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Aerospace SAFETY

THE MAGAZINE DEVOTED TO YOUR INTEREST IN FLIGHT

The IP • Whirlwinds of Disaster
Have Yourself A Plan • New Survival Kit for F-4s

Tell Us A War Story, Mac

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SPECIAL FEATURES

REGULAR FEATURES

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PREFLIGHT

A little fiction, a lot of fact, items you can use, and a bit of philosophy are to be found in this month's *Aerospace Safety*. One article was borrowed from the Army, "Tell Us a War Story, Mac," beginning on page 10. The article is entertaining in that it includes a couple of exciting war stories, but the author's objective was not just entertainment. He has a point to make that is just as appropriate for Air Force crews as for the Army types.

Occasionally instructor pilots and students are involved in accidents, some of them fatal, during training flights. Too often the accident results from the IP permitting the student to allow the situation to deteriorate to the point where neither can recover the aircraft. Sometimes this occurs at a critical point, such as turning final approach. A mistake here and slow reaction by the IP may be catastrophic.

The question that is as old as aviation is, *how far may an instructor permit a student to go before the IP takes over?* There doesn't seem to be any all-inclusive answer to this. Probably each case has to be judged by the instructor based on his own experience and capabilities.

"The IP," page 2, may provide some food for thought for IPs and pilots who occasionally ride with IPs or who may someday find themselves performing this very important, very demanding job.

"IPIS Approach" has been a much read feature of *Aerospace Safety* for several years. Recognizing that changes occur and wanting to keep the record straight, the IPIS people have gone back over the material from the beginning of the feature and updated a number of items. Pilots would do well to check these items, pages 6 and 7, just in case. ★

MUSINGS IN THE RSU

Maj Victor K. Macomber, 31 Tac Ftr Wg, 7AF, PACAF

Sitting in the RSU watching departures and recoveries one rainy day, I wished that I could ask each jock a couple of questions. I wanted to know just how worried we ought to be about executing today's frag with this monsoon weather moving through. Inasmuch as we are primarily interested in tactics and weaponry these days, I wondered how many really stop and think occasionally about the instrument flying techniques we take pretty much for granted but which, if neglected, can ruin a day just as surely as a short round or a low blow. So I wrote down a short list of questions that you fighter jocks might answer to yourself as a "how-goes-it review" of *your* instrument awareness:

• Do you make an instrument cockpit check before you hit the arming area? Discovering a compass hung up 30 degrees off the runway heading during takeoff roll is a little late.

• Do you have a plan for landing immediately after takeoff in minimum weather? Do you know your safe final approach speed with and without ordnance? With full fuel?

• Do you constantly fly instruments as if your alter ego were hanging on to your wing? We make a lot of single ship takeoffs and landings but every jock is still a potential flight leader on every flight.

• Speaking of unexpectedly assuming the lead, are you always navigating and aware of approximate heading and distance to the nearest emergency field?

• Do you know what allowances must be made to bring a wingman safely back in weather for each of the HEFOE emergency situations (Hydraulic, Electrical, Fuel, Oxygen, Engine)? Coming back on the wing in weather with complete electrical failure earlier this year, a "wingman-turned-leader" made things real sporty because he forgot that I had no trim.

• Do you consistently use all available navigational aids? Remember TACAN is not infallible and RADAR has the disconcerting trait of becoming unreliable in rain. The old bird dog in the F-100 can come through if you have it tuned in and working for you. It's also a convenient tool for catching the 40 degree TACAN error which still sneaks in once in awhile.

• Do you review the letdown plates for your divert airports from time to time? An unfamiliar letdown in the rain makes for a mighty nervous approach.

• Do you know minimum altitudes? Violating circling minima to stay VMC, for instance, is no passport to long life, particularly when turning final with unexpended ordnance where military power will barely sustain level flight.

• Speaking of minima, are you sure which number represents the minimum MSL altitude on each of your approach plates for alternate airports?

So how did you score yourself? Did you answer NO to any of the questions? If so, your professionalism is slipping and you're beginning to draw unnecessarily from your ration of luck. It's a nice thing, not having to sit through the annual instrument refresher course, take the written exam, or fly the check ride under the bag over here; but this business demands a degree of professionalism in instrument flight higher than previously required. Always be aware that the combat environment increases the likelihood of an emergency being mixed into the weather equation. A lot of people are depending (some may be staking their lives) on your safe passage to the target to deliver your load and safe return for another trip. DO YOU MEASURE UP? (Courtesy Combat Safety) ★

THE IP

So far the flight had been routine—a final check ride for the major in the front seat, who was checking out in a single engine jet for the first time but who had performed beautifully on this ride as on the previous flights.

The IP in the back seat mentally reviewed the maneuvers they had performed and decided it was time to head home. He'd give the student a simulated flameout landing, then they would make a full stop and that would be it.

"This will be an SFO, then give me a good full stop landing and we'll call it quits."

"Rog, an SFO."

Everything was going well so he relaxed, idly watching the cars on the freeway below. Then they were turning final. He called the tower to reiterate their intentions and made a gear check. His eyes were measuring the distance to the end of the runway while noting that the airspeed was a tad low. Now he tensed slightly, wondering if the major would bust it, which would mean a go around and another try. He wasn't catching it—if he didn't add power they would be short. In a second he would have to take over. Must be a slight downdraft here over the gully—they were beginning to sink rapidly.

"I got it," he said, while tightening his grip on the stick and pushing the throttle to military.

The approach to runway 35 at Fantasy Air Force Base is over a fairly shallow gully about 500 yards wide that terminates in a rather sharp embankment with rock outcroppings some 1000 feet short of the overrun. When the wind blows from the north there is a downdraft on the runway side of the gully, an updraft when the wind blows out of the south. The wind today was light but strong enough to create a slight downflow over the rocks into the gully. Base pilots were familiar with this condition and planned accordingly. Transients, even when warned by the tower, were apt to be fooled and the Ops people were accustomed to their comments.

As he shoved the throttle forward, the first alarm was ringing in his brain. That damn downdraft—he hadn't reckoned with that in his sense of well being and satisfaction that the man in the front seat was fully capable. He shoved harder on the throttle. Where was the power? All he could see now were the rocks on the cliff ahead and the flat expanse of the runway above the nose. Reflexively he pulled back on the stick, knowing that it was futile. "Oh ______."

The T-33 slammed into the rocks, nose high, its belly just inches from clearing the ledge. The nose gear snapped first then the fuselage and main gear hit almost at once. The aircraft bounced up several feet, yawed left and slammed into the ground on the right wingtip. The wing crumpled and the bird flipped, bouncing and cartwheeling until the wreckage finally ground to a stop on the overrun. Burning fuel left a thousand foot trail across the ground from the cliff to the flaming pile of wreckage.

He jerked upright in bed, flinging the covers aside, the blazing pyre of the airplane still etched in his mind. He was sweating and shaking. Now full consciousness took over and he realized the terrible scene had been simply a dream. He shook his head and wiped an arm across his forehead, remnants of the nightmare still lingering in his brain. He looked at his wife, relaxed and sound asleep beside him. He still had the shakes, so he got up and went to the bathroom. Cold water helped but he was in no mood for sleep now. Slightly confused, he hunted for his slippers, found them, and went to the kitchen where he poured a glass of milk and stood contemplating that awful dream.

He wasn't one to dream very often and when he did he couldn't

remember anything the next morning. Why was this one so vivid? Was his mind trying to tell him something? Yes, his student of the previous morning had busted an SFO but it hadn't been even close. He'd reacted early, telling the student to add power, which the man had done, and the approach had turned out beautifully. Besides, that student had been a lieutenant colonel, not a major. He hadn't even flown with a major for more than two weeks. He searched his mind, trying to account for the realness, the sheer terror of that vivid dream. Slowly, a step at a time, he began to piece things together.

One of the fellows *had* had a close one a few days ago, at that same place. Then last week the boss had briefed the IPs on a fatal accident at another base in which both crewmembers had been killed when the IP was too late in taking corrective action. Had his mind juxtaposed those two events to form a terrifying dream in which he was the victim? Was he beginning to have some doubts about himself? IPs sometimes get complacent and let students go too far. Others get to the point where they trust no one.

The workload had been pretty heavy, a lot of the men he had been checking out lately had little or no previous single engine jet time. Most of them were SEA returnees going into a kind of flying in which they had no previous experience. Maybe he was just tired — needed some time off. He didn't know.

He took the last swallow of milk and put the glass in the sink. He thought he would go to bed, but he still had an uneasy feeling. That dream had really been a doozy. And the crash again filtered across his mind. No, he wasn't a bit sleepy. He went into the living room and sat down. Now he really began to think, eyes closed, concentrating on what the dream meant—what it meant to him.

Was he a good IP? What were the earmarks of a good instructor? He had always been confident of his abilities. He thought he was a good instructor. But was he really? How does one know?

Gradually his mind began to form thoughts in an orderly fashion. Across a mental blackboard his mind wrote his thoughts. A good instructor was many things but basically he had two responsibilities:

- Teach
- Act as a safety pilot.

Many others came to mind but he listed them under these headings. And he realized that there was a difference between the kind of instructing he did and that of the IP who deals with youngsters just learning to fly.

For one thing, there was rank. Occasionally he had a full colonel in the front seat; lieutenant colonels were fairly common. Even if the man's rank didn't awe him, a captain, there was still a delicate relationship. It wasn't deference. And yet it was. One had to be firm and aggressive, to a point, but keep firmly in mind that the *student* may have four or five times as much total flying time as he and many more years of experience, possibly including two or three wars.

Some of them were excellent pilots who simply hadn't had single engine jet experience. They caught on quickly and were apt to be aggressive, especially when they became proficient enough to gain full confidence. Experience had taught him that this could be the danger point. The sheer pleasure of flying a highly maneuverable, fighter-type aircraft seemed to make a would-be tiger out of some of the older men. In their eyes one could see visions of goggles and white scarves.

A few of them reached the point where confidence exceeded proficiency. This was where the second line, "Act as a safety pilot," came into play. He guessed it was a little like being the parent of a teenager. You had to keep an eye on the child and guide him out of trouble while, at the same time, somehow, you had to allow him enough rein to learn.

Now he tried to picture himself as his students saw him. This wasn't easy. Take the lieutenant colonel he'd been working with for the past few days. He had come to the base from a SEA job where he'd been flying C-123s. He had a total of over 9000 hours, all of it in big birds, including both jets and recips. Now he was learning the T-33 as a support pilot. He was sharp, had been to ground school and had thoroughly digested the Dash One. The guy had taken it upon himself to get all the trainer time he could. He had been doing a beautiful job of flying during the checkout program. But this morning he had almost got behind the curve on an approach. What would have happened if he had been alone? As the IP, he had had to warn the man to add power. Would he have done so anyway? He didn't know. Maybe he had spoken too soon. How far do you let a student go?

The instructor pilot has a responsibility, in fact many responsibilities, come to think of it. He hadn't thought of his job in just that way before. He was, of course, responsible to his student to ensure his safety. And he was responsible to the Air Force for the aircraft and crew. But, he thought, I'm responsible to me too—to myself and my family.

He was beginning to feel drowsy and realized that his thoughts for the past half hour had taken the edge off the nervousness induced by the dream. So he began to sum up his thinking.

First, he was a teacher, in the strictest sense of the word. His job was to guide and instruct his students—regardless of their rank, or how many hours of flying time they had, or how sharp they appeared to be—in the intracacies of flying that particular airplane as well as in any procedures and practices common to all aircraft that they weren't current on.

The key to this phase, he felt, was in making a thorough briefing and ensuring that there was complete understanding between him and the student on every point. This not only saved a lot of time in the air, and a lot of unnecessary chatter, but also assured that in an emergency both crewmembers would know what to do and what to expect from the other man. He had always made it a point to make sure that emergency procedures were mutually understood. But he realized that sometimes he was guilty of rushing through the briefing when the student was of higher rank and in a hurry. He didn't like it, but he did it. Well, he wouldn't anymore. He owed that to both the student and himself.

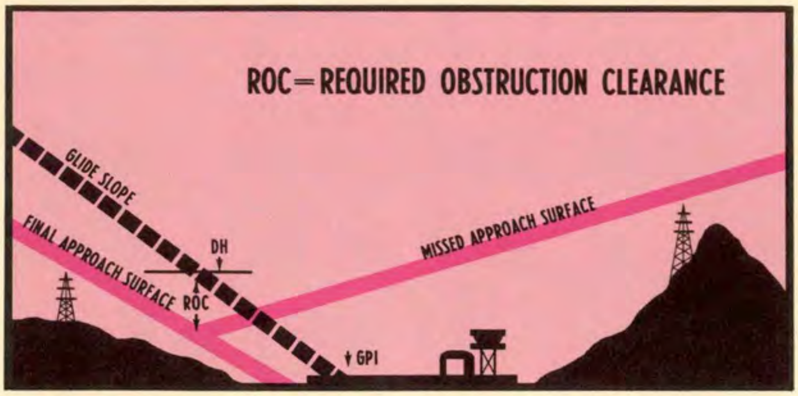
As for the second point—act as a safety pilot—he would have to think about that some more. Of course, he had considered this question before. The subject frequently came up in the office, usually in the form of a hairy story. He remembered accident briefs he had read that listed the primary cause as something like, "The instructor pilot allowed the student to maneuver the aircraft into a position where recovery was impossible."

But where do you draw the line? He resolved to talk to his boss about it in the morning. Meanwhile, however, he decided that this must be some invisible point in the instructor's mind. And that point would be determined on an individual basis, depending on the instructor's experience, skill, judgment and integrity. Plus, he added, sense of responsibility. Placing that point exactly—the line beyond where a student must not be permitted to go—without unnecessarily binding the man's freedom of action, and without destroying the learning potential, would require all of one's faculties. There could be no room for relaxation. No place for complacency. The IP must be alert and completely prepared from the time he briefed for the flight until the wheels were in the chocks. And, as a matter of fact, this extended through the post flight briefing. You had to have the guts to tell the student what he had done wrong, what he needed to improve upon. He smiled, remembering a somewhat belligerent type he'd had as a student when he first started instructing. The guy was pretty good, but he thought he knew it all and he wasn't about to take criticism from this upstart captain. He'd had a few rough moments, but later they had become friends. Maybe he had pressed a little hard. You don't have to beat the guy over the head with his mistakes.

Well, he had to get some sleep. As he walked down the hall to the bedroom, he thought over his summation. Maybe he would wind up being the best IP in the Air Force. With that thought he got into bed and went immediately to sleep. And there were no more dreams that night. ★

the I.P.I.S. approach

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas



THE HEIGHT OF DECISION

With the conversion to JAFM 55-9 (TERPs) criteria, the term Decision Height (DH) has replaced the old term minimum altitude. One could well ask: What's the difference and why the change? Let's examine the intent of the change.

Despite several erroneous definitions and interpretations which are prevalent, the definitions of DH and MDA are not the same. DH is the lowest MSL altitude at which a missed approach will be *initiated* when visual reference has not been established with the runway environment. Whereas, an MDA is the lowest altitude authorized until the runway environment is sighted. (AFR 60-27). Unlike the old minimum altitude concept, DH applies only to precision approaches; it corrects for any difference between the published field elevation and the runway touchdown zone elevation; and it may be lower than the minimum weather ceiling required to start the approach. A published DH is intended as a reference point on a glide slope from which the pilot can land visually. If the weather observation was correct and had been carefully considered before starting the approach, chances of a missed approach are proportionately small. However, missed approaches are critical maneuvers, and most of the DH questions are about this subject.

Q Is it acceptable for an aircraft to sink below a DH while transitioning to a missed approach climb?

A If a missed approach is initiated at the DH, the aircraft will undoubtedly pass through the DH during the transition to a climb. This is to be expected and was considered when the DH concept was established. The DH is not an altitude to be "bounced off." It is an altitude selected, after consideration of navigational equipment and pilot capabilities, to provide a safe decision point—a decision to land visually or to execute a missed approach.

The preceding question identifies a weakness in many of our training and evaluation programs. Frequently, stress is placed on the wrong items. Instead of emphasizing the importance of correct decisions, proper missed approach attitudes, and timely power applications at DH, an unrealistic significance is attached to the number of feet of altitude lost in the transition. Flight examiners have failed pilots for normal variations below a DH while transitioning to a missed approach. Other pilots, to ensure that the DH is not violated, increase airspeed and power early. They climb above the desired glide slope and may not reach DH at the missed approach point. Results, if a landing is possible—long touchdowns, excessive landing rolls, or the sink problems associated with idle power dives for the end of the runway. An unsafe habit pattern may develop—perhaps just to prevent an imprecise pressure altimeter from momentarily dipping below a DH figure.

The transition from an instrument approach to a visual landing is enough of a challenge without further complications. If a pilot is taught to be high on airspeed at DH, if he is taught to reduce his rate of descent before DH, if he is taught to be "decision height shy," he may be unable to safely land the aircraft. The misunderstanding of DH intent can completely negate the improvements that have been made in all weather landing systems.

Continually practicing instrument approaches with the prior intent of making a missed approach at DH can also result in poor habits. Practice instrument approaches should be planned as if a landing were intended. Missed approach decisions should not be made until the DH is reached. IPs, let's place the emphasis where it belongs. Airspeed and attitude control, recognition of minimums and the correct missed approach or landing decision are the real subjects of concern.

Logically, the next question is: How far below a DH can an aircraft be allowed to descend during a missed approach transition?

ANSWER: An exact answer for all aircraft is impossible. Most Air Force aircraft will transition into a climb with a minimum of further altitude loss. However, consider the following facts as guides.

All DHs are already above the missed approach surface (Fig. 1). A pilot executing a missed approach is concerned with the required obstruction clearance (ROC) provided at DH. This ROC varies with the DH and glide slope angle.

REQUIRED OBSTRUCTION CLEARANCE (ROC) AT DECISION HEIGHT

DECISION HEIGHT	GLIDE SLOPE 2.0°	GLIDE SLOPE 2.5°	GLIDE SLOPE 3.0°
100ft	87ft	74ft	65ft
200ft	155ft	128ft	111ft
300ft	224ft	183ft	155ft

If a pilot cannot transition to a climb within the ROC provided, he will violate the missed approach clearance plane—this should be avoided. Now, if your particular aircraft cannot transition into a normal instrument climb within the appropriate ROC, you will have to select a higher DH. A published DH is the *lowest* DH authorized. Higher DHs can be used, and some major commands do require higher DHs. Remember, though, if you use a higher than published DH, you will also need higher weather minimums. Lots of valuable fuel can be wasted starting an approach to a 100-foot ceiling if a pilot is aircraft-restricted to a 200-foot DH.

In summary, treat the DH concept as it is intended. Know your aircraft and fly a precision approach to arrive at DH on glide slope with the correct airspeed and rate of descent. ★

The *IPIS Approach* was first published as a recurring feature in *Aerospace Safety* magazine in January 1965. Since then instrument procedures have been continually revised so the following corrections are supplied:

January 1965: The procedure quoted in "Point to Ponder" is no longer authorized. An aircraft experiencing radio failure may not leave an assigned altitude and climb to the lowest cardinal altitude (thousand-foot levels) at or above the MEA of the highest route structure filed. FLIP II, Par S, 3, b, contains the current procedure.

April 1965: The term jet enroute penetration used in "Point to Ponder" has been changed to turbojet enroute descent.

May 1965: The second question and answer are invalid as they refer to the obsolete procedure described in the January 1965 correction.

September 1965: The first question and answer are invalid. VFR flights are no longer authorized along airways.

January 1966: The "Point to Ponder" item is invalid as it refers to the obsolete procedure described in the September 1965 correction.

January 1966: The circling approach minimums described in the first question only apply to approaches which have not been converted to JAFM 55-9 (TERPs). The majority of instrument approaches have converted to TERPs, and circling approach minimums vary by aircraft category.

March 1966: The enroute penetration referred to in the first question has been changed to turbojet enroute descent.

February 1967: The AFM 51-37 procedure quoted in the first question: "When departing the station, make a level turn in the shortest direction to parallel the penetration course" has been changed. AFM 51-37, Change 1, page 11-16, contains the current procedure: "After crossing the IAF, turn in the shorter direction toward the penetration course. Start descent when the aircraft is over or abeam the fix, headed in the direction of the penetration course."

August 1967: The quoted definition of decision height (DH) is incorrect. The correct definition is contained in AFR 60-27: "Decision Height (DH) is an altitude specified in feet above MSL, at which a missed approach will be initiated when visual reference has not been established with the runway environment." ★

1+25 to almos

Maj S. J. Templeton, Eastern ARRC, Robins AFB, GA.

NOTE: This is a true story. Names, personal data and other identifying aspects of the mission have been changed.

Holiday seasons alert the men who watch over the USAF Air Rescue Service search and rescue centers in the U.S. to prepare themselves for the inevitable SAR missions that go with these otherwise happy times of the year. Millions of Americans are on the move for long awaited family reunions; thousands of light private airplanes are in the air with families heading in every direction to be "home" for the holidays. Every year there are those that do not arrive. This is the story of one such flight on December 24, 1968.

George and Irene Anderson were well on their way home to be with their families for Christmas. This was a trip that had been planned for months and would be a chance to show everyone their new Piper that George had bought for use in his construction business in Dallas. All of the Christmas shopping had been done in those last hectic days; the packages were wrapped and neatly stored in the luggage compartment; there was George's usual expert touch in all the plans for their trip. Their flight was easy to the half-way point. A light lunch, the airplane serviced and they were off on the last leg of the flight.

George had every reason to be proud of his success in life. He had been out of the Air Force for only five years and his construction company had become a success beyond his brightest hopes. During 20 years in the Air Force he had been one of its best pilots flying the line in MAC and retired a major with over 10,000 hours in his Form 5. Having his own plane in civilian life was like having a car to anyone else. He loved every minute in the air.

Yes, life had been good to George Anderson. He was in perfect health. He was a success in every way. His children were now grown and happy in their lives, too. Happiness to George and Irene was getting away from it all and keeping on the move just as they had done in the Air Force.

This would be a special Christmas for them. All of the Anderson family clan had planned a really big Christmas celebration at the family home. Irene's family would be there, too. It would be the biggest event in the year for everyone. George's mother, two brothers and his new sister-in-law would be at the airport to meet them. There was no question about rolling the chocks on *this* ETA.

It was an easy flight to figure. A straight line on the map, 052°, 1 + 25 enroute. The weather was a little bad, even bordering on marginal at the destination airport. But George figured the long range forecast of 8000 feet, 7 miles in light snow showers would hold up. Regardless, he had a new plane with a perfectly working VHF transceiver and he knew he could slip in anywhere.

Flying a small plane with just you and your wife would allow you to do things they never would allow in the "big" ones. After all, on a VFR clearance into the Big City area without talking to Big City Center, who would know you were there? It was worth the chance, he could always stay low, VFR, if the weather got to bad.

George looked over his charts (those good ol' WACs, they're all you need to fly anyplace!) and

t home

noted the sharp rise in terrain to the east of his course. No problem—just stay on track and if you have to dodge around to stay in contact with the ground, do it to the west. Very simple!

Next came the last minute weather check. No one seemed to be quite sure about the enroute weather. The cold front that had passed was slowing down and could cause lower ceilings and more snow. It only took a moment to fill out a VFR clearance, departure point and destination. No sweat at all.

The sleek little plane eased into the air and climbed effortlessly to 6000 feet. They were on their way now, only a little over an hour and they would be seeing the smiling faces of their loved ones at last. George had the VOR locked on the first check point and watched the needle as it obviously hung on to the station. Between his WAC chart and that needle, he could tell within ten feet of where he was, even in that white sky, flying over the snow-covered land down below.

It was snowing only lightly now and George had moments when there was no contact with the ground, but the VOR needle was strong on every station so there really wasn't anything to be concerned about. The flight was almost half over and he would be tuning in Home Town VOR soon. It would be a simple maneuver, tracking out on 055° from there into the airport.

George and Irene were 30 minutes out from Home Town VOR now. The VOR frequency was changed on September 1 to 115.3; the ground elevation at the VOR is 1200, the elevation of the airport is 1240. Four months ago the frequency was 117.2 but was changed by the FAA to fit into the high altitude structure serving the Big City area. As always, when changing frequencies, proper notification through NOTAMS, chart changes, etc., was made by the FAA to all the aeronautical agencies in the U.S. Frequency 117.2 was moved 36 miles east to the Mountain View VOR, surface elevation 3010 feet.

One thing George always prided himself in as a pilot was that he kept a clean ship. His map case was complete. He took careful pains to keep his maps neat and in order. Even now he could "see" where he was on his chart by the radials that his trusty VOR was telling him. It was a comfortable feeling to be so sure of himself. It was time now to tune in the Home Town VOR. Should be no problem picking it up now, only 30 minutes out.

George checked his chart, read 117.2 for Home Town and tuned it in. The VOR needle didn't hesitate and began swinging around toward the 052° heading, but stopped at 077°. George thought this strange, but he had been fudging a little to the left of course and he had been maneuvering maybe a little more than he thought to stay VFR, so he must have gotten off course to the west. No sweat—just pick up a heading to intercept 055° and you can forget navigation, you're home free.

George was feeling a little guilty about being IFR most of the time now. But the flight will be over soon and he'll slip through OK. He was down to 3750 feet now in order to keep under the clouds, but that still gave him good terrain clearance into Home Town. He tuned in the Home Town tower, checked his time and knew he'd be over the VOR in a few minutes. Ah, yes, there goes the trusty needle — "Home Town tower, this is Piper 3479J over the VORTAC, descending for landing at Home Town, over."

"Piper 3479J, this is Home Town tower, you are cleared for an approach to Home Town, call three miles final. Current weather 700 overcast, 1¼ miles in snow showers, wind out of the northwest at 15 knots, gusts to 22."

Silence.

Piper 3479J did not respond, nor did the airplane arrive at Home Town. The family waited, but when George and Irene didn't arrive, they went home to wait for the call telling them they couldn't make it because of the weather. It was Christmas Eve.

Four days later the search directed by the Eastern Aerospace Rescue and Recovery Center at Robins AFB found Piper 3479J crumpled against a jagged mountain close to the Mountain View VOR. The elevation was 3010 feet. The approach plate to Home Town Airport indicated 3000 feet as the approach altitude. George and Irene were dead. The recovery ground party found them in their plane, crumpled Christmas packages in the snow close by and George's map case still intact. It was thrown clear and all of his maps that he had kept so neat for all those years were in still new condition.

Maps are like people who fly. They must be kept up to date. This is a changing world and none of us want to get off until old age catches up. Frequently the latest charts don't even tell it all and NOTAMS give us the information we need to complete the mission. ★

TELL US A WAR STORY, MAC

MAJ ROBERT E. POSTON, USA

War stories are exciting and thrilling. But think of all the knowledge, all of the experience gained the hard way that is shared with only a few friends, when they get together. Air Force crews are learning a lot these days. Tell a war story, but tell it where the information can be put to use most effectively—up through official channels.

ED. NOTE: This article was a monthly winner in the U.S. Army Aviation Digest Annual Award contest. While the "war stories" it contains are about Army aviation, the point of the article is valid for all services. We highly commend its reading to all USAF crews. We have taken the liberty of editing the article slightly and have substituted Air Force for Army terminology in some places. Editor.

The infantry company was in trouble. Intense fire from the fortified treeline to their front had them pinned down in the rice paddies and open area which they were attempting to cross. Now sporadic fire was beginning to come from both flanks as the enemy attempted to encircle the company position. What had begun as a fairly routine search and destroy operation was fast becoming a fight for survival in a cleverly set enemy trap.

It must have seemed to the company commander that everything that could possibly go wrong this day had already done so. Only moments before, when his company was not meeting resistance, he had requested that the supporting artillery battery be moved forward so that he would not move out of range of its supporting fires. Now, when he desperately needed fire support, the battery was enroute by helicopters to its new position. Although the move would be rapid, each minute could very well cost the lives of men in his company. He thought of tactical air support, but as he looked upward at the layers of low clouds above his position, he knew that the aircraft could not find nor support him under the 200 to 300 foot broken ceiling.

He reported his perilous situation to the battalion commander who advised that a platoon of aerial artillery had been dispatched to support the company while the tube artillery was moving, and that the rocket armed helicopters should be nearing his position. Almost immediately, the radio operator reported that the platoon leader of the aerial artillery had checked into the company net. The helicopters were approximately seven kilometers south of the company position, but were encountering zero ceilings and patchy ground fog.

As the company commander glanced skyward to recheck the weather over his position, it seemed that fate had indeed chosen this day to plot against him. The ceiling was still a couple of hundred feet, but in places light fog and the ragged bottoms of clouds brushed the treetops, making it doubtful that the aerial artillery could pick its way through to his position.

Enemy fire from the flanks of the company position was increasing and mortar rounds were beginning to fall on his position. An assault or attempted withdrawal through the grazing fire from the fortified treeline would be disastrous under existing conditions. To stay put meant almost certain encirclement. He must have fire support on the fortified treeline and have it soon.

In desperation the company commander grabbed the radio handset and called the platoon leader of the aerial artillery. He explained the urgency of his situation and his desperate need for artillery support.

The aerial artillery platoon leader already had given much thought to the possibility of such situations occurring. He had discussed it at length with the pilots in his platoon and decided upon various courses of action which he might take depending on the problem. Now without hesitation or delay he proceeded to implement one of the plans.

The leader climbed the platoon, in trail formation, above the lower layer of clouds and proceeded VFR between layers toward the beleaguered company's position. He queried the company commander about the approximate ceiling and visibility at his position, the magnetic azimuth and distance from the position of his radio set to the treeline to be attacked, a brief verbal description of the treeline and its orientation to the surrounding terrain, and advised that the company be prepared immediately upon command to mark the treeline with red smoke from rifle grenades.

As the platoon homed to the company's FM radio, the platoon leader made a careful map study of the terrain, elevations and obstacles around the coordinates given as the company's position. He then gave his platoon the following briefing on VHF: "Begin spacing yourselves in trail formation with one minute intervals between aircraft. The heading from the radio to the target treeline is 310 degrees and the distance is approximately 400 meters.

"You heard the commander's description of the target. The elevation of the ground down there is approximately 100 feet with none in the immediate area higher than 150 feet and no known obstacles other than trees. The ceiling is apparently

tell us a war story, mac

between 200 and 300 feet so we should break out with no problem. It looks like we will be able to maintain VFR on top or between layers at 1200 feet until reaching the company's position.

"We will fly outbound from the radio on a heading of 100 degrees for one minute while descending at 500 feet per minute to 700 feet. Then turn right to 310 degrees back to the radio while continuing descent to 300 feet. We should be in the clear at 300 feet but if not, do not descend farther; fly heading 310 degrees for two minutes and then climb back to VFR on top.

"We should be under these clouds before arriving back at the radio. The target should be easily recognized from the description given us, but if you are not sure, don't fire. Remember, the target will be marked with red smoke and the forward friendly positions with yellow smoke. Plan to fire six pairs in each of four ripples. We may not get more than one pass.

"Any questions? OK, let's be on our toes. This could be rather ticklish, but it will work. FAA might not approve of this procedure but I'm sure that company down there would."

As the platoon leader turned inbound toward the company's radio, he broke out of the clouds right at 300 feet and requested immediate marking of friendly positions and the target. Only seconds after the red smoke ignited in the treeline, the first of the helicopters' rockets slammed into the target.

The company mounted an assault on the fortified treeline immediately after the last helicopter's firing pass. The enemy, surprised and dazed from the impact of 192 2.75 inch rockets, offered only light resistance.

The infantry company was thankful for the much needed support and the aerial artillery platoon was justly proud of a job well done. They reported to their higher headquarters that support had been given to the company, but not how it was accomplished. How it was accomplished was reported only to their buddies at the bar that night.

On another day, the pilot of an O-1 and his observer were cruising along on a daily reconnaissance of their area of responsibility. It was a beautiful day with just a few puffy cumulus clouds, a bright sun reflecting from the rice paddies and canals below, and a cool breeze blowing in from the South China Sea.

The observer was almost daydreaming as he thought of how well he knew his area of responsibility. Every canal, every paddy, every treeline and every hootch were familiar to him. He thought of how he had watched daily the countryside below turn from the brown of the dry season to the lush green shades of the wet season. He had seen the rice planted and watched it grow until it now stood tall and nearly mature.

Today the rice, the coconut palms, the reeds and rushes along the canals, and all of the broad leaf tropical plants seemed to be alive as they bent and waved in the brisk breeze below. It looked as though someone had taken a giant comb and combed the entire countryside into the direction the wind was blowing. Virtually every sprig of vegetation was bent with the wind except about two dozen clumps of tall green reeds along the sides of two intersecting canals. The observer wondered momentarily why those clumps of reeds did not bend and sway. Were they some type of stiff reed with which he was not familiar?

He picked up the binoculars to take a closer look. The clumps of reeds appeared to be the same type as the others around them, but they

were not bending in the wind because they were pulled together and tied at the top.

The observer called this to the pilot's attention, and they decided to take another look from a lower altitude. On a pass at 500 feet, it appeared to the pilot and observer that something was hidden in each clump of reeds, but they could not tell what it was. No personnel were seen and no ground fire was received on the pass at 500 feet, so they decided to make a pass at contour altitude. This pass, only a few feet above the reeds, revealed a carefully concealed enemy bunker, foxhole, or gun position in each clump of reeds. It also revealed, by the ground fire received, that at least a portion of the positions were occupied.

The pilot climbed the O-1 to a safe altitude and reported to the area commander. He reported the number and location of the positions, but he did not report how they were discovered. How they were discovered was reported only to his buddies at the bar that evening.

Just as in the stories above, how many lessons have been learned and new tactics, techniques and procedures developed never to be disseminated farther than to a few buddies at the bar? How many costly mistakes have been repeated and lives lost as the thousands of Air Force aviators, who were not one of the buddies at the bar, searched for effective tactics and techniques which had already been employed but not shared?

The principles of war never change, but the tactics, techniques and procedures used in the conduct of war must constantly be changed, improved and modified to retain optimum effectiveness. Many factors influence the development of new tactics and require changes or modifications of existing tactics. The objective, the environment, the enemy, and the introduction of new weapons systems are but a few of these factors. Rarely are tactics developed in peace time, and none can be judged effective until they have been tested and proved in battle.

While the development and modification of tactics is a continuous process, changes do not often come about suddenly or dramatically. Changes and improvements are a result of the lessons learned, trials and errors, successes and failures and experience gained by individuals and units in all phases of combat. Each individual and every unit commander must ensure that his trials, errors, experiences and lessons learned are reported so that others may benefit from them and develop more effective tactics, techniques and procedures.

The primary means of disseminating information is through doctrinal publications and training literature. These include field manuals, training circulars, training and special texts, reference notes, Air Force training programs and special publications. The personnel who prepare these publications are not fountains of all knowledge; they have no crystal balls, they cannot disseminate information which is not reported. They depend on you, the individual on the scene, to provide the much needed information.

The Air Force is training hundreds of new aviators each month. If these aviators are to avoid the mistakes and errors made by others before them, they must be given the benefit of previous experiences and trained in the latest and best possible tactics, techniques and procedures. This can be accomplished only if the improved methods, experiences and lessons learned by those on the scene are reported.

Any new concepts, ideas, or experiences should be reported, of course, through the proper chain of command. Remember, the next time you have any information which may be useful to others in your profession, don't be bashful. Tell us a war story, Mac. ★

REX RILEY'S

CROSS COUNTRY NOTES

COMMUNICATION. Among a pilot's problems is that, being human, he reacts, like other people, to what he hears. For example, here are some words that should sound familiar: "Alpha 63, report right downwind for runway 04 left." Then, ". . . report base for 04 right."

Now, will the pilot react to what he has heard, or to what he thought he heard? Will he make an assumption, or will he query the tower as to which runway the controller meant? Here's what happened:

An O-2 called the tower ten miles out and was advised to report right downwind for runway 04 left. When he reported downwind, tower advised, "Report base for runway 04 right." The pilot acknowledged. When he called base, tower gave winds and altimeter and cleared him to land 04 right. Again this pilot acknowledged. At this time a B-57 was on short final under GCA control, and was cleared to land on 04 left. While still on base leg, the O-2 made another transmission, which was garbled on the tower tape, relative to landing on 04 left. Tower replied, "Understand you are landing on 04 right." The O-2 continued his approach to 04 left and arrived over the B-57 as it touched down. Tower sent the 0-2 around and the B-57 pilot swerved right and added power, attempting to get ahead of the O-2. The right main wheel of the O-2 touched the top of the left tip tank on the B-57, denting it.

This was a close one—too close. It could have been a tragedy because of what appears to have been a very simple mistake on the part of the O-2 pilot. But remember, communication is a two-way street.

HYPOXIA. During the first two hours the mission went routinely. Then, in preparation for a drop from 22,000 feet, an oxygen check of the crew was made and the aircraft depressurized. Soon an airman member of the crew began to stagger and fell. Other crewmembers went to his aid and the pilot made an immediate descent. Soon the airman had recovered. Hypoxia was due to a loose fitting mask and twisted oxygen hose.

Had this aircrew member performed adequate preflight and inflight oxygen equipment checks, including pressure test of the mask, this incident would not have occurred.

AN INCIDENT REPORT which listed the cause factor as "Violation of common sense safety practices" came in the other day. It prompted me to pause and consider the implications of using vague catch-all expressions to describe accident causes. Not only do they tend to make the hapless victim look like an idiot, they at least partially negate the value of the experience as an accident prevention vehicle. The report told of a B-58 launch crewmember who investigated, much too closely, a smoking engine. He was sucked into the intake and his ear covers wiped out the first four rows of compressor blades. Luckily this ground crewman escaped with only cuts and bruises. He may have more sense now than he had before the incident, but there obviously isn't anything common about it because incidents like this one recur all too frequently. Avoiding hazards may be common sense for senior mechanics and supervisory personnel; however, we make a serious mistake when we *assume* that specific dangers and hazards are common knowledge. Never assume that your troops will automatically avoid intakes of running engines, overheated brakes, high areas without guard rails, or any of the other common flight line hazards that you take for granted as dangerous.

AN OBSERVANT TOWER CONTROLLER saw something bounce along the runway behind a pair of F-100s making a formation takeoff. He notified the flight, which orbited the field while fire department personnel recovered the object and brought it to base ops. Safety, operations, and maintenance personnel were already standing by and identified the object as an F-100 afterburner cone assembly. On their recommendation, the tower advised the flight to continue burning off fuel and to stay out of afterburner. Meanwhile, personnel who watched the takeoff were questioned. They agreed that the wingman's aircraft seemed to have a slightly abnormal flame pattern during takeoff. This info was relayed to the flight, and maintenance personnel were dispatched to check the wingman's aircraft as soon as the pilot cleared the runway.

The wingman made a successful heavy-weight landing and the maintenance team soon confirmed that his aircraft was the one with the problem. The leader then proceeded to burn out fuel for a normal landing.

Thanks to an alert tower controller and fast, knowledgeable response from all hands, aircraft damage was kept to minimum. Rex doffs his safety hat to TSgt Pedro G. Calvillo, watch supervisor; A1C Robert S. Herndon, local controller; and A1C Dominick A. Colangelo, Jr., trainee local controller, and to all of the sharp people at Aviano Air Base who helped make this a job well done.

WHAT DO YOUR FUEL TANKS READ when they are empty? The natural answer to this one is probably "somewhere near zero, I hope." Some pilots may answer, possibly logically but not necessarily correctly, "maintenance makes sure that the tanks read zero when there is no more usable fuel."

Here's a very recent example of why we cannot make this assumption.

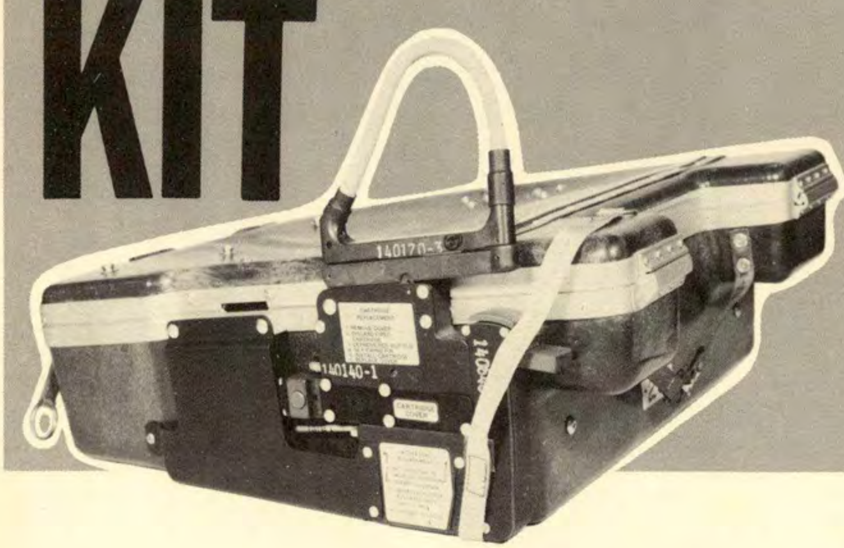
A T-29 crew landed with 1000 pounds of fuel indicated in each of the two tanks. They decided to fly another short leg with 34 minutes ETE before refueling. With the use of reasonable Dash One cruise procedures, operating at a low gross weight, and fairly good weather at both ends of the line, their indicated fuel should have been adequate. On long final approach, 37 minutes after takeoff, the right engine began to lose power—the fuel flow became erratic and the fuel pressure low warning light illuminated. Both fuel quantity indicators read between 300 and 400 pounds at this point. Crossfeed was selected and the right engine started running smoothly again. The engines started backfiring and surging on short final but the landing was accomplished without further incident. The right engine stopped 200 yards after clearing the run-

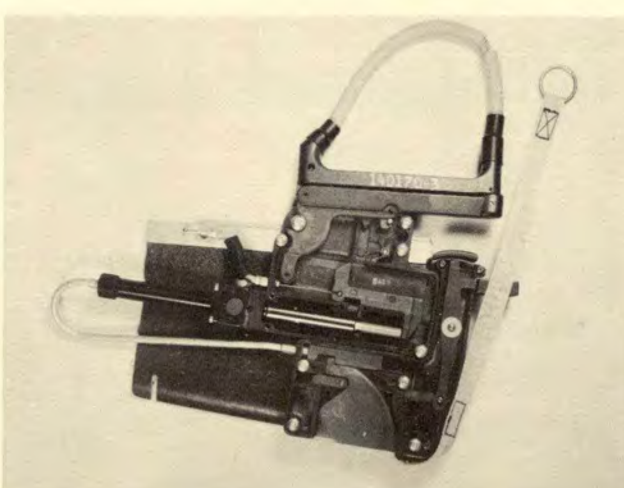
way and the left engine stopped about 200 yards further down the taxiway. At this point both gas gages read approximately 300 pounds.

The aircraft was serviced and flown back to its home base where a review of the records indicated no fuel system maintenance in the past 80 days. There were no write-ups indicating errors in fuel quantity. The aircraft was completely defueled and the number 1 and 2 gages read 295 and 310 pounds respectively.

The investigating officer recommended that fuel quantity gage calibration checks be made during every second major inspection. Until this becomes a Dash Six requirement, you T-29 types might do well to heed another of this investigator's recommendations: base fuel planning on the assumption that the last 500 pounds of fuel in each tank is unusable. Those of you who fly other machines whose range tempts you to fly the fuel down close to the zero indication might do well to either ascertain the accuracy of your gages or add a significant safety factor to your planning. ★

NEW SURVIVAL KIT FOR F-4s





John J. Sheehan
McDonnell-Douglas Corp.

A survival kit that features automatic deployment is the latest thing for F-4 crews. Effective with F-4D #68-6912, RF-4C #68-562 and F-4E #68-366 the new survival kit type CNU-111/P (FSN 1660-104-3261 TP) will be incorporated in production aircraft. For previously delivered Phantoms T.O. 13A5-32-503 (Installation of Emergency Oxygen System Martin-Baker Ejection Seat) and T.O. 1F-4-808 (Koch Kit Interface) will direct modification.

This kit manufactured by H. Koch and Sons differs from the Bendix Survival Kit in that it incorporates automatic kit deployment, and removes the emergency oxygen system and composite disconnect from the kit. Selective deployment gives the crewman the option of manual or automatic "hands off" separation of the kit and deployment of raft/rucksack assembly.

Automatic operation is controlled by a lanyard attached to the emergency harness release handle (Figure 1). When the parachute deploys and man/seat separation occurs, this lanyard pulls an actuator from the handle mechanism which fires a cartridge activated piston. Four seconds later, this piston strikes an arm which is attached to the lid latches, unlocking them and allowing the kit to drop away in a deployed condition, while still being attached to the crewman by his left-hand kit-to-man connector. For this sequence to occur the crewman would have to select automatic on his mode selector located forward and slightly below the manual kit release handle. If he does not desire automatic deployment, he should select manual mode and actuate the kit when desired by using the emergency release handle.

Since this kit does not contain emergency oxygen, a modified MD-2 bailout oxygen bottle system has been incorporated, on the left-hand side of the ejection seat bucket. Actuation of the cylinder is accomplished automatically on ejection by the actuating arm striking a bracket mounted on the seat rails as the ejection seat moves up the catapult. Manually the oxygen is actuated by pulling a knob located on the forward left hand side of the seat bucket, just aft of the manual garter release handle (Figure 2).

Vent air and "G"-suit services for the crewman are now located on the console (left-hand side), as shown in Figure 3, and the communication cord is attached to the oxygen delivery hose (Figure 4). This modification was necessary when the composite disconnect was removed from the survival kit.

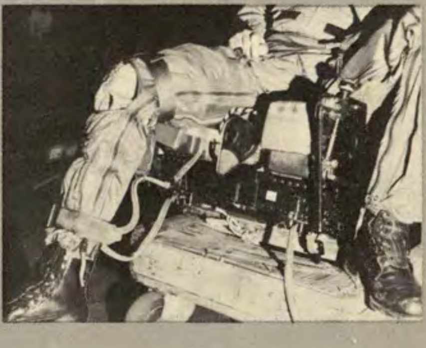
Emergency egress and ejection procedures remain the same. (Refer to the Dash One of your particular aircraft.)

IMPROVED GARTER SYSTEM

A modified leg restraint (garter) system has been incorporated, effective with F-4J #155842, F-4E #68-303, RF-4C #68-548 and F-4D #68-6904.

This system consists of two garters per leg. One is attached above the knee and the other above the flying boot. The alignment and retraction of this system has been designed to offer the most secure restraint of the legs during ejection, and was designed primarily to offer this protection through the seat envelope; particularly the high speed end.

Correct routing and positioning of these garters as per the photo at right, is important to prevent fouling of the retraction line and optimum retention. ★



HAVE YOURSELF A PLAN

Some emergencies can be planned for in advance. For your aircraft, know what these would be and . . .

Lt Col Raymond L. Krasovich, Directorate of Aerospace Safety

Name any game and the same basic rule applies—a little homework goes a long way. Check the winning football coaches; they study the opposition and figure out the pattern leading up to each play, then scheme for ways to spoil things. Study the big name lawyers and you'll find that they identify the weak spots in their cases and prepare defenses, instead of hoping that the opposition doesn't think to exploit those areas.

Then we get into this business of flying airplanes. You do study your Dash One emergency procedures, and you do know the weak spots of your bird and plan ways to cope with them, don't you? Knowing your airplane and having a plan of action all roughed out helps take the clutch out of an emergency. Everything won't always go as planned, but the fact that you have gone through the planning process a few times will make it easier and quicker for you to come up with acceptable actions to handle those things that didn't go according to Hoyle.

Your plan should go above and beyond the Dash One. For no matter how sophisticated our aircraft and how much effort went into covering all possible emergencies in Section III, situations crop up that demand additional knowledge of the aircraft and all the good judgment, experience and skill that you can muster.

For an example of the kind of planning I'm talking about, consider the utility hydraulic system on the F-4. It is the most failure-prone system in the airplane. Our incident reports show over 100 failures a year for the past three years. One look at the utility system and you can see the reason for this high failure rate. It's complex. We have leaking aileron actuators, Nr 4 and Nr 6 hydraulic transfer pumps, rudder actuators, radar antenna drives, air compressors and refueling receptacles, not to mention the usual B-nut and line leaks, pump failures, air in the system, and leaks induced by combat damage.

"So what," you say, "just blow the gear and flaps down and make an arrested landing. Strictly routine."

Of course it's routine, except when the emergency system fails to work. Any emergency system that must be exercised as much as the F-4 emergency gear and flap system is bound to fail on occasion. No system is perfect and the last three times that this system failed on the F-4 the score looked like this: One aircraft slightly scratched, two completely destroyed, along with a badly damaged RB-66. It seems one of the wayward Phantoms tried to snuggle up with the '66 even though the larger bird was on the ramp.

Let's take a closer look at these incidents. In all three, the utility hydraulic failure was compounded because one main gear failed to extend when the crew used the emergency extension system. In one case, the pilot did an excellent job of minimizing damage by making an arrested landing in his F-4. Another F-4 jock experienced his utility failure on an ACM mission. When he attempted an arrested landing with the left main retracted, he touched down about 700 feet short of the barrier and the left wing dropped. The pilot added power to get the wing up off the ground. He raised the wing all right; in fact, the whole machine became airborne and flew over the barrier. The bird touched down beyond the barrier and the wing again dropped, dragging the aircraft toward the ramp. The pilot made an AB go around. The crew had someone look them over and, after some discussion, the decision was made to have them eject.

An RF-4 crew encountered their utility failure at night. When the left main failed to extend they were left without a landing light. The pilot had enough fuel, so he decided to try and bounce the stubborn gear down. He touched down harder than planned and the wing dropped, causing the external tank to drag on the runway. The pilot attempted to go around but aborted the attempt because the fireworks from the dragging tank caused him to think the wing was on fire. The aircraft slid off the runway for a rough ride across the infield, shearing both remaining gear and coming to a halt when it plowed into the RB-66.

You may think it can't happen to you, but I've decided to do a little Monday morning quarterbacking in order to have a working plan in case it happens to me. So here's what I'd do. First, I'd use the checklist procedure, including pulling the emergency gear extension handles in BOTH cockpits. If this fails, face it, the wheel is going to stay in the well until the maintenance troops unlock it after we're on the ground. Bouncing the bird on the runway won't hack it.

So you have the nose and one main down and locked with half flaps. Now, what can I do to stack things a little more in my favor? I'd want to get the machine to a comfortable landing weight with enough fuel to make a couple of no sweat go arounds in case things didn't work out right. I'd prefer from 3000 to 4000 pounds. This, incidentally, will insure that the fuel is in the fuselage tank. I'd be careful not to forget to depressurize the fuel system by placing the air refueling switch to EXTEND. The receptacle won't open without utility system pressure, but the system will depressurize with the switch in this position. I would retain *empty* external outboard stores (MERs or tanks) but would jettison *all* external ordnance.

Now, with the hook down, I'd get set up for an approach, taking into consideration runway, overrun and approach condition, effect of crosswind, type of barrier available, and just how close ramps, buildings and other obstructions are to the runway. Given a choice, I would land with the bad gear on the side away from the closer obstructions. Then if things went to pot and I couldn't go around, I wouldn't end up nose to nose with an aircraft on the ramp that just might be bigger than me.

Now to get down to the nitty gritty: the approach and landing. As you can see from the previous mishaps, lateral/directional control is one of the prime considerations for this type landing. Remember, with a utility failure the pilot is without the services of the rudder and, if the failure was caused by a cracked aileron cylinder, he may be without one of the PC systems as well. This leaves him with a one aileron-one spoiler combination with which to maintain lateral and directional control.

To insure adequate control I would fly the approach and landing at 17 units angle of attack, and make my approach fairly flat. I would aim to touch down about 500 feet in front of the barrier. I'd try for a *very* smooth touchdown, flying the bird on. The feel of the hook touching down makes a pretty good gage, and permits last second adjustments to the touchdown point. I'd plan to ease the power to idle once the main and nose gears were on the ground.

One big departure from normal landing technique would be stick position after touchdown. Instead of keeping the stick aft, I would move it *smoothly* forward and *away* from the sick gear in an effort to keep the bird's weight on the two good rollers—a full effort to keep that wing off the ground. This should give me a little more control and insure a good engagement. If I missed the wire I'd go around and try again.

Will this technique work? I don't know, but based on what I know *won't* work, I think it will give me a better than even break toward getting the bird down with only a few scratches.

There are a couple of other points to ponder. Before writing this I researched the records all the way back to 1955, looking up the accident history for all fighters attempting a landing on the nose gear and one main gear. The F-84F took top honors for having the most landings of this type. Surprisingly enough, the bird got off in most cases with little damage. And this was back in the old days before arrested landings. Other fighters experiencing one main gear up landings include the F-100, F-101, F-102, and F-104. The jocks fared pretty well in these landings with most escaping injury. A few received minor injuries. Post landing fires followed some incidents, but thanks to arresting systems and pre-positioned crash equipment this hazard is now minimized. One item I searched for was happily missing—that was the tendency for the bird to cartwheel or roll over during a *controlled* one main gear up landing. Not one of the aircraft mentioned had this happen.

Admittedly, WHEN AND IF I ever make a landing with only one main gear down, something may come up to change things. But at least I have a plan to start from, based on thinking that hasn't been affected by stress. Now, would you like to hear about the plan I have to permanently shuck this desk they have me chained to? It goes like this. . . . ★

WHIRLWINDS OF DISASTER

Capt Kenneth E. Munson, 504 TASG, APO San Francisco 96227

This is a story about airplanes. It is a story about big, mean airplanes and little bitty airplanes (including fighters). It tells about the way they act toward one another during takeoffs, landings and in flight. The information presented here should be part of every pilot's store of knowledge.

Here's what got me interested in the subject. A light aircraft took off before dawn at one of our busy Southeast Asia bases. After takeoff roll was started the tower operator's attention was turned to landing aircraft. Minutes later the word was out that the light plane had crashed within the field boundaries. Why?

There were no bullet holes. The engines were going full bore on impact. The control surfaces had been checked OK prior to flight. The pilot survived the crash, thanks to a good helmet, flak vest and a locked shoulder harness. He could help the investigators (fortunately).

Everything had been normal through preflight, start, taxi and takeoff. The wind was calm, visibility was ten miles and it looked like it would be a good mission. No other aircraft were in sight and all was peaceful. At about 100 feet the world suddenly went topsy-turvy. Moments later the pilot found himself crawling out of the battered wreckage in bewilderment.

Any ideas? Let's eliminate a few possibilities: There were no other airplanes in the immediate vicinity, so it was not a midair. The engines were running, so it was not power failure. Maintenance was not a factor. Air traffic control procedures were examined and they were "by the book."

There are a few good hints in the preceding introduction, if you haven't already figured out with what this aircraft tangled and lost.

Enough of this hedging. This aerospace vehicle engaged the violent vortices of air called *wake turbulence*. A large turboprop jet transport had taken off approximately one minute ahead of the light aircraft and had made a sharp turn out of traffic to avoid flying over hostile ground at low altitude. By the time the light plane pilot had finished his runup and switched to tower frequency, the transport was well clear of the airdrome and had switched to an enroute frequency. Now you ask, didn't the small plane pilot see the transport? No. He was making an intersection takeoff while the transport had started at the end. In fact, the transport was breaking ground at that intersection, but our pilot was doing his runup and had on a ballistic helmet (very soundproof), so he didn't hear or see a thing. By the time he finished the checklist and switched to tower, the transport was well clear and the tower controller did not, nor was he required to, give a traffic advisory.

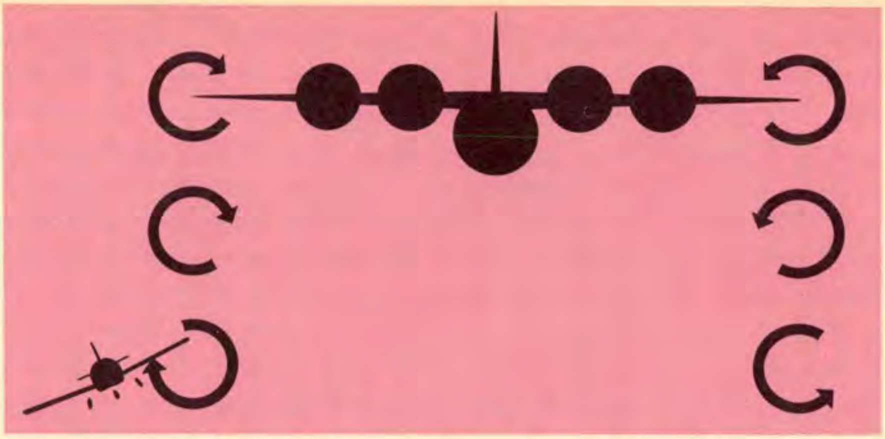
Our aviator roared off with an "all's well" feeling.

The most obvious question is, why didn't the tower controller give a wake turbulence advisory? Good question! He doesn't have to unless in his OPINION he feels wake turbulence exists. And he isn't required to be an expert. His job is to provide safe traffic separation.

Now, about wingtip vortices. They are formed at the wing tips of all aircraft. They begin just prior to liftoff (at rotation) and stop on landing when lift is no longer present. The vortex velocities depend entirely on the weight, speed and wingspan of an aircraft. A big, heavyweight transport will create winds with maximum rotational velocity during takeoff and landing. The lighter and/or smaller the vehicle the less intense the vortices. But don't let that fool you. Even the vortices from a small, light plane can be violent enough to toss another light plane all over the skies. If you are very close to the ground it can push your stomach right up into your throat.

The vortices settle toward the ground at the rate of 300-350 feet per minute and continue spinning above the surface at an altitude approximating one-half the wingspan of the generating aircraft. This means that, if an aircraft with a wingspan of 150 feet departs ahead of you on a calm day and crosses the end of the runway at 550 feet and you follow one minute later, crossing the end of the runway at 225 feet, the possibility of your getting in the middle of a vortex is pretty good. Take as another example the light aircraft that started this whole blurb. He flew right into the left wing vortex that was spinning merrily about 100 feet above the runway.

Remember all you have heard about wake turbulence hanging around for several minutes? It's true. It may be stretching things to say it will stick around for ten minutes without dissipating, but some remnants could still be around, especially aloft.



Vortices descend from the generating aircraft, a pilot can fly into a vortex on takeoff if he follows the previous aircraft too closely and remains below the first aircraft's flight path.

Now! Other than saying that wake turbulence hangs around for awhile and descends at a somewhat predictable rate, what other characteristics does it have? For one thing, as it spins above the runway it moves aft toward the approach end of the runway at five or six knots. This means it is moving toward you if you are in takeoff position. Also, in calm wind the vortices drop in parallel behind the generating aircraft, spin for awhile above the runway and then move laterally apart. If there is a light crosswind of less than ten knots, the upwind vortex will probably stay on the runway for awhile and the downwind vortex will be pushed laterally away. Of course, if the surface wind is strong enough, it will clear the runway of both vortices. It doesn't necessarily break them up, it just pushes them aside.

If you are operating with parallel runways and these spinners move far enough, the fellows on the other runway may get caught by surprise. For example, assume the parallels are 100 yards apart. If a 90 degree crosswind is moving one of the vortices at six knots, it will move it from one runway to the other in about 30-35 seconds and not much of its potency will have been lost. All of this is nice to know and the safest solution is not to fly at all. Since we must, here are a few hints to help you avoid these Whirlwinds of Disaster during takeoff and landing. Inflight avoidance will be covered later.

Hint I: Since the vortices move downward, plan your takeoff to be above the flight path of aircraft departing ahead of you. This means avoiding intersection takeoffs if bigger, heavier airplanes are starting takeoff from the end. If you must make an intersection departure, remember you will fly up and into the turbulence. (The Directorate of Aerospace Safety does not recommend intersection takeoffs as a general policy.) An upwind turn out of traffic as soon as possible may give you the needed clearance.

Hint II: If you are departing behind a *landing* aircraft, plan to become airborne at a point beyond where it landed (no more lift, no more vortices).

In each of the first two hints, don't forget parallel runway operations. The same factors are involved.

Hint III: If you have intersecting runways and both are in use, on takeoff try to be well above the flight path of aircraft departing the other runway. When you land get the wheels solidly on the ground near the approach end and avoid the intersection if possible. In any event don't fly through or below someone else's flight path.

Hint IV: In the traffic pattern, don't get behind and below big airplanes. Fighters are pretty well clear, with the normal 1500 feet overhead, until they turn on final approach. Then, in every case, getting low behind an aluminum overcast of some kind makes a low final approach even more dangerous.

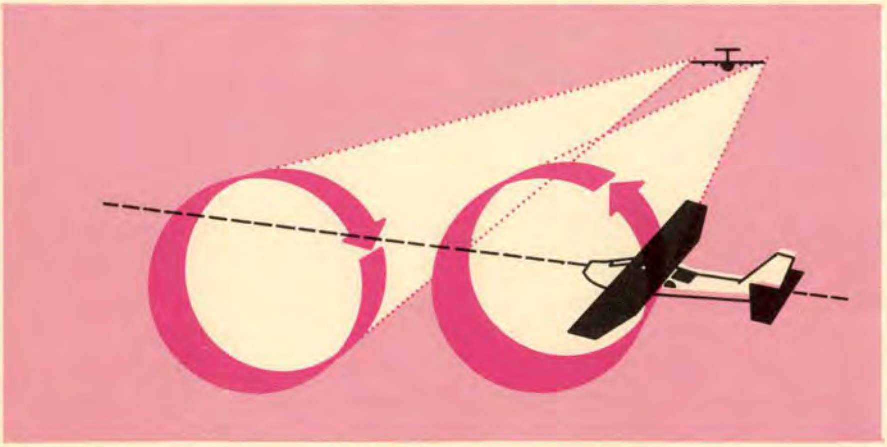
Light aircraft usually wind up below the transports in the pattern so stay inside or outside the big fellows' flight paths, depending on the wind. If you know the winds, this too may help. Again, final approach is critical. If VASI lights are available, staying on or slightly above the glide slope should keep you out of trouble.

Now, let's have some discussion about inflight encounters with wake turbulence. Behind large jet aircraft, remember that if you stay in the exhaust smoke it may be a little bumpy but not violent. That is, if you stay close to the big airplane. Farther out the smoke may become entwined in the vortices and attempting to stay in the smoke would give you the thrill of your lifetime. Staying level with the aircraft is certainly better than being too low and even with the wingtips. Fighters with refueling capabilities can vouch for this. Behind large aircraft in flight the vortices are not as severe as during takeoff and landing. To repeat an earlier statement, don't let that fool you, it can still turn you up and over.

If you must pass through an area of probable wake turbulence try to avoid going through at a 90 degree angle. The airloads on your aircraft can be tremendous, with the possibility of structural failure. Penetrations at small angles still hold this possibility but the odds are somewhat better since a roll rate may be induced to help offset the sheer forces of a head-on encounter.

Now it is time to throw out a few statistical type facts. The roll-up process that occurs to form the vortices is directly proportional to weight and inversely proportional to wingspan and airspeed. Aircraft roll rates of up to 80 degrees per second can be induced, especially in light aircraft. Helicopters produce the same type of vortices as fixed wing birds. That's affirm—exactly the same. If you should happen to get caught between two vortex centers it is possible to get a downflow of 1500 feet per minute. If your aircraft cannot achieve that rate of climb you have only one direction to go—down! Now, if all of these things are true, and they are, picture yourself sticking only one wing into a vortex and imagine the results. Or if you are a fighter jock, imagine driving right into the core of a vortex and popping out inverted. It has happened!

If possible, avoid crossing vortices at 90° angle since loads on aircraft structure can be severe, even catastrophic. Best advice: Avoid vortices completely, when possible!



A recent FAA publication (Airman's Information Manual, Part I, November 1968) discusses most of the preceding information and also makes the following statement: ". . . the aerodynamic forces applied on the light aircraft by the circulation of air in the vortices and the pilot's attempt to counteract it could result in the airframe design limits being exceeded, and possibly structural failure."

The light aircraft that got this article underway attests to the accuracy of this statement. The right wing was bent upward at the midway point to the tune of about 15 degrees. Damage to the interior structure of the wing was massive. Remember this all happened while the airplane was in flight. I take the FAA statement on corrective actions at face value, but I'd still bet that my normal reaction would be throw in all the controls I had to straighten the aircraft out—especially at low altitude. How about you? Actually, the only 100 per cent effective action is avoidance of the vortices.

There is still a lot we don't know about wake turbulence but progress is being made. Don't forget that, even with all of the information with which you are now armed, these vortices remain somewhat unpredictable and can do just about anything they decide they want to do. Watch out!

If you want some more or rephrased info, check the September 1966 *Aerospace Safety* or the September-October 1967 Flying Safety Officers Kit. The time you spend learning about the environment in which you fly is never wasted. Happy flying! ★

Threshold: "The entering or beginning point, the point at which an effect

CROSSING THE THRESHOLD

begins to be produced"

Maj David L. Elliott
Directorate of Aerospace Safety

Accidents occur every day when machines are flown outside their design performance envelopes.

Arresting systems fail when they are engaged at gross weight/ground speed combinations that are a little too high.

Pilots get killed when they eject a little too low or a little too late —they stepped across the performance threshold.

Airplanes have performance thresholds. The T-33 has one at about .8 mach, the F-4 at about 15 units on the angle of attack indicator, and, as some of you recall, the F-86 had one at about 7 positive Gs. In fact, if you'll look in any Dash One, under operational limitations, you'll see pages of thresholds: the point at which an effect begins to be produced.

The danger with a threshold is that it's not a finite line. When an F-4 reaches 15 units on the angle of attack indicator, nothing much happens. And when the F-86 exceeded 7 positive Gs, usually nothing happened — but a couple of times the wings came off.

When the BAK-umpty-ump arresting system was designed, the engineers built a capability into the system. To insure that this capability would be available in all of the BAK-umpty-umps produced, a fudge factor was added—sort of an increased capability to overcome imperfections in the production process. Then the Mil Specs required an additional safety factor. According to my statistics professor, this package is wrapped with an assurance factor. So presumably it could be said: "There is a 99 per cent assurance that the BAK-umpty-ump will not fail within the design specifications when installed thus and so, etc." The assurance factor may be higher or lower, but I've been told that there's no such thing as a 100 per cent assurance factor.

Let's say that the probability of the BAK-umpty-ump failing at the design specifications is one in 1000. If the design specs are exceeded, the probabilities of failure increase as a function of the excess. The probabilities of failure where the design specs are never approached are lower than the specified assurance factor.

All too often the probabilities of failure when we exceed the design capability are unknown. What may appear to be a slight excess could result in horrifying probabilities. A low altitude ejection is a good example of a horrifying probability. The tech order refers to it as the emergency minimum ejection altitude. For example, the T-bird Dash One states the emergency minimum ejection altitude with the rocket seat and zero delay lanyard hooked is zero, if the airspeed is 120 knots. That's an emergency minimum. That word *emergency* means that when conditions are so bad that you have a good chance of getting killed, you can perhaps decrease the odds by ejecting at the emergency minimum. Under these conditions you are standing *on* the threshold. A gust of wind can deflect you either way. When you eject on the runway the malfunction has got to be more than a nose wheel shimmy, so to speak.

The tech order stresses an early decision to eject and the Directorate of Aerospace Safety has pointed out many times that the probability of success is much higher when the ejection takes place well above the minimum altitude.

A real danger is passing over too many thresholds at once, or reaching a psychological and physiological threshold just as the aircraft is reaching a performance threshold. An example may be when the young pilot is maneuvering from the 12 o'clock position of his aggressive adversary just as his airplane is passing through 28 units on the angle of attack indicator, and his G suit is approaching structural failure.

Our physiological thresholds vary from day to day and are dependent on numerous factors. It could be said that, by definition, that 50 per cent of our performance is below average. That, of course, could mean that 50 per cent of the time our thresholds occur sooner than we'd expect.

The Doc tells us that adequate rest is necessary; that a proper diet defends us against hypoglycemia; that 5-BX, aerobics, and isometrics are good for our staying power. That's encouraging; at least there's one threshold that we can perhaps influence.

We have little control over most of the other thresholds. We can be aware of them, and also be aware of danger signals that may present themselves. If your F-4 wallows excessively at 22 units on the angle of attack indicator, it's probably not wise to try for 28. If your vision is beginning to blur at 3½Gs, 5Gs could be a tad too much; and if your crew rest expires at midnight, 2345 is a lousy time to break 200 and a half.

The next time you cross a threshold . . . watch your step! ★

AEROBITS

EVERY SO OFTEN A LOOSE OBJECT in the cockpit causes the crew a problem. Frequently the problem is binding controls, such as in the following example. The single engine jet received a routine preflight by the pilot who taxied out and began takeoff roll on a 10,000 foot runway.

At the computed rotation speed the fun began—the stick was frozen and the pilot couldn't move it with both hands. He aborted at 160 to 170 knots with about 2000 feet of runway ahead of him. He jettisoned the wing tanks, which traveled along under the aircraft and caught fire. He got the drag chute out but it burned off. In the last chapter, the aircraft left the runway, traveled through the dirt for 600 feet, took down a fence, crossed a road and zoomed down a 30 foot bank and finally stopped on a highway.

The pilot was mighty lucky and wasn't seriously hurt. This accident was caused by an unidentified object and an IFR Supplement causing the stick to bind. The other object wasn't identified because it probably was destroyed in the fire that wiped out the aircraft.

A SAFETY SURVEY turned up quite a list of discrepancies relative to munitions management at one base. The base is not identified here but some of the items are in order to give other units some idea of what existed elsewhere. While the list is certainly not all-inclusive, the items are among those that turn up frequently in safety surveys of munitions management. Perhaps this list will prove helpful in keeping your munitions shipshape. Items:

- Aircraft grounding points on the flight line painted over.
- No up-to-date map in the fire department of base explosives locations and quantities.
- Fire extinguishers partially empty, missing or inadequate for the task.
- An aircraft loaded with munitions was leaking fuel.
- Munitions trailer brakes for the most part inoperative.
- WP (white phosphorous) igniters left exposed to the sun in open containers on the flight line.
- Low OJT passing rate in munitions handling field.

CREW COORDINATION. Three major accidents involving two-place fighter aircraft on instrument final approach occurred in the first 11 months of 1968, resulting in four crewmember fatalities and the loss of three valuable aircraft. Two of these accidents occurred in VFR weather conditions. Investigators were unable to identify any equipment malfunction connected with these accidents; therefore, operator factor was strongly suspected.

From the safety standpoint, one of the greatest by-products of the second crewmember is the invaluable assistance he can give to the aircraft commander during instrument approaches, especially in conditions conducive to spatial disorientation.

Commanders should insure that all aircrews are thoroughly briefed and are knowledgeable of the value of crew coordination. Use that "guy in the back" whether he be a rated RIO, navigator, or pilot.

Lt Col John Holman
Directorate of Aerospace Safety

AN AIRCRAFT ARRESTMENT SYSTEM has been modified for joint civil-military airports and successfully tested at the National Aviation Facilities Experimental Center located at Atlantic City (NJ) Airport.

In a combined FAA-USAF project, the BAK-9 arresting gear cable was placed in a slot cut into the runway one and one-half inches wide and deep. The cable, one and three-eights inches wide, is held down by retractable rubber supports spaced eight feet apart, operated by compressed air. It can be raised and lowered at the runway side or by controllers in the airport control tower.

At joint-use airports, the cables are generally located towards the ends of the runway and ride four inches above the surface—high enough to rip off protruding belly antennas of small aircraft, interfere with some wheel fairings and dent undersides.

USAF will make the recommended changes at 12 joint-use airports following new requirements issued by the FAA. The modified system will be designated as the BAK-14.

LINE-UP CHECKLIST WAS COMPLETED and the takeoff roll began. Engine power was normal and there were no directional control problems during the initial part of the run. Suddenly strong fumes filled the cockpit, brought tears to the eyes of both pilots, and distracted them to the extent that the aircraft was soon out of control. They veered to the right, corrected and then swerved to the left and off the runway. The aircraft was totaled when it struck a wrecker, a jeep and a drainage ditch.

The culprit was a hand fire extinguisher from which CB, chlorobromomethane, had been triggered. The toxicity of CB is well known to all crewmembers; a broken seal on a fire bottle is a warning signal that must not be overlooked. Bottle location should be carefully standardized and each container regularly inspected to ascertain that it is secure beyond a doubt.

THE "LAST CHANCE" SAFETY CHECK has proved to be mighty fine insurance. Here's what a base reported for one month. Twenty-four aircraft turned back:

- 13 due to hydraulic leaks.
- One aircraft with oil leak in engine bay area.
- Four fuel leaks.
- Three cut tires.
- One engine bleed door stuck closed.
- Loose latch on lower gun bay panel.
- One aircraft without drag chute.

This last item requires a bit of explanation. The drag chute was somehow lost during taxiing for takeoff. Inspectors found it in the "last chance" maintenance inspection area.

There have been instances when pilots taxied past the inspection area without stopping for a check and then had an accident because something was missed. That kind of behavior doesn't take much smarts. Nor does it require a genius to pass up a last chance life support equipment check. If your base doesn't do this, you can do it during the maintenance check. Take a quick look at oxygen regulator (flow indicator/100%) and connections, recheck chin strap, zero lanyard, survival kit fastened, and other items that apply to your mission and aircraft. ★

Mail Call

FIRE RESISTANT FLYING SUITS

I am writing to you in the hope you might have the latest information on the Air Force's possible use of fire resistant flying clothing. A recent helicopter accident in our command has reemphasized to me the need for better fire protection from our flying clothing.

I read of frequent use of NOMEX material in flying clothing, racing suits, etc., particularly in Army and Navy safety publications. The first reference I have seen recently in Air Force publications was in your December 1968 issue and referenced use of this NOMEX material on the backs of a new flying glove being issued.

I am hoping you can bring me up-to-date on the status of these tests and possible use of this or similar material in issue flying suits.

Capt Sydney E. Gurley
Western ARRC
Hamilton AFB, CA

According to a recent report prepared by our Life Sciences people, the life support SPO in January received 20 flight suits in various weights and weaves manufactured from a new synthetic known as PBI (polybenzimidazole) which was developed under the direction of the Air Force Materials Laboratory. This material will withstand 1200°F before charring and has the characteristic of absorbing moisture which gives PBI anti-static qualities not existing with NOMEX. Test suits made of PBI will be available for OT&E probably by February 1970.

PBI is very costly and apparently there are no plans at this time to discontinue the NOMEX program in lieu of PBI. NOMEX suits in quantity in sage green and Indian orange should be available during 1969.

WELL DONE, MAJOR BERRYHILL

On Nov 13, 1968, I was at RAF, Upper Heyford, England, visiting Maj James V. Berryhill, Commander of the Base USAF Air Rescue Squadron. Jim had a busy afternoon and it has occurred to me that his outstanding professional action in saving two multi-million dollar airplanes might be worthy of a "well done" or other mention in your fine magazine.

Maj Berryhill was pulling alert that afternoon in the H-43 when the "bell" went off. He soon learned that there was an AF-135 sitting at the takeoff end of the runway with an outboard engine on fire. He quickly maneuvered the H-43 to a position where he could use the rotor wash to beat down and control the flames until the fire trucks could arrive to finish off the job. His quick action no doubt saved the fire from spreading and causing major or total damage.

At 4:10 P.M., the "bell" went off again —an RF-101 was low on fuel and the pilot could not get the main gear down. There was not time to foam the runway, thus, increasing the potential fire hazard upon touchdown. Picking up the FSK, Maj Berryhill maneuvered to a position to which he anticipated the aircraft would slide to a complete stop. Touchdown was at 4:16, and the aircraft, sliding on the wing tank, did catch fire. From here on, everything was textbook perfect. Jim dropped the FSK and the firemen got into position to begin fighting the fire while he maneuvered to use the rotor wash to control the flames. The young firemen did their jobs so well that between them and the rotor wash, the fire was put out completely before the fire trucks arrived on the scene. Their quick action kept the damage to a couple scarred wing tanks.

Maj Berryhill, by the way, is a much decorated veteran of Air Rescue in Vietnam and the commander of the team that took first place in the recent NATO Air Rescue competition.

As a former Air Force pilot and now a pilot with Pan Am, I can fully appreciate the dedication and competence of men like Jim Berryhill—particularly when he happens to be my brother-in-law. Perhaps you will agree with me.

Tom H. Keller
St Louis Park, MN

Well Done!

'THE CAPABILITY-JUDGMENT GAP'

In the article "The Capability-Judgment Gap" by Lt Col Victor J. Ferrari (Nov 68), he discussed how "inexperienced or immature instructors may misinterpret the observable self-confidence and performance of students as an indication of good judgment and, consequently, set up a potential accident." To decrease the credibility gap of this article and to show just how right Lt Col Ferrari is, I submit the following statement from an inexperienced, but not an immature, instructor pilot.

"I think my friends should realize that this type of maneuver is very dangerous. The maneuver should not have been continued as long as it was. I think the thing that trapped me was that the actions which the student did take were essentially correct. I failed to realize the importance of the fast application of the procedures involved. What made the crash inevitable was the maneuver itself, the slow application of the emergency procedure, and my untimeliness in taking corrective action." ★

Maj Charles J. Nagle
C-7A Combat Tactics Officer
7th AF, APO San Francisco 96307

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.

☆ U. S. GOVERNMENT PRINTING OFFICE 1969 341-215/7

Captain Richard W. Dabney, Jr.

352 Tactical Fighter Squadron, APO San Francisco 96321

On 21 May 1968, Captain Dabney was number two in a flight of two F-100s scrambled off alert status from Phan Rang AB, RVN, to provide close air support. Captain Dabney delivered his ordnance with pinpoint accuracy, then was forced to leave the target area because of low fuel status. Soon after departure, and prior to rejoin, the fire warning light in Captain Dabney's cockpit illuminated. He immediately declared an emergency and began a turn directly toward the nearest divert air base. Shortly thereafter, the aft section overheat light also illuminated so tanks and pylons were jettisoned in a clear area. The lead aircraft closed, and the pilot advised Captain Dabney that he was trailing smoke, but that no fire was apparent.

The landing gear was lowered about one and one-half miles on final. As airspeed decreased, a marked decrease in flight control response was noted, and the RAT was engaged. Captain Dabney decided that enough control response was available to land the aircraft. The flaps were lowered at one quarter mile, and 20 knots extra airspeed was maintained on final approach to provide zoom capability. Touchdown was about 500 feet down the runway with a 10 knot quartering tailwind. Captain Dabney then found that the drag chute would not deploy. Maximum braking was applied, but with stopping distance becoming critical and no barrier available, Captain Dabney intentionally blew both tires, providing marked deceleration. Partial directional control was maintained with nose wheel steering even though the left wheel was on fire.

As a direct result of exceptional skill and judgment, Captain Dabney was able to stop the aircraft on the runway. Postflight inspection revealed that the aircraft had received four .30 caliber machine gun hits, one of which penetrated the left intermediate fuel cell. Leaking fuel had caused fire damage throughout the aft section and the fire had burned through the drag chute assembly. The courage and superior airmanship displayed by Captain Dabney saved a valuable combat aircraft. WELL DONE!

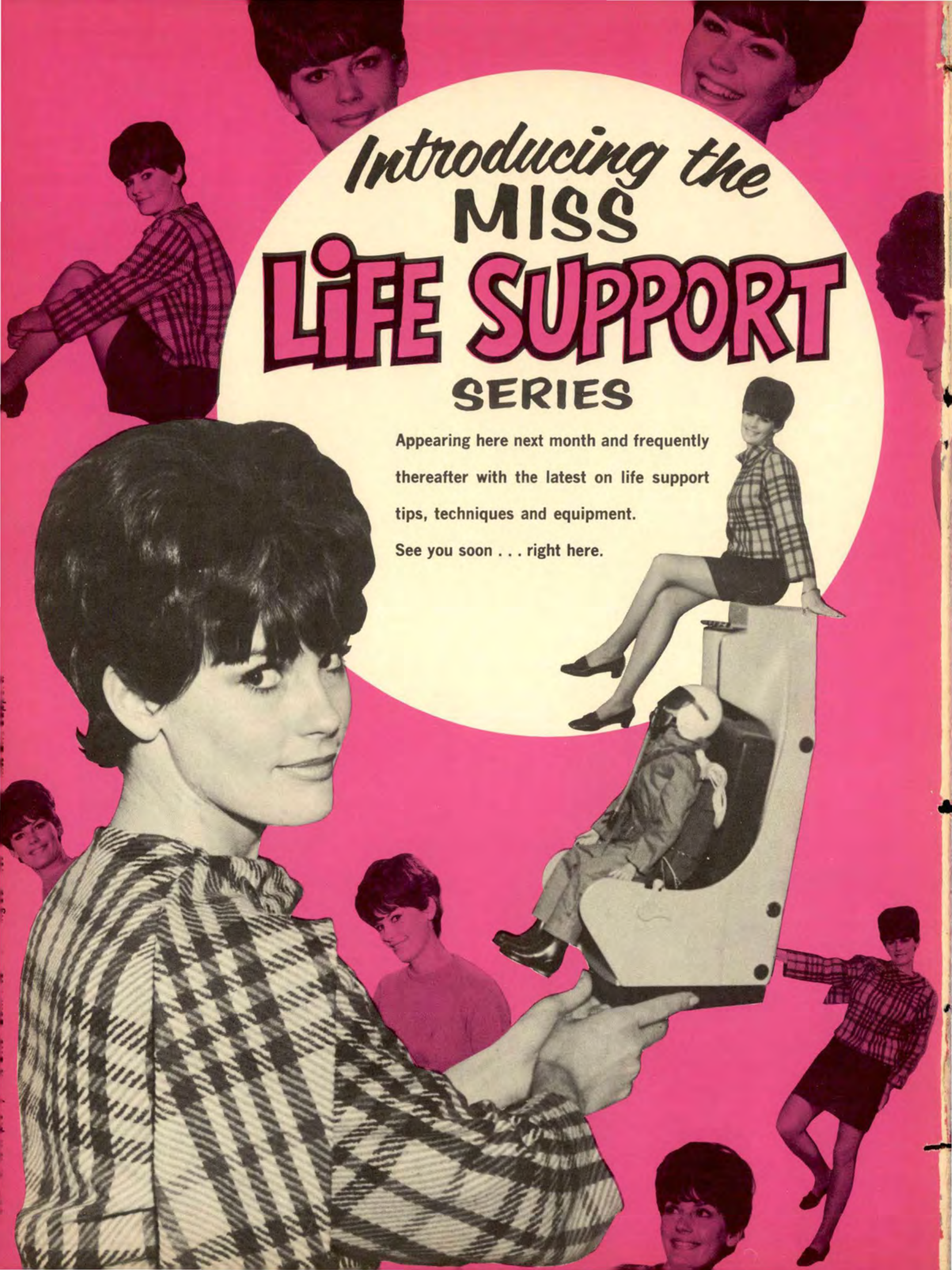
Captain Lawrence D. Haight

318 Fighter Interceptor Squadron, McChord AFB, Washington

On 11 February 1968, Captain Haight was scheduled to fly an F-106A from McChord AFB to Richards-Gebaur AFB, Mo. The aircraft was configured with two 360-gallon drop tanks and a full load of secondary armament. Takeoff progressed satisfactorily to the point of liftoff, at which time Captain Haight heard a "mild explosion" and felt a loss of thrust, and the fire warning light came on. Simultaneously the control tower advised Captain Haight that he was on fire.

The aircraft was now approximately 50 feet in the air with the landing gear still extended. Rapidly assessing the situation, Captain Haight retarded the throttle to idle and landed the aircraft at about the 400-foot remaining marker. He then deployed the drag chute, released the tailhook, placed the idle thrust switch to the ON position and began maximum braking. A successful engagement was made near the center of the BAK-6 barrier. After the aircraft had stopped, Captain Haight shut down the engine and evacuated the aircraft. The fire in the aft section had already extinguished itself before the arrival of the crash trucks. The barrier engagement caused no damage to the aircraft and Captain Haight was unharmed.

Investigation revealed that the engine had failed internally, causing the afterburner flame to deflect onto the side of the engine. This blow-torch effect burned through the engine and the side of the aircraft causing a severe loss of thrust. Afterburner eyelid operation had also been rendered inoperative by the fire and the eyelids were stuck in the open position. The fire ceased when afterburner operation was terminated. Captain Haight's reaction to this emergency resulted in saving an aircraft that would most certainly have been lost otherwise. WELL DONE!


Introducing the
MISS
LIFE SUPPORT
SERIES
Appearing here next month and frequently thereafter with the latest on life support tips, techniques and equipment.
See you soon . . . right here.