3 tells us to add 30 kt to our IAS, so we would fly 190 KIAS and our VVI would settle down to 800 fpm. By the way, if our airspeed violates some placard speed, we probably should consider abandoning the approach at this point.

As another example, let's fly a 2½° glide slope at a 140 KIAS approach speed. With a 10K headwind on the surface, we expect a 130K "over the fence" groundspeed. Step 1 tells us to look for a target VVI of 570 fpm. However, on final we see 650 fpm. Step 2 tells us our actual GS is about 150K. We now see we have a 10K tailwind, and a 20K wind speed change between where we are and the surface. Now, since we never reduce below approach speed, step 3 tells us to maintain our 140 KIAS on final and accept the higher descent rate. But in this case we are forewarned of the energy excess situation that may be awaiting us if the wind shears out at low altitude.

The above method is far from a complete resolution to the wind shear problem. However, it does tell the pilot that a shear exists and it does give an approximation of the magnitude of the shear. Moreover, use of the method ensures that when we encounter an abrupt shear, we will still have flying airspeed. If the shear occurs gradually, continuous power adjustments (monitoring the VVI) will be necessary. However, most of the excess energy (in the form of extra airspeed) will be dissipated by the time we reach the threshold. The opposite case of excess energy (in the form of extra groundspeed) may not be dissipated by the time we reach the threshold. That means the landing roll will be **increased**. In any case, the pilot should be prepared to execute a timely go-around.

It is a suggested technique. We offer it in the hope that it will help you combat the effects of wind shear. Try it. You'll like it! ★

Figure Number 1

INSTRUMENT APPROACH PROCEDURE CHARTS
RATE OF DESCENT TABLE
(ft. per min.)

A rate of descent table is provided for use in planning and executing precision descents under known or approximate ground speed conditions. It will be especially useful for approaches when the localizer only is used for course guidance. A best speed, power, attitude combination can be programmed which will result in a stable glide rate and attitude favorable for executing a landing if minimums exist upon breakout. Care should always be exercised so that the minimum descent altitude and missed approach point are not exceeded.

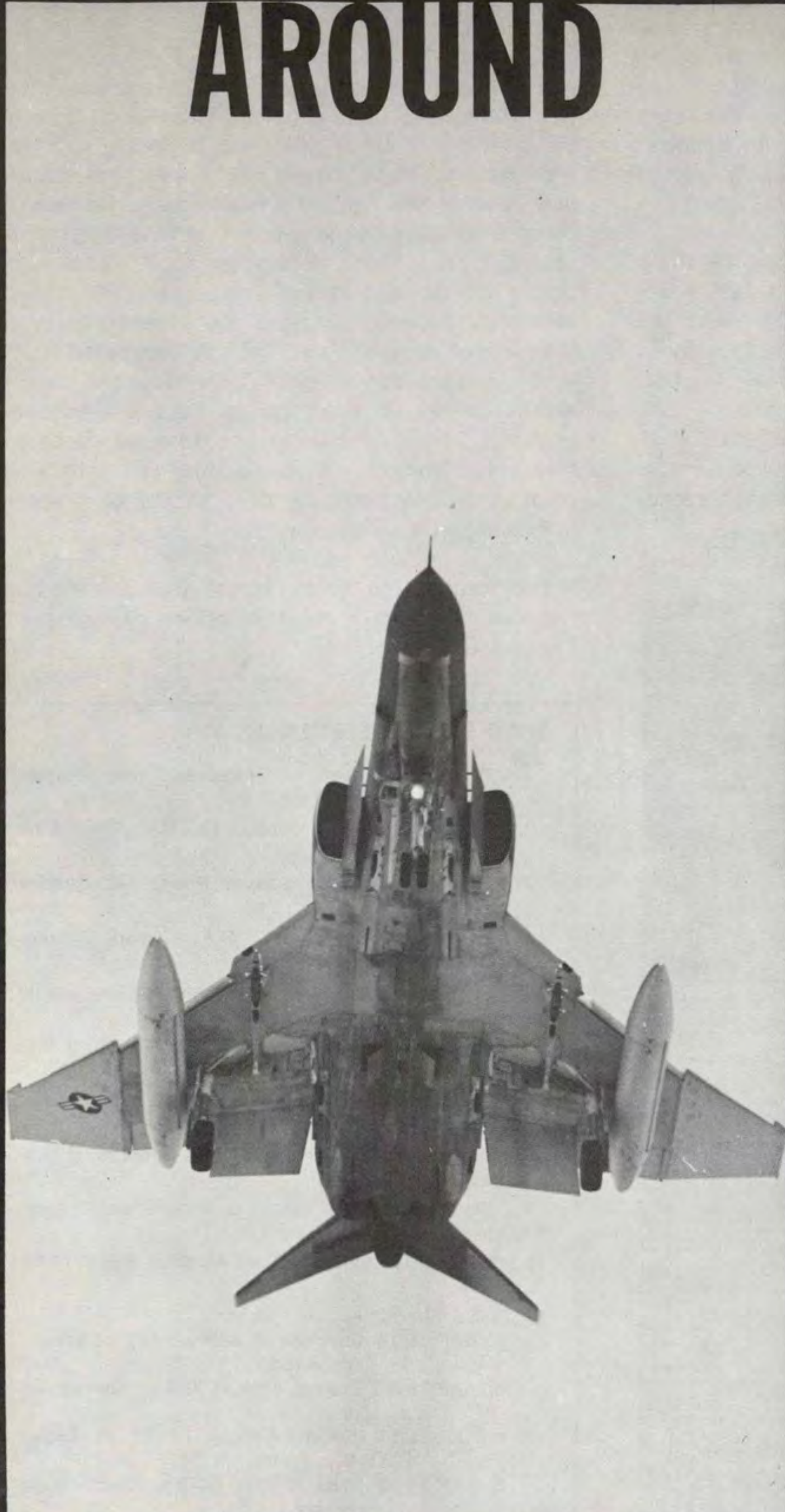
ANGLE OF DESCENT (degrees and tenths)	GROUND SPEED (knots)										
	30	45	60	75	90	105	120	135	150	165	180
2.0	105	160	210	265	320	370	425	475	530	585	635
2.5	130	200	265	330	395	465	530	595	665	730	795
3.0	160	240	320	395	480	555	635	715	795	875	955
3.5	185	280	370	465	555	650	740	835	925	1020	1110
4.0	210	315	425	530	635	740	845	955	1060	1165	1270
4.5	240	355	475	595	715	835	955	1075	1190	1310	1430
5.0	265	395	530	660	795	925	1060	1190	1325	1455	1590
5.5	290	435	580	730	875	1020	1165	1310	1455	1600	1745
6.0	315	475	635	795	955	1110	1270	1430	1590	1745	1905
6.5	345	515	690	860	1030	1205	1375	1550	1720	1890	2065
7.0	370	555	740	925	1110	1295	1480	1665	1850	2035	2220
7.5	395	595	795	990	1190	1390	1585	1785	1985	2180	2380
8.0	425	635	845	1055	1270	1480	1690	1905	2115	2325	2540
8.5	450	675	900	1120	1345	1570	1795	2020	2245	2470	2695
9.0	475	715	950	1190	1425	1665	1900	2140	2375	2615	2855
9.5	500	750	1005	1255	1505	1755	2005	2255	2510	2760	3010
10.0	530	790	1055	1320	1585	1845	2110	2375	2640	2900	3165
10.5	555	830	1105	1385	1660	1940	2215	2490	2770	3045	3320
11.0	580	870	1160	1450	1740	2030	2320	2610	2900	3190	3480
11.[illegible]	605	910	1210	1515	1820	2120	2425	2725	3030	3335	3635
12.0	630	945	1260	1575	1890	2205	2520	2835	3150	3465	3780

WIND SHEAR REFERENCES

1. **"Windshear Effects on Airspeed," Air Weather Service Technical Report 163, March 1962.**
2. **"A Case of Shear Trouble,"** The MAC Flyer, **June 1975.**
3. **"Windshear," Talon Service News, Fall Quarter 1975.**
4. **"Low Level Wind-Shear," FAA Advisory Circular 00-50, 8 March 1975.**
5. **"Mishap with a Moral—Windshear at the Middle Marker,"** The MAC Flyer, **May 1976.**
6. **"Windshear—The Mystery of the Vanishing Airspeed,"** Interceptor, **June 1976.**
7. **"Low Level Wind Shear," TAC Attack, September/October/November 1976.**
8. **"Windshear," Boeing 1976 Flight Operations Symposium.**
9. **"Some Comments on . . . Wind Shear,"** Aerospace Safety, **February 1977.**
10. **"Windshear Update," Shell Aviation News #439, 1977.**
11. **NTSB Aircraft Accident Reports**
    a. **AAR-76-14 Continental Airlines 727 at Stapleton Airport.**
    b. **AAR-76-8 Eastern Airlines 727 at Kenedy Airport.**
    c. **AAR-74-14 Iberian Airlines DC-10 at Logan Airport.**
    d. **AAR-74-13 Delta Airlines DC-9 at Chattanooga Airport.**

THE SMART WAY TO GO AROUND

CAPTAIN BOB ZIENER
Air Force Military
Personnel Center
Randolph AFB TX



WARNING

The Inspector General has determined that snap decisions can be hazardous to your health.

Decisions. *Decisions.* Even the most routine flight requires hundreds of timely, precise decisions. The USAF expends tremendous amounts of time and money to give its pilots the training and experience necessary to make quick, intelligent decisions. That's part of what flying airplanes is all about.

Among the many decisions pilots must make is one that can be critical to the safety of the flight. It is a decision which, when not correctly and timely made, has destroyed numerous aircraft and cost many pilots their lives. That is the decision to initiate a go-around after touchdown. An untimely decision with insufficient runway remaining to get safely airborne may be catastrophic. Recent accidents clearly show that even the most seasoned aviator can seriously misjudge the capability of his aircraft to successfully go-around during the landing roll.

1977. A commercial airliner unexpectedly "floats" on landing and touches down 2,500 feet down a 4,658 foot runway. After initiating breaking, the pilot decides that he cannot stop on the remaining runway. After he initiated a go-around, engine spool-up time exceeded remaining runway length. . . .

1977. After touching down on a wet runway, a T-38 pilot retracts the wing flaps to increase weight on the main gear. He decides that he cannot stop in the remaining runway and initiates a go-around. Due to the flaps being up, the required takeoff roll exceeds the remaining runway length. . . .

1976. A commercial airliner touches down extremely long on a snow-covered runway. After applying reverse thrust, the pilot decides he cannot stop in the remaining runway and initiates a go-around. Due to the high speed, the thrust reversers are incapable of being slowed and the pilot is unable to apply forward thrust. The aircraft departs the runway at high speed. . . .

The common denominator in these disasters was not that the pilot made the decision to go-around, but rather *when* he made the decision to go-around. During normal flight planning, it takes about 15 minutes to correctly analyze the situation and compute takeoff data. Pressure altitude, temperature, wind, runway length, runway surface condition, runway gradient, and aircraft weight are precisely combined to yield several exact parameters (flap setting, accel check speed, rotation speed, refusal speed, takeoff distance, etc.) which are used to assure a safe takeoff. Yet, in each of the above situations, the pilot made a snap decision to abort the landing and attempt a rolling takeoff in an extremely dynamic situation with little, if any, prepared takeoff data.

How can you avoid this perilous pitfall? The key lies in better pre-approach planning. The first step is usually to figure your stopping distance and compare it to available runway length. But don't stop there. Using the aerodrome sketch on an approach plate, determine the absolute maximum acceptable touchdown point and then positively fix it, using runway markers or a known geographic point (taxi-way, intersecting runway, etc.). If you are not on the ground, on speed, and ready to start breaking by this "go/no-go" point, a go-around may be in order.

An important point to remember is that a go-around after touchdown is still just that—a go-around. Most complex aircraft have different procedures for executing a go-around vs a touch-and-go. The touch-and-go is a training maneuver specifically designed for certain conditions and pilot proficiency. Since many Air Force pilots are not trained for proficiency in touch-and-go procedures, trying to decide between initiating go-around procedures and touch-and-go procedures can waste valuable distance and speed at an extremely critical time. A well-timed go-around with appropriate steps to eliminate any deployed drag devices (speed brakes, spoilers, drag chute, etc.) is probably the best course of action. Consideration should also be given to lowering the nose while on the runway to put the aircraft in its best acceleration attitude.

Once on the runway and beyond the "go/no-go" point don't be deceived by the slow rate of airspeed decay. Remember, during the landing roll, it's kinetic energy—not indicated airspeed—that decreases at a constant rate. The actual stopping situation for an aircraft touching down at 150 knots ground speed with 8,000 feet of runway remaining and decelerating at a constant rate is depicted in Figure 1.

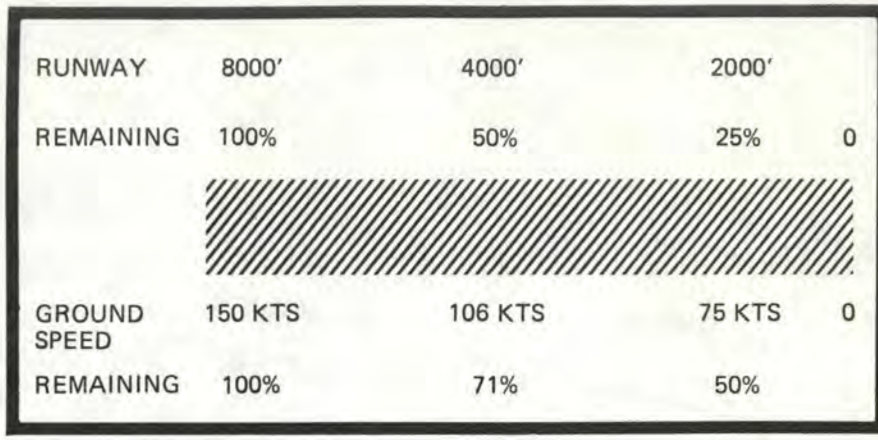


Figure 1

That 75 KTS with 2,000' remaining on a wet runway looks terrible from the cockpit, but a safe stop is still possible. Any situation seriously affecting stopping distance (hydroplaning, excessive reaction time, mechanical malfunction, improper configuration/aerobraking, etc.) could be detected by checking for the 106 KTS GS at 4,000' remaining. It's also during this portion of the landing roll that the aerodynamic stopping devices are becoming progressively less effective and the brakes are becoming more effective. Since most of the variables are behind you, the ability of the aircraft to stop in the remaining runway is largely dependent on your braking proficiency.

Decisions need not be hazardous to your health. The key is preparation. Know the performance limitations of your aircraft, but just as importantly, know how to handle them. ★

DO IT IN OKLAHOMA?

CAPTAIN JAMES J. LAWRENCE
Directorate of
Aerospace Safety

Sounds like a pretty attractive offer, doesn't it? Yet, if I add to the above classified the fact that this excellent opportunity is as an instructor pilot at the 443d Military Airlift Wing (MAW), different visions are conjured up. For the uninitiated, the 443 MAW is the Military Airlift Command's training wing located at Altus AFB in Altus, Oklahoma. Despite the fact that all the information in the above want ad is true, MAC is having a difficult time recruiting instructors to serve there. I recently had the opportunity to spend some time at Altus. What I found was distinctly different from my expectations, derived from discussions with C-141 and C-5 pilots.

Despite the standing jokes like "I spent a week at Altus one day" or "Don't breathe when the wind is blowing from the south," I thoroughly enjoyed the visit. What I found was a group of people dedicated to their mission. They are allowed to think freely and try new ideas; a product of the training environment which is often lacking in a large operational wing. The community is friendly, albeit small, and geared toward the sedate life of the many surrounding farmers and their families. Homes are reasonably priced, and recreation opportunities are abundant.

My purpose here must be rather obvious by now. This will be the story of the people and mission of Altus AFB. Hopefully, the goal is to get some of you career-oriented heavy pilots to think again about the pros and cons of a tour of duty at that southwest Oklahoma base. If the rest of the audience can gather up the reserve to read on, you, too, may enjoy this story of people and their efforts to improve themselves, their wing, and the United States Air Force.

Let's begin with a description of the town and the base. The city of Altus, located about 3 miles from the field, is a typical southwest Oklahoma farming community. Wheat is the major produce grown, and the city is nearly devoid of industry (as well as air pollution). Some of the bigger department chains are beginning to set up in Altus, recognizing the growing market, but the majority of established businesses are of the family-owned and run variety. One or two visits and proprietors recognize you as a regular customer and greet you by name. A pleasant situation, especially for a big city dweller, like me.

The city officials and the inhabitants maintain an excellent rapport with base personnel. Their motivation is as much economical as it is *Sooner* hospitality, for the base is the single, biggest economic stimulus to the community. The local standard of living would decline rapidly without the support of Altus AFB.

The Altus area offers a great deal in the way of extracurricular activities for those of the outdoor persuasion. The country is wide open and a heaven for campers, off-roaders, fishermen, hunters, hikers, and bikers. There is a lake for boating and water-skiing and open, uncongested skies for the light aircraft enthusiast. Housing is abundant and equitably priced, but as the town grows, so does the cost of homes. Home ownership appears to be a sound investment in Oklahoma, just as it is elsewhere in the US.

The base is equally alluring. MAC has spent a good deal of money modernizing and beautifying the facilities. Most of the older structures have been or are soon to be replaced; to include a new hospital. The host wing runs a very active recreation program. Activities include many sports, art festivals, classic art films, chess and billiard tournaments, trips to Dallas and Las Vegas, and much more.

Without doubt, Altus AFB has everything to offer the military family that one could find at any Air

An aerial view of Altus depicts the small town atmosphere and the surrounding farm land. Agreeable weather and very light air traffic make Altus AFB an excellent site for qualification flight training.

Force Base. Reasonably priced homes, good schools, low taxes, and residents receptive to military neighbors make off or on base living a comfortable, pleasant existence.

The 443 MAW conducts 25 different courses of formal training for aircrews and special ground personnel of the Military Airlift Command. The primary mission is to provide transition training for aircrew members on the Lockheed C-141 "Starlifter" and the C-5 "Galaxy."

Initial pilot qualification training consists of 4-weeks of intensive academic training followed by 4-weeks of flight simulator and flying training. The ground academics are provided by the 443d Technical Training Squadron, and flight and simulator training are accomplished by the 56th and 57th Military Airlift Squadrons; the 57th for the C-141 "Starlifter," and the 56th for the C-5 "Galaxy."

Training is conducted for C-141/C-5 initial qualification, first pilot/aircraft commander, upgrade, and instructor qualification. Several navigator, loadmaster, and flight engineer qualification programs are also conducted. Air transportation personnel from MAC passenger and cargo terminals are also trained at Altus. C-5 pilots are instructed in an aerial refueling course and C-141 pilots, navigators, and loadmasters are trained in aerial delivery systems for combat, world-wide airlift, and humanitarian mission support.

In addition to this high training commitment, Altus provides operational airlift support for MAC's Twenty-Second Air Force. They also support MAC Headquarters at Scott AFB, only 1 flying hour away, for VIP airlift. The 443d's mission is a large one but the people, the key ingredient for success, are the ones that carry the ball. Next, I'll tell you about some of the innovative things these people are doing at Altus AFB, in the sleepy town of Altus, Oklahoma.

The Technical Training Squadron (TTS) is responsible for providing the academic training program for 19 of the different courses offered. In the last calendar year, 3,200 students received instruction at this squadron. The staff consists of the highest qualified and most experienced people from the operational units. Their extensive experience plus the necessity to possess highly effective communicative skills results in a very select staff of unique and dedicated people. Many of their contributions have greatly enhanced the quality of the training program and saved the Air Force a bunch of

The cockpit procedural trainer allows student pilots and flight engineers to learn their stations and checklists. Here, the students can familiarize themselves with the new environment at their own pace, without wasting valuable simulator or aircraft time.

dollars at the same time. Here are just a couple of them.

We all know flying airplanes costs big money. Simulators were developed partly to cut down on the flight time needed to train an individual. But today's highly sophisticated flight simulators, though cheaper than aircraft, are still expensive to operate. The people at the TTS have gone one step farther. They have constructed cockpit procedural trainers by scrounging aircraft equipment from airframes in accidents or building their own mock-ups. They then developed tape/slide presentations which the student uses to learn the cockpit, instrument panels, normal and emergency procedure checklists, limitations, and the like. This system has economized on the needed simulator time and made simulator training more effective due to crew familiarity prior to exposure.

The instructors at the TTS have put together a library of tape/slide presentations on the operation of the many complex aircraft systems on the C-5 and C-141. These shows are designed to supplement the normal instructional syllabus and they represent many long hours of individual effort to improve the training program. Presentations are controlled individually, by the student, in the learning center. All personnel are free to use these facilities whenever they can spare the time. It's not unusual at all to find a resident flight examiner sneaking down to brush up on his systems knowledge prior to an annual flight evaluation.

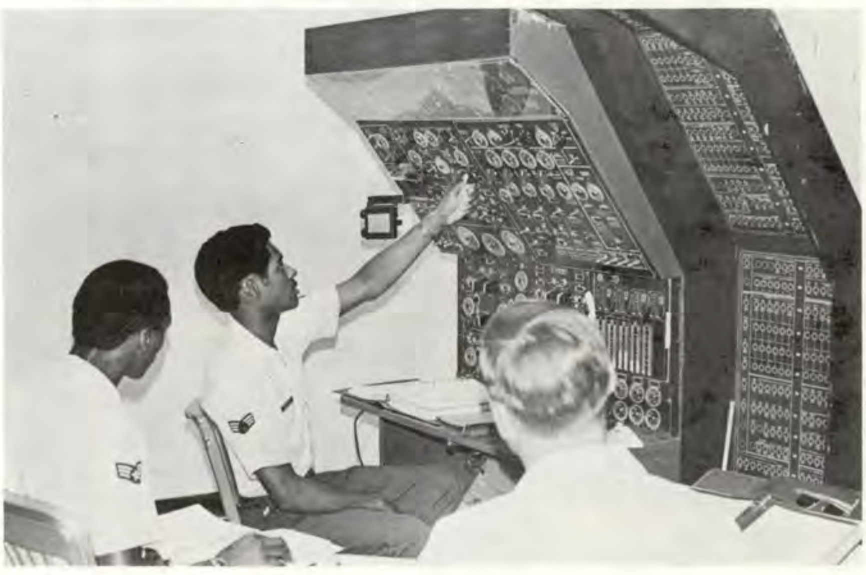
The life support people have gotten into the self-help act also. After securing a C-5 escape chute from salvage, they built a simulator platform and modified the chute for use indoors. Armed with built-in malfunctions, the chute is used to hone egress skills in MAC crewmembers. The price tag included only the cost of wood, almost negligible. I wonder what an Air Force contract to procure a similar device from a manufacturer would have cost? These people, like so many others I met, were extremely proud of their ingenuity and professionalism as instructors. Their pride was undoubtedly justified.

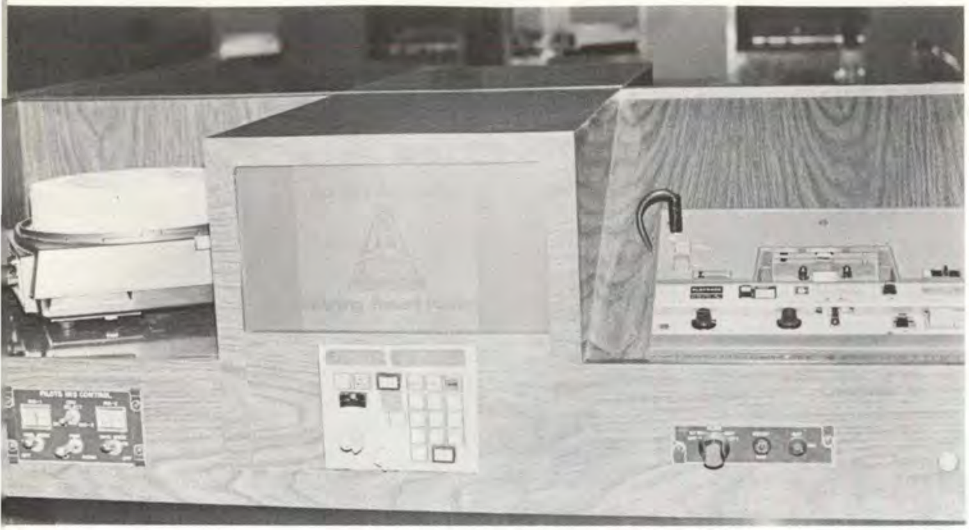
Another interesting local project involves the adaptation of a normal student learning center cubicle into an inertial navigation system (INS) simulator. The TTS electronics wizards built an INS control panel into the cubicle. Instructors then created a self-paced learning presentation which teaches the crewmember how to program and operate the INS panel. The INS was then wired so that digital readouts operated as the student followed the program and instructions. No commercially procured training aid could be more effective, yet the material cost to the Air Force, almost nothing—left over parts, an unused cubicle and a lot of free thinking and dedication.

The loadmaster training people have also contributed. Their qualification training program includes simulators which are the exact replicas of the cargo compartment of a C-5 and C-141. This equipment is used to teach loadmasters the skills of handling tons of equipment with-

The life support trainer is a locally conceived and constructed apparatus which provides students practice in using the aircraft's complex life support equipment. The escape chute, pictured above, is programmed to malfunction during primary activation efforts.

An instructor and two flight engineering students practice systems operations at the Technical Training Squadron. The instructor to student ratio allows for personalized attention during the academic phase of training.

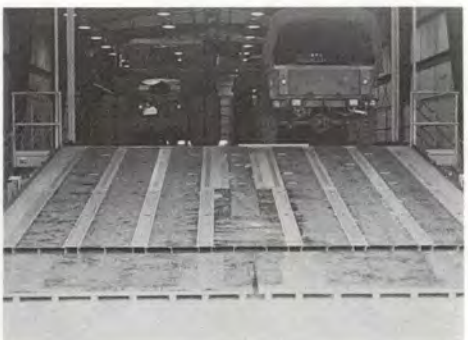




A standard student learning cubicle, some leftover hardware, a bunch of ingenuity and presto—an INS procedure trainer. An innovative idea which has proven to be very effective, with an extremely low price tag.

Systems mock-ups help the students to visualize the operation of an aircraft system and identify and correct system malfunctions. LEFT: The C-141 landing gear system trainer tracks the movement of valves, hydraulic fluid and electricity. RIGHT: The C-5 forward and rear cargo door trainer is a miniature replica of the aircraft's components. The operation is identical to the real thing and malfunctions can be simulated.

OKLAHOMA? continued

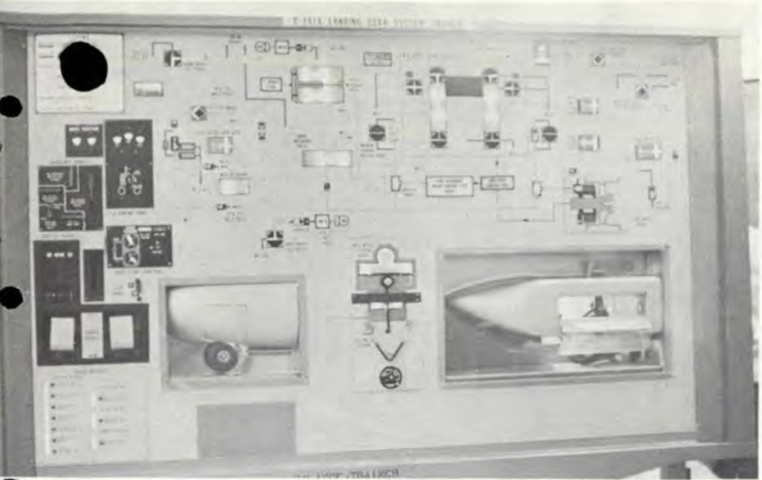


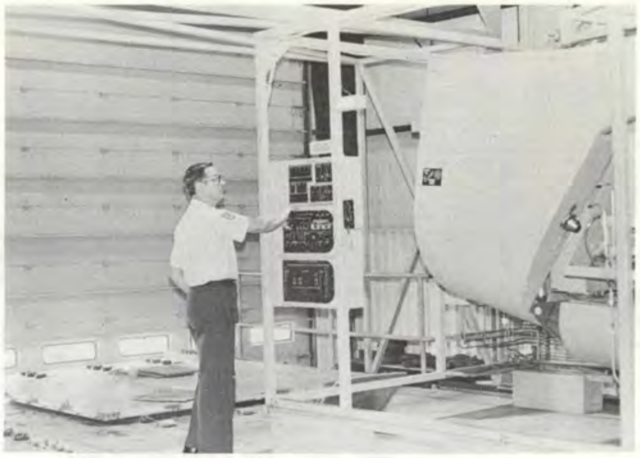
Loadmaster simulators were originally built to supplement the loadmaster qualification training program. Specifications and hardware match the cargo compartments of the C-5 and C-141. An additional use, recently initiated, is to train Army mobilization teams, thus, saving valuable aircraft time and eliminating costly aircraft damage.

out endangering valuable aircraft during the training phase.

An alternate use, identified and developed by the loadmaster school was to use these simulators for training Army personnel in mobilization exercises. They proposed bringing in Army teams from Ft. Sill, Oklahoma, to train on these simulators rather than sending MAC aircraft to them. The result, a large MAC-use cost saving to the Army and the avoidance of a lot of loading damage and down time to MAC aircraft. To date, the TTS has worked with the Army on simulating and instructing on the loading of over 1,200 tons of equipment and vehicles. From a conservation of resources standpoint, the savings have been substantial.

I could easily go on in-depth about the engineer station mock-ups, engine displays, navigator training facilities, combat airdrop training, systems mock-ups and much more. The point, however, has been made. The people there, people like you and I, have been given the freedom to try new ideas, test theories, incorporate what works, and discard that which doesn't. The overall result: high esprit, a faculty that can self-actualize, and a darn good training program.





Although my story stops here, the story of the people at Altus AFB is much larger than I am able to recap in this article. The flying squadrons and the instructors have been equally innovative in the flight and simulator portions of the training program. (Editor's note: The use of the simulator will be addressed in an *Aerospace Safety* article on simulator advances scheduled for publication in the near future.) I found friendly, motivated and proud people on the wing staff, at Base Operations, in the maintenance complex, on the flight line, and most everywhere else I visited.

I guess the bottom line is that every Air Force assignment is a challenge and an opportunity. It will be as good or as bad as we, the Air Force people, make it. If you approach a tour emphasizing the negative aspects, the result is sure to be an unenjoyable tour. Emphasizing the positive will normally lead to the opposite result. ★

Aerospace Safety magazine and I wish to thank the entire wing safety staff of the 443 MAW for their help and courtesy during the preparation of this article. Lt Col Edwin C. Ross, Chief of Safety, was a gracious host, and Lt Col Charles A. Rovell, Jr., Flight Safety Officer, served well as guide, mentor, and friend during my visit.

Loadmaster airdrop training is also conducted at Altus AFB. Dummy loads are loaded on pallets and rigged for airdrop delivery. The cargo loading procedures are studied and mastered on the ground prior to the flight training phase.

The pilot qualification program begins with four weeks of intensive academic training. Here, a navigation system mock-up depicts aircraft instrumentation during different phases of an ILS approach.

The Modern Eskimo

MAJOR GILBERT C. BODRAK • Operations & Requirements Branch
3636th Combat Crew Training Wing (ATC) Fairchild AFB WA

When you think of the word Eskimo, what do you visualize? An illiterate resident of the Arctic with no command of English? This may be an illusion that has been fostered for decades, but let's look at the modern Eskimo, the person who may save your life. Times have changed and this durable race has changed with it.

The basic problem for both the Eskimo and a downed crew member is survival. Basic in this sense of the word does not mean simple, at least not to the crew member. The Arctic area has had chill factors of −150°, food is scarce, and life is always in jeopardy. To survive in this hostile environment, one must have knowledge. determination, and a will to survive. The modern Eskimo excels in these traits—and more. His ability to survive has been judged as one of the most remarkable adaptations of man to a stringent environment.

Imagine, if you will, a bailout or crash landing in the north country. Towns and settlements are

separated by hundreds of miles. If at all possible, try to delay the inevitable until you are near one of these settlements. Once on the ground and you are proceeding toward the settlement, questions will arise. What kind of people can I expect to find? How will I communicate?

You will find that the modern Eskimo is a very competent person, especially in the art of survival. To survive in this harsh environment, no one person, or race of people, can be imperceptive of the elements and the hardships that they must endure. They must be tenacious yet adaptive. The old breed of Eskimo fished from hand-powered kyacks or umiaks. Today he uses power boats. The old hunted and fished for food to live; now they hunt and fish not only for food to eat but to have a commodity to trade or sell in local co-ops. The dog sleds of the past are still used for hunting and long distance travel, but have been replaced by the snowmobile for short trips and checking local trap lines. The igloos, snowsheds, and tents of the past have nearly all been replaced with wood frame homes. Yes, times have changed and the Eskimo with them.

The food you receive may not be to your liking and may vary dependent upon your bailout or crash landing location. If, for example, you find a coastal settlement, your diet would consist of primarily fish, seal, walrus, bear, bread (if flour is available) and tea. If you should land further inland, the meat would be caribou, wolf, or musk ox (occasionally eaten raw). A single Eskimo or his dog may consume about three pounds of food per day. Realize that this man must supply food for himself and his family (a typical family may include a dozen people with seventeen or more dogs). If he has had an exceptionally good hunt, he will restock his caches and announce his success to the community by yelling "come to my house."

When food is in abundance the Eskimos, with memories of past hunger, will gorge themselves until nothing is left. The party may last several days. You will find the people most gracious, generous, and willing to help. However, don't take advantage of their hospitality. The natives have little enough to eat, so eat sparingly and offer payment when you leave. Tobacco, in any form, is not only appreciated but considered a proper form of payment.

Although many things have changed for the modern Eskimo, one that has remained fairly standard through the years is clothing. Clothing normally worn by a downed crew member is not adequate for prolonged exposure when temperatures are severe. The Eskimos may either make, issue, give, or sell you a parka, trousers, and boots. The set has the hair or fur facing inward and is covered with an outer garment of caribou skin. Fur mittens, and boots with sealskin soles and caribou skin uppers complete the outfit. This clothing will afford proper protection to you in even the coldest of weather, providing some form of shelter from the wind is available.

Although dog sleds, igloos and kayaks are still in use, today's Eskimo has adopted powered boats and snowmobiles. Most live in wood frame homes and get most of their food from co-op markets.

Your next surprise may be the language. The native Eskimo language is termed polysynthetic (various word elements combined to a single word that is equivalent to a sentence). Another characteristic is the elaboration of terms by adding various suffixes to a word stem to express relative age, sex, and condition of animals, condition and amount of snow, etc. The native Eskimo language, however, is very difficult to learn and is rapidly decaying. Children in school and the younger generation are now being taught English and French. If most of the settlement still speaks Eskimo, find a child or teenager to act as an interpreter.

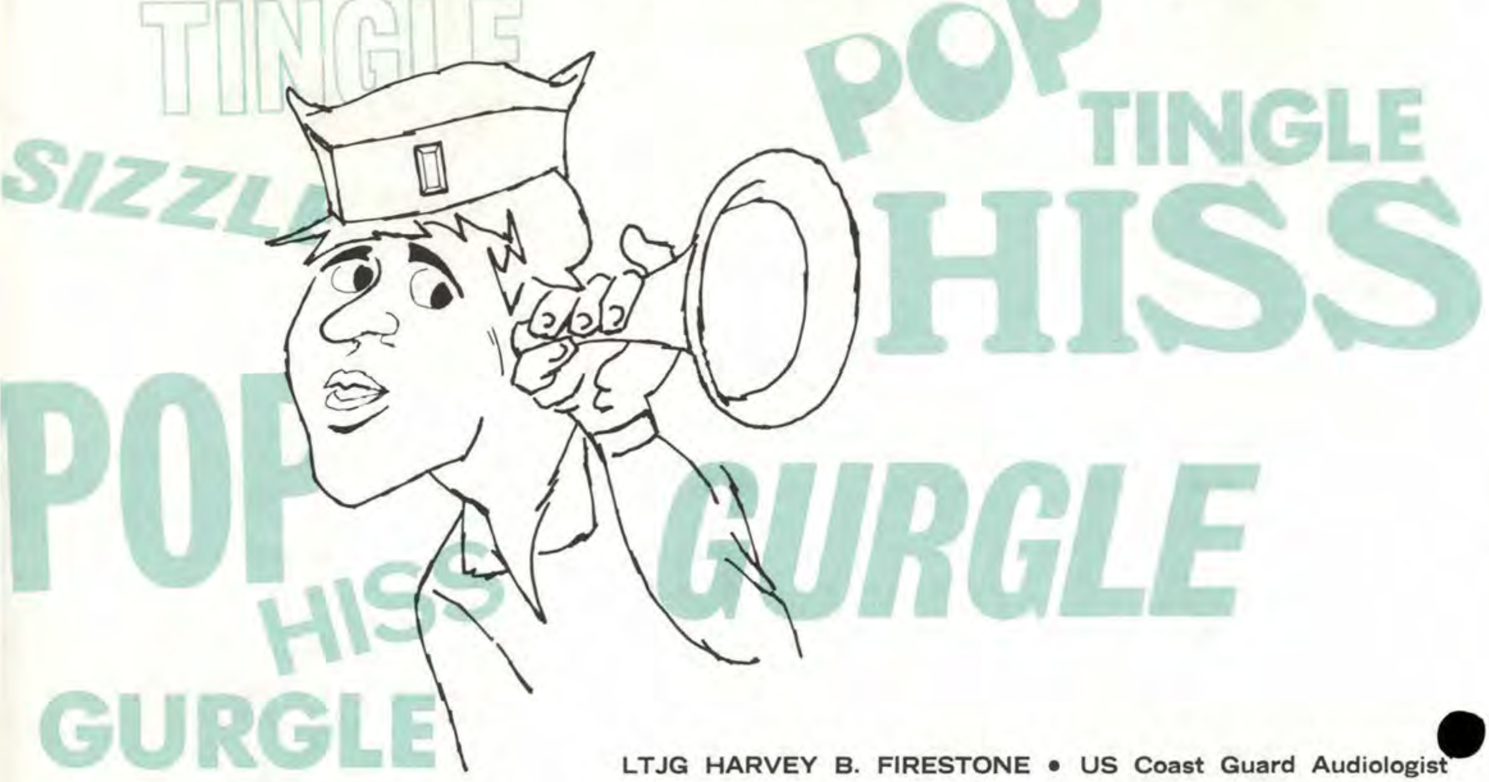
The greatest change in the modern Eskimo's way of life has been brought about by the establishment of a chain of co-op stores and greater employment of Eskimos in the wage market. The co-op has helped spread food to the various settlements, particularly during lean years and has given the Eskimo an outlet to sell his various commodities. It has had some adverse effects, however. Some feel that it is changing the food habits of the people in the new settlements—for the worse.

As the Eskimos get more and more cash from sale of their products in the co-op and wages (government work, logging, construction, etc.), they don't hunt and fish as much, and must, therefore, supplement their diets with purchased food. That food is not as high in protein and fat content which is so vitally needed in this cold climate, and the cost is high since supplies must be flown in from the south. The co-op, however, may be an advantage to the downed crew member.

Communication between the various co-op settlements is achieved via short wave radio. This radio system can relay your plight from village-to-village in an attempt to raise help or establish search parties for your fellow crew members. In addition, the remote settlements are supplied by air. Small aircraft fly in supplies and pick up items to be sold in the markets farther south. If space is available, you may be flown out at that time. If not, your position will be relayed and SAR efforts initiated.

Yes, times have changed and the Eskimos have changed with them. They are a modern, generous, yet tenacious race of people that have dispelled any fear of the frozen north and have learned to live with it. Your understanding of these people and their way of life may well be the deciding factor in your survival. ★

WHAT HAPPENS TO YOUR EARS WHILE FLYING



LTJG HARVEY B. FIRESTONE • US Coast Guard Audiologist

Nearly everyone who flies has experienced a hiss, tingle, pop, sizzle, or gurgle in their ears. Some people don't feel any effects in their ears, while others have ears that "stop up" and become painful. So what happens, and what can you do to prevent ear problems while flying?

The problem you are facing is called barotrauma. "Baro" means air-pressure related. "Trauma" means injury. The problem of air pressure in your ears is introduced by the atmospheric heights the aircraft may travel through. The air pressure decreases when you rise above the earth's sea-level pressure of 14.7 pounds per square inch, which results in expansion of any trapped air. Your ears accommodate by trapping or releasing air in the middle ear.

Some anatomy is helpful in understanding how this occurs (see Fig. 1). The external ear is composed of the pinna which collects sounds and channels them down a semitube closed at one end by the eardrum. This is the external ear canal. The eardrum must vibrate for you to hear by normal air conduction. Sounds can only occur in a medium elastic enough (like air) for vibration of the eardrum and the three small bones—hammer, anvil, and stirrup (which, incidentally, are the smallest bones in the human body). As the medium changes, so does our hearing—ever notice how you hear under water? If wax blocks the channel, or rests on the eardrum, it naturally impedes the flow of sound and vibratory transmission. This changes the pathway, but not the medium. Inserting an earplug can quell noise by air transmission pathway reduction just as well. We need air on both sides of the eardrum to allow our ears to function properly.

Dizziness may occur due to barotrauma to the fluids and cells of the semicircular canals, which generally control our labyrinthine function and affect our sense of balance.

Hearing may be your only problem. Cabin attendants may advise you to hold your nose and blow, or yawn very widely. This is good advice because the middle ear needs air to equalize itself. The only way to provide air to the middle ear is through the Eustachian tubes of each ear. These tubes connect the middle ear with the superior aspects of the epipharnyx—uppermost throat region. The 19-letter (count 'em) salpingopharyngeous muscle attaches to the pharyngeal ostium of the auditory tube, opening and closing the flapper valve-like structure when yawning or swallowing. (Fig. 2.) Equalizing pressure enhances sound transmission, resolves balance problems, and decreases the amount of mucous membrane seepage of the middle ear.

Problems arise in equalizing pressure when a cold settles in our head and our ears get stuffy. This is due to the swelling of the mucous membrane lining of our middle ear and throat. This often is enough to encompass the area around the opening of the Eustachian tube with enough swelling to close it off and reduce the salpingopharyngeous actions of air exchange.

The reason ears "beep" is due to the negative air pressure sucking on our eardrums. Audiologists (specialists in hearing conditions) and otologists (surgeons of the ear) who peer into an ear can see an imploded eardrum—indicative of middle ear problems. You can feel temporary, slight pain from barotrauma when the ligaments holding the three bones and the eardrum are stretched.

Now, here is the action phase of what you can do to overcome barotrauma. Swallowing normally opens Eustachian tubes. Chewing increases saliva, and the consequent increased swallowing is enough to induce barometric equalization. This is why chewing gum is often given to airline passengers. (But it sure can "gum up" the valves of an oxygen mask!)

Yawning is a completely safe method of middle ear equalization, but it doesn't work for everyone. If yawning doesn't work, you can hold your nose and gently swallow or blow or alternate those procedures until your ears clear.

You should be careful when you do this, however. If you are running a cold or other upper respiratory infection of any sort, you risk infections of the middle ear by attempting equalization by any method but yawning. An alternate —although infrequent—method of middle ear barometric equalization is to visit the otologist's office to have him pass a silver tube through the nose to the Eustachian tube and middle ear. Air is passed up the catheter to gently inflate the middle ear. This procedure is called a bouginage. For the most severe ear blocks, the surgeon is required to lance a minute hole in the eardrum (called a myringotomy).

Two ways to know if you are susceptible to barotrauma are by flying or low-pressure chamber training and trying to clear your ears. Whatever technique you find that works consistently is reasonable. But be careful. Blowing those eardrums outward from their inward position too many times will cause your eardrum to weaken by stretching. The strained ligaments of the ossicles may cause pain. Your hearing may be temporarily dulled, or if there is enough pressure, you might blow a hole in your eardrum.

So be gentle on yourself. You may be able to equalize one ear only with one technique, while holding the nose and swallowing, or yawning works fine for the opposite ear. The best advice, of course, is not to fly at all when you have a stopped-up head and ears.

Good luck and happy flying. If you have an ear block now and can't hear, at least you can read!
—Courtesy **Approach.** ★

FIGURE 1
THE HUMAN EAR SHOWING PORTIONS AND STRUCTURES

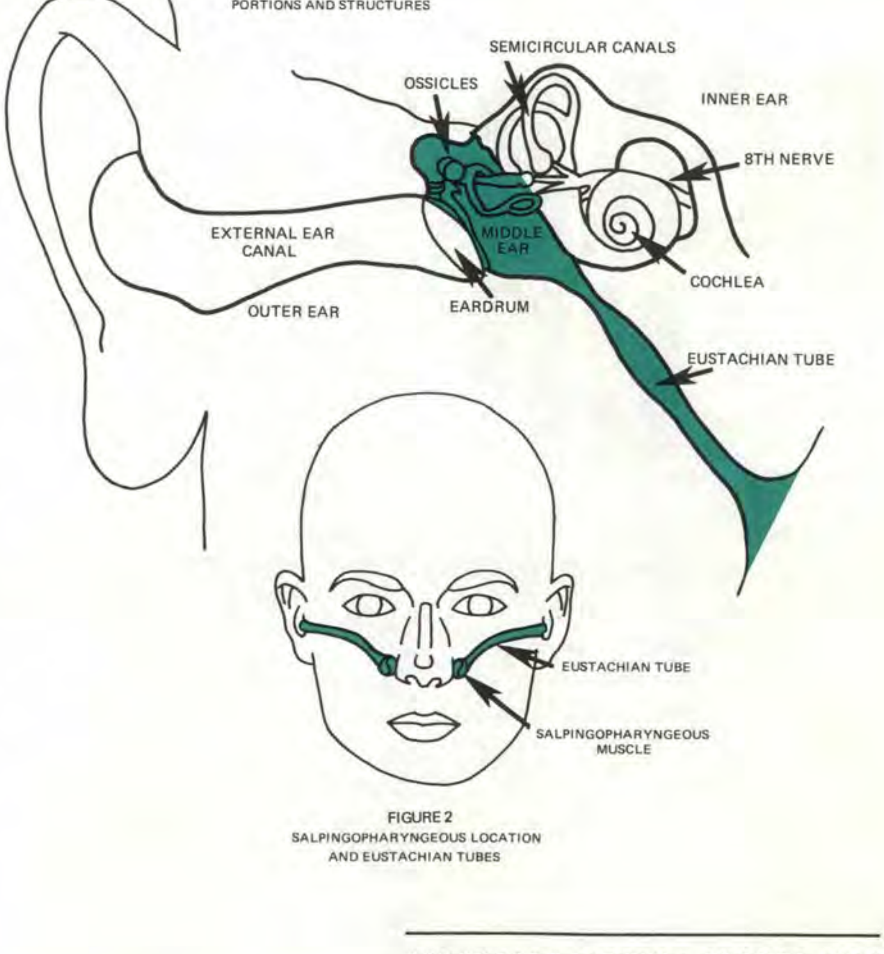


FIGURE 2
SALPINGOPHARYNGEOUS LOCATION AND EUSTACHIAN TUBES

GEAR UP

(WINGS DOWN)

LT COL WARREN R. HORNEY
Directorate of
Aerospace Safety

United States Air Force Aero Clubs periodically experience the traditional gear up landing of a retractable gear aircraft. And the last 12-month period has been no exception. We had the classic "couldn't hear the tower for the horn blowing" and even had one involving a Piper Arrow with the automatic gear extension system (they said it couldn't be done). However, of more interest are a series of mishaps involving Cessna aircraft which have the gear welded into the down and locked position. In each of the cases listed below the aircraft ended up with the wing low (on the ground) and the gear up—pointed straight toward the sky:

A pilot on a cross-country flight became disoriented while flying above the overcast. He had not received a weather briefing. When his fuel supply ran low (he hadn't refueled prior to takeoff either), he descended through a break in the overcast and landed perpendicular to the furrows of a plowed field. Result—aircraft upside down.

Another pilot was unable to find his destination because he had neglected to apply a fairly significant crosswind factor to his planned headings. He finally reversed course to return to the home field. Although the fuel gauges showed a low fuel condition he chose to press on, relying upon the owner's manual endurance figures. Eventually the engine quit, and after attempting to run the engine on the primer, the pilot made a partial flap landing in a rice paddy. The nose gear dug into an embankment and the aircraft came to rest inverted.

A student pilot on initial solo was cleared to land on a sod runway instead of the hard surfaced runway from which he had taken off. He mistakenly landed in a green field adjacent to the desired runway, allowed the nose wheel to dig in, and the result was a low wing, high gear Cessna 150.

Finally, a private pilot flying a late model Cessna 172 got into a porpoise when he forgot to lower flaps and touched down fast and nose low. After a series of bounces of increasing amplitude, the nose strut failed, the prop dug into the runway, and the aircraft did an extremely tight outside loop to the wheels-up position.

Most incredible of all, in one of the above cases the aircraft was righted, the prop bent back to more-or-less straight, the rudder hammered free, and the machine flown to a nearby airport for repair. That was some tough Cessna.

What can we as aviators (and even student pilots are aviators) do to keep the wings up and the wheels down? First, we can avoid forced or off runway landings. Good flight planning, timely precautionary landings at an airfield when things start to go bad, and heads up flying will eliminate most forced landings. However, every light plane pilot should be prepared for the time when the fan quits or some other contingency makes an off-field landing mandatory.

Let's discuss briefly how we can more gracefully terminate the flight that ends in a big bounce on a runway or a forced landing off the runway.

First, there is really only one graceful way to get out of a porpoise: go-around. The conventional response to a developing porpoise-elevator up as nose falls and elevator down as nose rises usually is counter-productive since the elevator response is insufficient to counteract the motion in the time available before the next bounce—

Scenes such as these often result from poor flight planning and poor judgment that lead to off runway landings. Technique is also important. Every pilot should know soft field landing procedures. On the runway, engine okay and porpoise develops—TAKE IT AROUND.

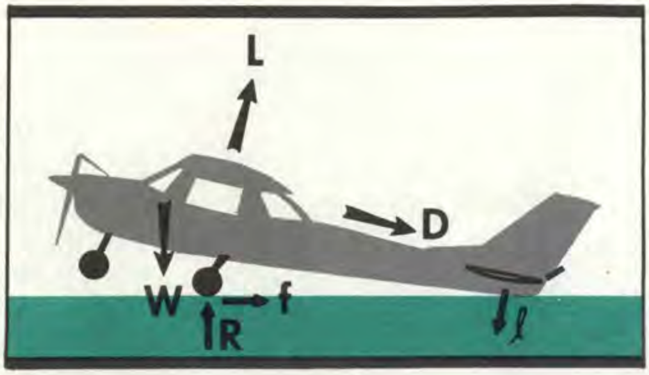


Figure 1

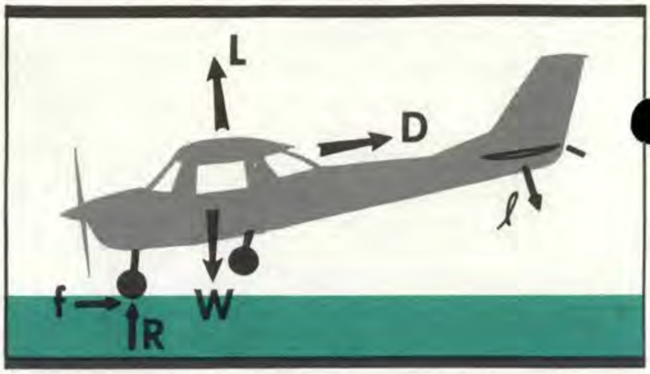


Figure 2

GEAR-UP continued

so you must neutralize the elevator, add full power, and go-around. By the way, don't forget to retract the flaps to the appropriate position after you get the aircraft under control, or you may end up in the trees off the far end of the runway. (Yes, that, too, has happened to an Aero Club pilot in the recent past.)

But what about the real forced landing with all the trimmings—engine dead, field rough or soft (plowed fields are designed to be soft), but at least we have a field identified? First, let's set up a good pattern so that we hit our key points while we prepare for the landing—radio call, mixture cutoff, fuel off, throttle closed, ignition off, doors unlatched. Now we come to the critical part—the final approach and touchdown. Remember that maneuver we learned during private pilot flight training—the soft field landing? Now is the time to do it for real—let's get full flaps down (then turn off the master switch if you have electric flaps) and get the airspeed down to full flap final approach speed. Now as we flare for landing, let's use the soft field technique of holding that nose high attitude as long as we can so that the aircraft touches down at minimum airspeed (you'd be surprised how slow that really is). Then, after touchdown, hold full up elevator until the aircraft comes to a stop. You can now deplane and start preparing your "There I was . . ." remarks for the locals—much more appropriate than trying to decide what's going to happen when you release that seat belt (and hopefully shoulder harness) that is suspending you upside down.

Why does the full flap, soft field landing increase the probability of remaining upright? For several reasons. First, you land at a lot slower airspeed and have less momentum to dissipate. Secondly, you keep the nose wheel (and prop) from digging into the ground and causing your translating aircraft to become a rotating body. Third, a look at Figure 1 shows that you have the lift (L) and drag (D) forces working in your favor—keeping weight off the wheels and slowing you down. When you dump the nose you lose most of your lift, thereby putting the weight on the wheels (including a significant portion on the nose wheel). You also lose a portion of the drag which opposes the nose-over (Figure 2).

So, why would anyone make a partial flap, high-speed landing in an actual forced landing? Because that is the way most people land most of the time. If you don't believe it, spend a Sunday afternoon at the local aerodrome watching light plane landings.

What should we do? Practice! Practice 180° and 90° power off landings until you can land where you want every time. Practice soft field landings until you have confidence in your ability to keep that nose wheel off the runway until an absolute minimum airspeed. *If club rules allow,* and a sod or dirt runway is available, make some landings there so you aren't intimidated by a runway or field less than 10,000 by 150 ft. Needless to say, student pilots shouldn't do the above until cleared by their instructor.

In summary, let's follow the four P's for avoiding wheels up landings:

PLAN ahead. A good flight plan, weather briefing and preflight preparation will keep us out of a lot of trouble.

PREPARE for eventualities. Take action when things start to go bad. Have a backup plan, and a fall back from that. A precautionary landing is almost always a good idea.

PRACTICE. Nothing builds confidence and skills like practice. Have confidence in your ability to make a successful forced landing when the occasion arises.

PERFORM. If you have to make a forced landing, keep your wits and make a full flap, soft field landing that preserves both the aircraft and your pride.

Let's keep the wheels on the ground and the wings in the sky. ★

HOW TO FAIL SPECTACULARLY

FR. ART PERRAULT

We hear a great deal today about the laws of success, and self-help books are a booming business; but how about our right to fail? Is there a scientific method to ensure failure? We know that the only way to become successful is on purpose, but is it possible to be a failure on purpose? An exhaustive survey taken recently disclosed the fact that only 3% of all Americans are "outstandingly successful," that 68% are "moderately successful" and 29% of our people are "complete failures," achieving nothing.

Two tramps were sitting on a park bench discussing the economic situation, and one said to the other, "This depression don't bother me none . . . I was a failure during the boom." How can we guarantee our failure even during times of unprecedented prosperity?

- Be a drifter—avoid like poison any short-range, intermediate, or long-range goal. The Wall Street Journal, faced with the complaint that high taxes make it impossible for anyone to rise from rags to riches today, made a study that disclosed there have been more new millionaires starting from nothing in the past decade than in any other period in history. These people were all different in many ways except that they were decisive. So rule number two for failure is:

- Procrastinate—they even have a slogan for Procrastination Week: Don't Put It Off, Procrastinate Today!

Another good method is never to do today what you can put off til tomorrow. If you get a sudden urge to "do it now" just sit down until the mood leaves you.

Research conducted by Columbia University disclosed the amazing fact that it is not aptitudes but attitudes that make us successful. 93% of our success is attitudes and 7% is skill and knowledge. So failure rule number three is:

- Be negative—you can catch more flies with honey than with vinegar, but who needs them? If you want to be successful, think success. So if you want to be a failure, think failure.

- Be a poor communicator—be a poor listener; even a fool is considered sensible when he keeps his mouth shut, so yak up a storm and remove all doubt.

All of our actions are consistent with our inner opinions about ourselves. The picture that we have inside about ourselves, whether it is true or false, determines what we can or cannot do in life. So rule number five for failure is:

- Sell yourself short—remind yourself constantly about all of your weaknesses, shortcomings, and past failures . . . and don't forget to tell others. Be a blob.

The biggest problem facing management is motivation. So failure rule number six is:

- Fizzlemanship—when you get that "hot button" urge to achieve, fizzle!

Worry prevents our doing the very thing that would remove the worry. So failure rule number seven is:

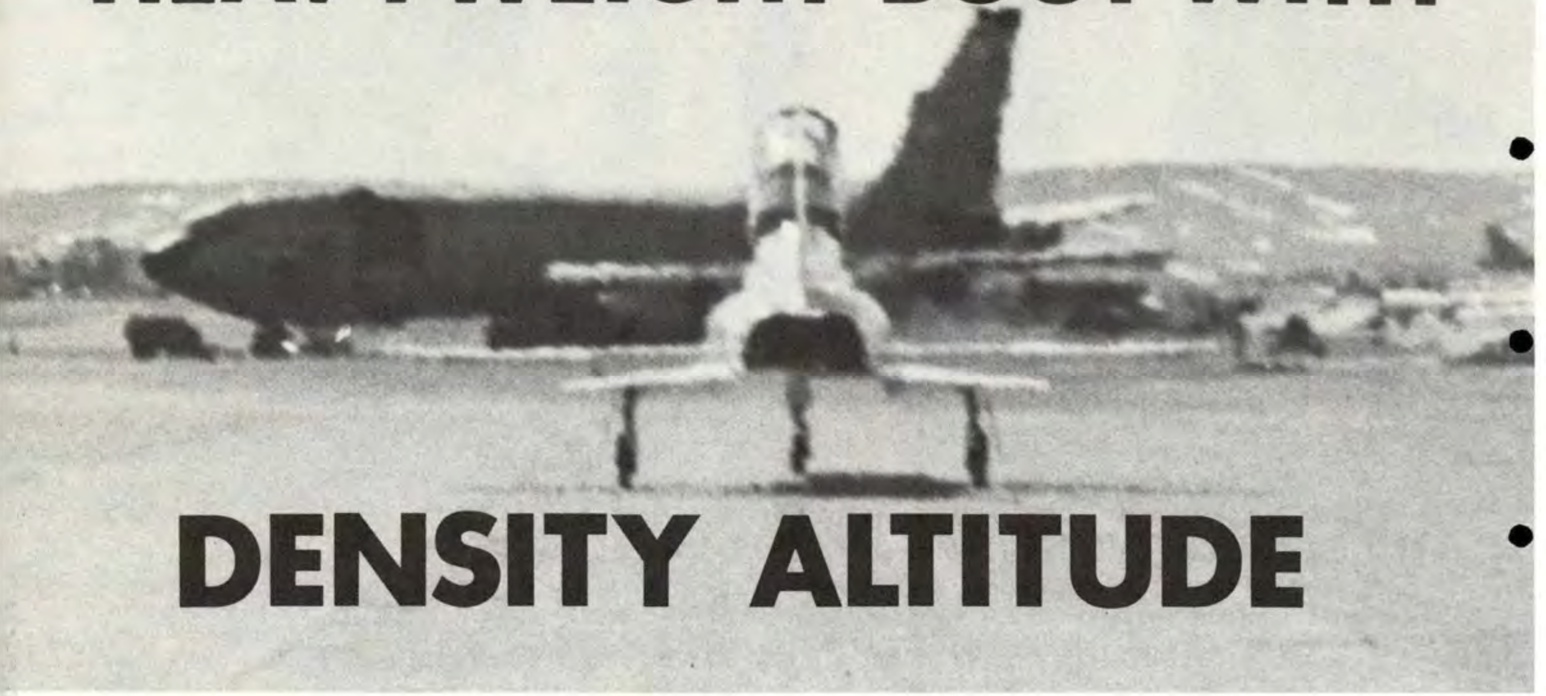
- Be a worry wart—a neurotic is a person who worries about things in the past that never happened, unlike the normal person who worries about things in the future that never happen! If you run out of things to fear, you can fear fear itself!

How do we fail in life without trying? The answer is in failure rule number eight:

- Don't try—if at first you don't succeed, forget it! Everyone is a self-made man, but only the successful ones admit it.—From the "Chaplain's Message," *Jet Stream*. 22 Jan 78, published by 150 TFG, New Mexico ANG, via *TAC Attack*. ★

If your bird is reluctant to fly, you may be having a . . .

HEAVYWEIGHT BOUT WITH DENSITY ALTITUDE



Those heat waves making the runway look like a lake ought to be telling you something: it's Summer and time to think very seriously about DENSITY ALTITUDE. One of the first things you notice is that your bird seems reluctant to fly. But don't start blaming the engine(s), air will be the problem. Heated, it starts to rise and expand.

Air, a mixture of gases, occupies space and has mass; therefore, density. Density, or the concentration of molecules, determines the ability of air to support. The thicker, more dense it is, the greater its support capability. Air density is affected by three main factors: temperature, pressure and humidity. Of these, temperature and pressure have the most adverse effect. When air undergoes a drop in pressure or a rise in temperature, expansion takes place and the air molecules move away from each other. Air density decreases and so does its ability to support. The reverse holds true if pressure rises or temperature decreases. Humidity has a similar effect as moisture displaces air, making humid air lighter or less dense than an equal volume of dry air.

This relationship of pressure, temperature and humidity of air establishes density altitude. For practical purposes, we can express density altitude as the relative altitude or load-lifting ability of air as it expands and contracts. At times, this expansion and contraction seem unbelievable. At one Army post, for example, the actual elevation ranges from 300 to 500 feet above sea level. Depending on weather and time of day, the density altitude may vary from minus 1,000 feet to plus 4,000 feet. Consider that a UH-1H at a gross weight of 9,500 pounds can clear a 50-foot obstacle with a zero ground run (vertical takeoff) under standard (15 degrees C.) sea level conditions. With a temperature rise to 35 degrees C. the aircraft will require a takeoff distance of 255 feet and an airspeed of 20 knots to clear the same obstacle.

Since lift is not only dependent on the shape of an airfoil and angle of attack but also on the mass of air causing the lifting force, as density altitude becomes greater, lift decreases. In helicopters, high density altitude has the same effect as loss of rotor rpm. For example, power trains can be overtorqued, reciprocating engines can be overboosted, and autorotations can become especially critical when pilots attempt otherwise normal maneuvers under high density altitude conditions. (The Air Force has no helicopters with reciprocating engines, but the O-2 and aero club planes are all recips.)

Low density air (high density altitude) also affects engine performance. High humidity alone can cause a reciprocating engine to lose as much as 12 percent of its rated brake horsepower. Since the reciprocating engine operates with a fixed displacement, all air processed is directly associated with combustion. If water vapor enters the induction system, the amount of air available for combustion is reduced. Since most carburetors do not distinguish water vapor from air, an enrichment of the fuel-air mixture takes place. Any increase in inlet air temperature permits the carburetor to further enrich this mixture. Since the maximum power output at takeoff requires a fuel-air ratio richer than that for maximum heat release, still more enrichment takes place—and power reduces. The end result includes high power settings and increased fuel consumption.

While the volume of air flowing through a gas turbine engine may remain constant at high density altitudes, this thinner air contains less mass, and thrust (power) is lost. A temperature of 100 degrees F., for example, reduces the thrust of a gas turbine engine by approximately 15 percent from that under standard conditions of 59 degrees F.

During hot weather, density altitude changes are rapid, frequent and great. The load you take off with at dawn may well be beyond the capability of your aircraft an hour later. Density altitude must not only be computed for takeoffs, but also equally important, for destination landings. This is particularly true if you are taking off from a low altitude and plan to land in high terrain. And, particularly, extra caution is a must for autorotations.

With this in mind, your aircraft will do all it is asked to do and come home safely even on the hottest day if you (1) compute density altitude BEFORE weight and balance, (2) always assume density altitude to be higher than it probably is, (3) study your Dash One density altitude tables, and (4) act accordingly. (Adapted from **US Army Aviation Digest.**) ★

300,000 SAFE

Col H. W. Miller, R, 14FTW Wing Commander, greets Capt Stan S. Tada, L, and 2d Lt David R. Fink, Center, after they flew 300,000th accident-free hour.

Anyone out there who went through pilot training or worked in maintenance at Columbus AFB, MS, since 1969? If so, your assignment there made you a part of a very significant achievement which culminated on 3 April 1978. When Captain Stan Tada (IP) and 2d Lt David Fink (Student) landed TWEET 90290 they recorded the 300,000th accident-free flying hour in T-37s at Columbus. This achievement was the result of outstanding effort by everyone associated with the T-37 operation at Columbus since July 1969 when the UPT mission was assumed. That's nine years of professional performance by aircrews and support personnel backed by superior supervision.

The 300,000 flying hours equates to about a quarter of a million sorties, most with student pilots flying the aircraft, and approximately 2½ million maintenance manhours that have been accomplished correctly. All of those who have been associated with the 37th FTS and Columbus AFB can be very proud of the organization—and its outstanding flying safety record. ★

OPS TOPICS

BELTS COULD HAVE PRE-VENTED FATALS

A CH-53 was engaged in external load training when the aircraft started to experience excessive "collective bounce" and to depart controlled flight. The AC took control and called for the crew chief to jettison the load. During subsequent gyrations, the crew chief and flight mechanic were both thrown from the aircraft. The mechanic was relatively unhurt, but the crew chief was struck by the main rotor and was killed. In violation of all regulations and good common sense, neither of them was utilizing any type of restraint, i.e., lap belt or gunner's belt.

OXYGEN CONNECTOR

An A-10 flight was climbing through FL 220 when the chase pilot noticed that the pilot of Lead was having difficulty maintaining aircraft control. Passing FL 270, Lead stalled. It appeared to the chase pilot that Lead was disoriented. He did not respond to radio calls on FM or UHF. The aircraft recovered and went into a series of climbs, stalls, and dives. The chase pilot continued to talk to Lead, urging idle power and appropriate turns. At about 12,000 feet, Lead regained full consciousness and complete control of the aircraft. He then checked his oxygen system and discovered that his oxygen mask hose had become disconnected from the CRU 60/P connector. After reconnecting the oxygen hose to the CRU 60/P, the pilot checked the connection by tapping the hose and it again became disconnected. He then firmly reconnected the hose and visually confirmed that the locking pins were seated in the locking grooves. The mission was then terminated uneventfully.

ELECTRICAL HAZARD— KC-135A

A parachute hanger bar with parachute attached dislodged from the rack and punctured the vent screen of an aux pwr panel located behind the aircraft galley. One end of the hanger bar was lodged against "A" and "C" phase external power circuit breakers shorting the two together. The parachute shoulder harness was partially fused to the hanger bar. Minor damage was sustained by the connecting wires. Lesson: Don't hang chutes near the aux power panel.

KC-135 BOOM SCRAPED

Mission was scheduled as a night AR and RTB. The student pilot was making the takeoff when he inadvertently actuated stab trim. Actuation occurred shortly after S1 (113 kts) and prior to rotation (140 kts). Neither pilot noticed trim wheel movement until the aircraft rotated despite forward yoke pressure. The IP took control of the aircraft, noticed trim wheel turning, applied nose down trim, forward yoke pressure, and continued takeoff. Crew was not aware that an over-rotation occurred. Mission was continued without incident. Trim switch operated normally for the entire mission. Maintenance post flight inspection revealed a scraped boom. Painted trim markings on the trim wheel were obscured. Good item for pre-takeoff briefings to get all eyes in the front to watch for unusual occurrences. ★

Why Flight Safety?

Last June we published some thoughts on safety by Squadron Leader Peter A. Barratt of the Royal Air Force. Then we ran across the article below, author unknown, extracted from the Royal Malaysian AF "flight safety bible." It appeared in the RMAF *Flying Saf*ety magazine. We think it one of the best expressions of the role of *people* at various levels in mishap prevention. We chose to title it . . . "Why Flight Safety?"

The aim of the flight safety program at all levels is the elimination of costly accidents which directly affect the operational capability of the RMAF. Personnel and material losses resulting from accidents constitute an unacceptable drain on the vital resources on which the nation depends for its security.

The primary concern of the flight safety program is not safety for safety's sake alone. It is recognized that there are certain inherent hazards in service aviation: hazards which must sometimes be accepted in the interests of mission accomplishment. However, recognition of these hazards does not dictate their blind acceptance; rather, their recognition should serve to indicate more exactly just where the major flight safety preventive effort should be directed.

Because operational effectiveness and mission accomplishment is the commander's prime responsibility, the onus for flight safety must, therefore, rest personally with him. Flight safety is thus a function of command. The commander, in turn, because of the complexities of modern aircraft, must rely on his various technical, administrative, and executive staffs for expert advice. Thus these supporting staffs also become directly and intimately involved in all aspects of the flight safety program.

It follows then that flight safety (accident prevention) is not one person's responsibility; rather, every person connected in any way, however remotely, with the aircraft operation must share in this responsibility. The designer, manufacturer, engineer, supply officer, maintenance organization, ground support elements, and aircrew must all contribute in their own specialty to the end that costly accidents do not occur.

The causes of accidents originate in a variety of ways, ranging from an incorrect statement of the operational requirement, through design, production and development, to operating and maintaining the aircraft in service. They also originate in the training of aircrew and ground crew and the operational risks which are inherent in service flying. The great majority, however, can be traced to human fallibility. In the service this can be countered by higher professional standards in flying, servicing, administration and staff work, and by high morale; all these are products of inspired leadership. It is, therefore, commanders at all levels who can do most for flight safety. Furthermore, the commander is responsible for operational efficiency, so he must be responsible for the implementation of flight safety.

Experience has shown that the establishment of a flight safety organization is necessary to keep accident rates low. Such an organization must be advisory and not executive. Flight safety is a means of achieving operational efficiency and is not an end in itself.

To be effective, a flight safety organization must be independent of executive branches and be of equal status to them, and be directly under or have right of access to the commander. To be efficient in its task it must have an adequate system for reporting, investigating, collating, study and analysis, and for exchange of accident data. It must be able to advise on accident risks, seek potential causes, suggest remedial action and publicize accidents and their causes so that all may benefit from the experience of the few. Thus, flight safety does not run counter to the operational aims of the service, rather it enhances mission capability. ★

AIRCREW JUDGMENT-- NOT GONE OR FORGOTTEN

CAPTAIN DAVID V. FROEHLICH
Directorate of Aerospace Safety

Those of us who have flown airplanes for a few years have, at times, become involved in discussions of the amount of written guidance "available" to aircrews. These same discussions have invariably had at least one voice which cried aloud: "They're taking away all of the judgment by the aircrew." I TAKE EXCEPTION!

Maybe it's time to think about our vast array of flying rules, regulations, and restrictions in a new light. We tend to think of numbers and limits only in terms of maximums or minimums. Maximums are usually figures based on equipment limitations and minimums are based on safety margins. Only rarely does a regulation contain a "recommended" or "optimum" figure. Due to this lack of "optimums," more judgment is required by the aircrew than ever before. Let me illustrate with a discussion of maximums and minimums.

MAXIMUMS

These "highest allowable" numbers often take the most hits during hangar flying sessions. I submit that, deep down, we all know that a maximum exists for a reason, whether it is based on safety margin, equipment life or body life. Crew duty day, for example, is defined in terms of a "maximum" number of hours for which a crew member may perform duty. It seems only common sense that two or three hours of "weather busting" takes more out of a pilot than the same time period of auto-pilot droning. By the same token, if a loadmaster has been through the bag-drag mill for several hours, he is definitely more mishap and injury prone than the individual fresh on the job. A "maximum flight duty period" is just that! The judgment of the crew member takes precedence. If circumstances reduce efficiency because of extraordinarily demanding conditions, it is the responsibility of individuals to determine their own personal maximum crew duty day. AFR 60-1 states: "Aircraft commanders will terminate a flight when safety may be compromised by fatigue factors regardless of flight duty periods authorized." I can hear it now. "Boy, my ops officer would tack me on the wall if I terminated the mission early because I thought my crew was too tired to press." Don't you believe it! Every commander and supervisor I've known would much rather take an honest shot in the statistics and have to explain a delayed or cancelled mission than have to explain a mishap or notify next-of-kin.

Aircraft limitations are another oft-times attacked subject in discussions at the "ol' watering hole." The typical comment is: "I've been having over-Gs (you may substitute any number of appropriate limitation excursions) since I started flying and never pulled the wings off one yet. . . ." This is another area for aircrew judgment and responsibility. If the aircraft has a Dash One "G" limit of +6.0, that's a maximum! If the mission requires pulling the pole, do it! If the extra Gs aren't necessary, the name of the game is equipment life. This philosophy should apply to all phases and types of operation. Engine and airframe life are a function of how you, the aircrew, use the equipment. The point—maximums are there to be used only when mission requirements dictate. It's the responsibility of the aircrew to use judgment in the determination of aircraft (and equipment) usage versus mission profile.

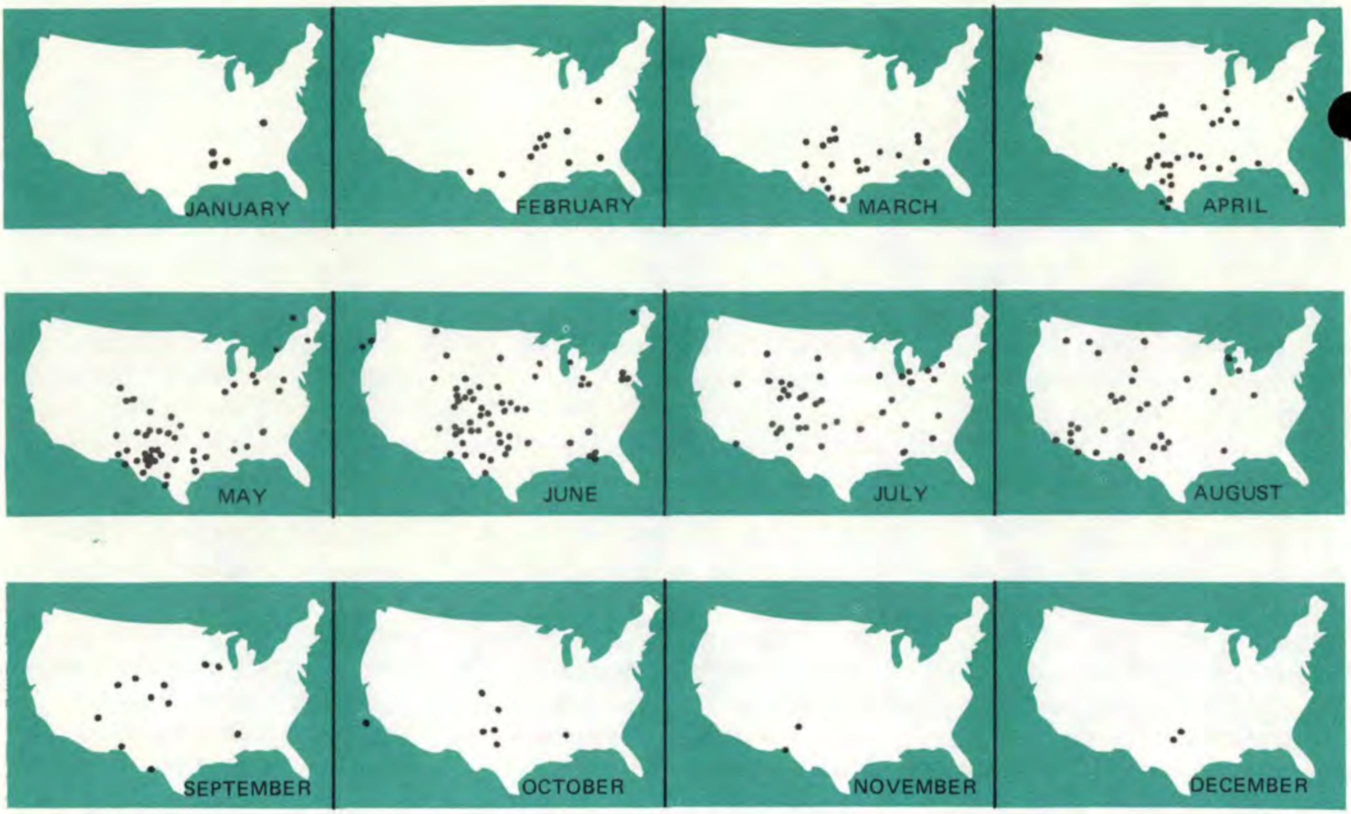
MINIMUMS

This is another area which definitely requires judgment! Minimums of various types are found in 60-16, approach plates, Dash One's and any number of other publications dealing with aircraft operations. Minimums are (again) just that! They are the lowest figures which have been calculated to provide a required safety margin for equipment operation, aircraft performance or aircrew survival. Aircrew members need to keep this rationale in mind when dealing with "minimums." Circumstances may cause those figures to be too low for your particular situation. Again, hopefully, common sense takes over for the crew having electrical fluctuations at altitude and facing either their 500 and 2 destination or VFR alternate. Sure, the weather is above minimums but to me, that VFR alternate is the place to go if you have any hints of electrical gremlins. Judgment is the real name of the game. Lots of folks have bought the farm because of too much pride to go to an alternate when things are going sour. Press-on-itis will catch up to you eventually. I can't say it loud enough—minimums are **minimums!**

Every day there is always one message in the stack of Class A, B, or C's that shouts "lack of judgment, they pushed too hard or too far." We tragically lose several folks every year who stay with a sick air machine until below ejection minimums. If your Dash One says "2,000' minimum controlled ejection altitude," would you stay with a dying bird to descend from your present 3,000' down to 2,000'? This is a judgment call which deals with life or death in many cases. Minimums may need to be adjusted upward if the situation dictates.

Whether you're dealing with a transport or air-to-mud mission, a healthy or not-so-healthy machine, or a single-seat versus multi-place aircraft, safe and successful mission accomplishment requires continuing judgment. Don't let untempered reliance upon minimum or maximum numbers turn you into a statistic! ★

Figure 1



Hail encounter distribution from a study conducted some years ago. Each encounter caused damage to aircraft.

HAIL HAZARDS

When modern, high-speed aircraft encounter hail in flight, it is well known that the results can be quite unsettling. And we are in the midst of the US hail season. The number of aircraft encounters with hail is highest from June through August, and the main concentration is in the South and the area between the Mississippi River and the Rocky mountains. Of course, you can tangle with hail any time in the year, but if you get past September, the odds are way in your favor until March in the South and Southwest.

Now, we don't wish to belabor the fact that hail and aircraft don't mix, but we would like to elaborate a little on the kinematics of hail-producing thunderstorms and some of the things flight crews can do to avoid sustaining expensive or possibly even pernicious damage.

Hail can form in cumulus and cumulonimbus clouds with strong, rising convective currents in a similar manner as ice forms on aircraft; that is, when a solid object with a surface temperature at (or below) the freezing point of water comes in contact with supercooled water droplets which freeze, the object undergoes ice accretion. The birth of a hailstone occurs when a supercooled drop combines with certain kinds of dust particles or by collision of the drop with an ice particle. Hailstones thus grow in the updrafts of convective clouds by sweeping up supercooled droplets above the freezing level. While a hailstone is growing in such an updraft, it always falls at its terminal velocity with respect to the air: the velocity at which the wind resistance keeps it from accelerating. When the velocity of the updraft equals the terminal velocity of the hailstone,

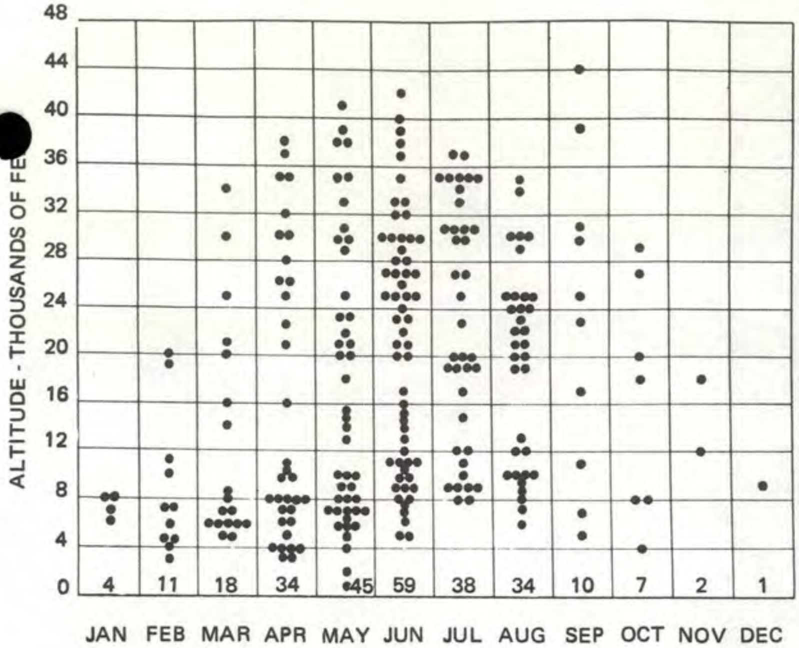
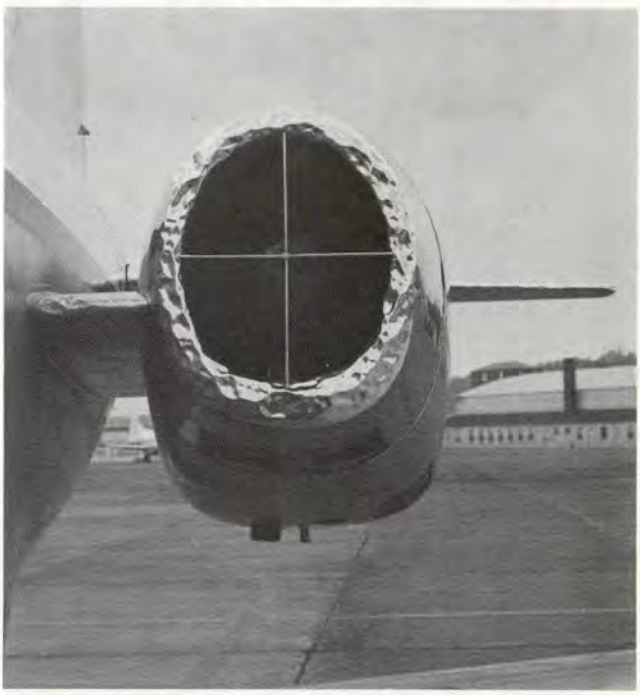


Figure 2

C-141 radome destroyed in encounter with hail.

the hailstone remains at a constant altitude until the updraft velocity changes or it grows larger (thus increasing its terminal velocity).

The magnitude and direction of these updrafts can cause the hail to be ejected from the top or sides of the storm, which of course presents a hazard to an unsuspecting flight crew. It has been computed that the ejection of hail would be at the altitude where the horizontal flow overcomes the force of vertical motion (shear zone). The direction of the wind flow above the 500-millibar level in conjunction with the location of the shear zone may help to identify the side where the hail fallout occurs. In plain language, this means that flight crews should avoid the sides of the thunderstorm cell and not fly under the anvil top—especially on the downwind side. As a general rule of thumb: If possible, get no closer than 2 or 3 miles in any direction of the intense thunderstorm radar echo and remain 10 miles away from the downwind side. Without radar, try to stay at least that far outside the cloud.



T-39 intake appears to have been attacked with a ball peen hammer. Note damage to leading edge of horizontal stabilizers.

In summary, hail will form when the following conditions are met:

- The cloud must grow sufficiently far above the freezing level to produce ice particles.
- The cloud must contain sufficient quantities of supercooled water droplets and strong updrafts to allow the ice particles to grow to hail size.
- Hailstones form only when a quantity of the large supercooled droplets, which occur in cumulus type clouds, are carried to altitudes well above the freezing level. These droplets freeze to form the nuclei for hailstones.

Although these are necessary conditions, they are evidently not sufficient because not all such clouds produce hail. A final note, however, to those who are flying in and around thunderstorms: never assume that a particular storm cell is free of hail. (Adapted from **Air Safety Review**). ★

CAPTAIN

William W. Hillman

FIRST LIEUTENANT

Clyde M. Russell, Jr.

67th Tactical Fighter Squadron

On 24 November 1977, Captain Hillman and Lieutenant Russell were lead of a two-ship formation of F-4C aircraft. Shortly after takeoff, the wingman's aircraft experienced problems and was escorted back to home base. During the landing phase, Captain Hillman attempted to lower the gear, but the left main gear remained in the up and locked position. Checklist procedures were employed to extend the gear, but all efforts failed. An attempt was made to raise the gear using the emergency retraction procedures outlined in the checklist, but despite all attempts, the nose gear and right main gear remained down. The crew was now faced with only two options: ejection or landing under less than favorable conditions. They decided to try an approach end cable arrestment. The runway was foamed as a precaution to reduce the possibility of fire. Captain Hillman and Lieutenant Russell discussed all the aspects of the landing to include ejection parameters, the possibility of a cut cable or hook miss, and emergency ground egress. After lowering the hook, a low approach was flown to observe the foam pattern, and they decided to fly a 17-unit half-flap approach so that an attempt could be made to keep the left wing off the ground until cable engagement. A perfect touchdown 250 feet short of the cable and in the foam pattern was made, resulting in a successful cable engagement. The drag chute was deployed, and the throttles and master switches were turned off to further preclude any fire possibility. The aircraft came to a stop at a 30° angle from the runway heading with the nose gear and left wing tank off the runway. Aircraft damage was limited to the left external wing tank. Captain Hillman and Lieutenant Russell displayed exceptional skill, detailed system knowledge, and outstanding crew coordination in analyzing and overcoming this in-flight emergency. Their timely actions and professional skill possibly saved a valuable aircraft. WELL DONE! ★

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UNITED STATES AIR FORCE

Well Done Award

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

Top Row, L to R—SSgt Robert E. Wright, Jr., MSgt Roosevelt Williams, SMSgt James A. Copeland, SSgt Karl S. Freienmuth, 1st Lt Israel S. Yarchun. Bottom Row, L to R—Capt Ronald Pregmon, Capt James W. Thompkins, Capt Robert T. Brown, Capt Chester J. Trosky, Jr., 1st Lt James E. Colotta.

CAPTAIN

Chester J. Trosky, Jr. and Crew

53d Military Airlift Squadron
Norton Air Force Base, California

On 31 October 1977, shortly after liftoff, Captain Trosky, aircraft commander, and crew were faced with an extreme emergency when their C-141 aircraft experienced massive failure of the number three engine. The ejected turbine parts penetrated the number four engine, causing it to seize immediately. The parts also penetrated the fuselage wall, igniting the cargo. Operating without numbers three and four engines, at low altitude, and in an unfamiliar environment, they successfully suppressed the cargo fire and made an otherwise uneventful landing. The skillful handling of the critical situation by Captain Trosky and crew, their rapid appraisal, and prompt and positive actions throughout this emergency are a tribute to the dedicated professionals they have proven themselves to be. WELL DONE! ★


U.S. AIR FORCE