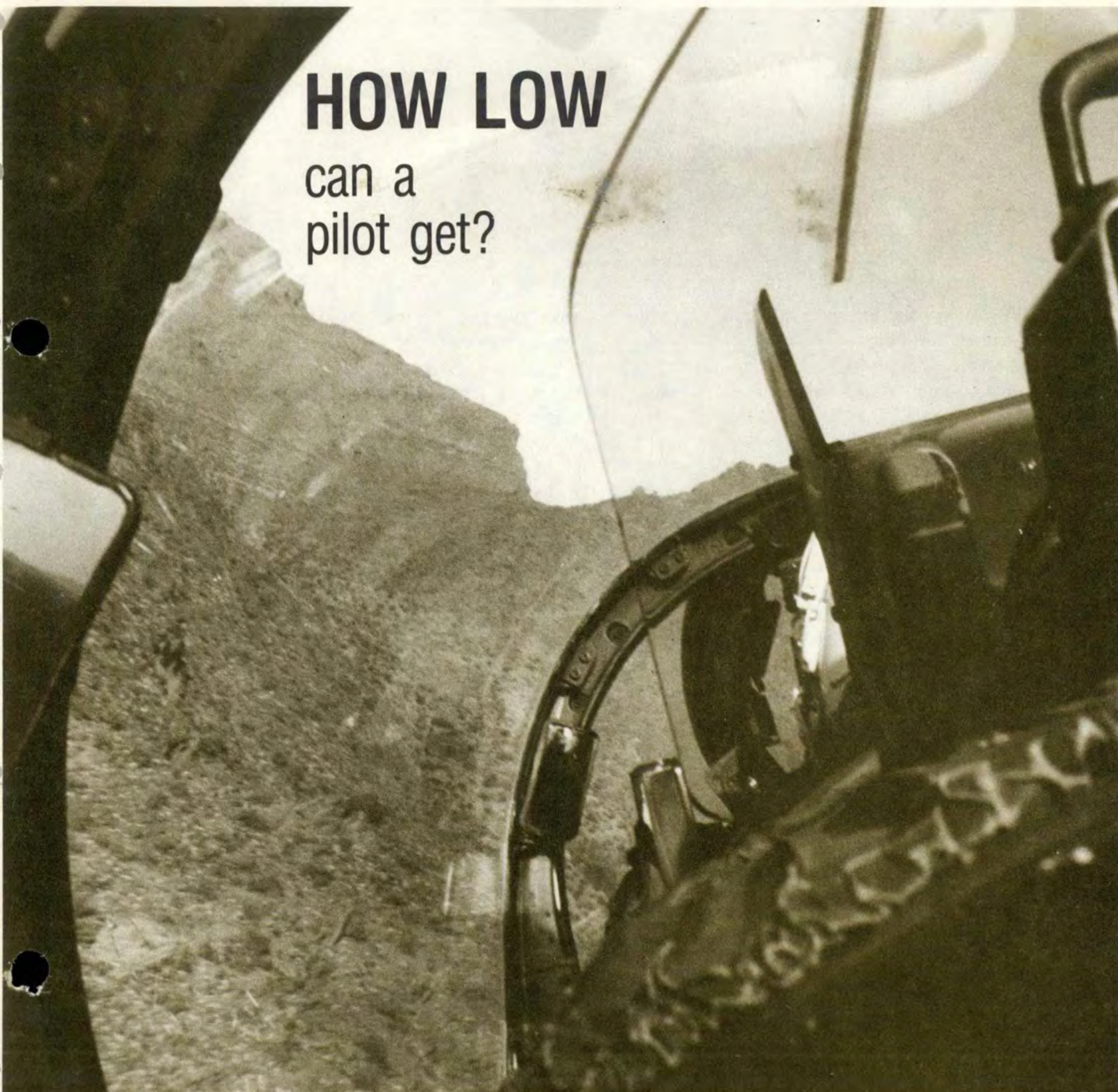
flying

SAFETY JANUARY 1983

ACBT - WHO NEEDS IT?

Why did I Eject?

Decisions, Decisions



THERE I WAS

■ We were lead in a two-ship cell during air refueling. It was the summer of '73, and I was still a young boomer. As I finished my air refueling checklist and was waiting for the B-52 to finish air refueling with Number 2, the pilot announced "Crew, go on oxygen. We have a fire on board!" My heart almost stopped.

A thousand things were racing through my mind as I stowed the boom, donned my helmet, and started disconnecting from primary oxygen to transfer to the walk-a-round bottle.

All went smoothly until, in my haste to get back up front to the cabin, I set my oxygen regulator to emergency instead of turning it off as required. How could this happen? I panicked and it wasn't necessary as, upon reaching the control cabin, I discovered the copilot's flight director system smoking and pulled the appropriate circuit breakers.

Air refueling was aborted, and we received clearance from Center to descend to a lower altitude, as the copilot noticed the oxygen was depleting. The rest of the crew switched to the walk-a-round bottle, and I went back to check the cargo and boom compartment regulators.

I felt very foolish discovering what I had done. We switched to the gaseous system, and all crewmembers returned to the primary oxygen system. We returned to home base for an uneventful landing, and I was a wiser crewmember.

"There I Was" is an excellent title for this personal account of my experience but, in closing, I ask "Could this happen to you?" ■

■ We were on a cross-country to an ANG base co-located with a civilian municipal airport.

Since the visibility was not optimum (4 NM), we decided to shoot the ILS, so we tuned and identified what we thought was the ILS localizer. As we flew inbound, we wondered why we couldn't intercept the glide slope.

We queried the Approach Controller about it, and he said the ILS was monitoring normally.

As we continued to proceed inbound, it became painfully obvious that the localizer was taking us away from where we thought the base was (fortunately there were a couple of rivers near the base). Some deft map reading finally convinced us to abandon the approach and navigate visually to the field. We finally sighted the base and landed.

After the flight, we reviewed the approach plate and discovered that we tuned and identified the VOR located some 6 NM north of the base instead of the ILS localizer. ■

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page 2

page 7

page 10

SPECIAL FEATURES

REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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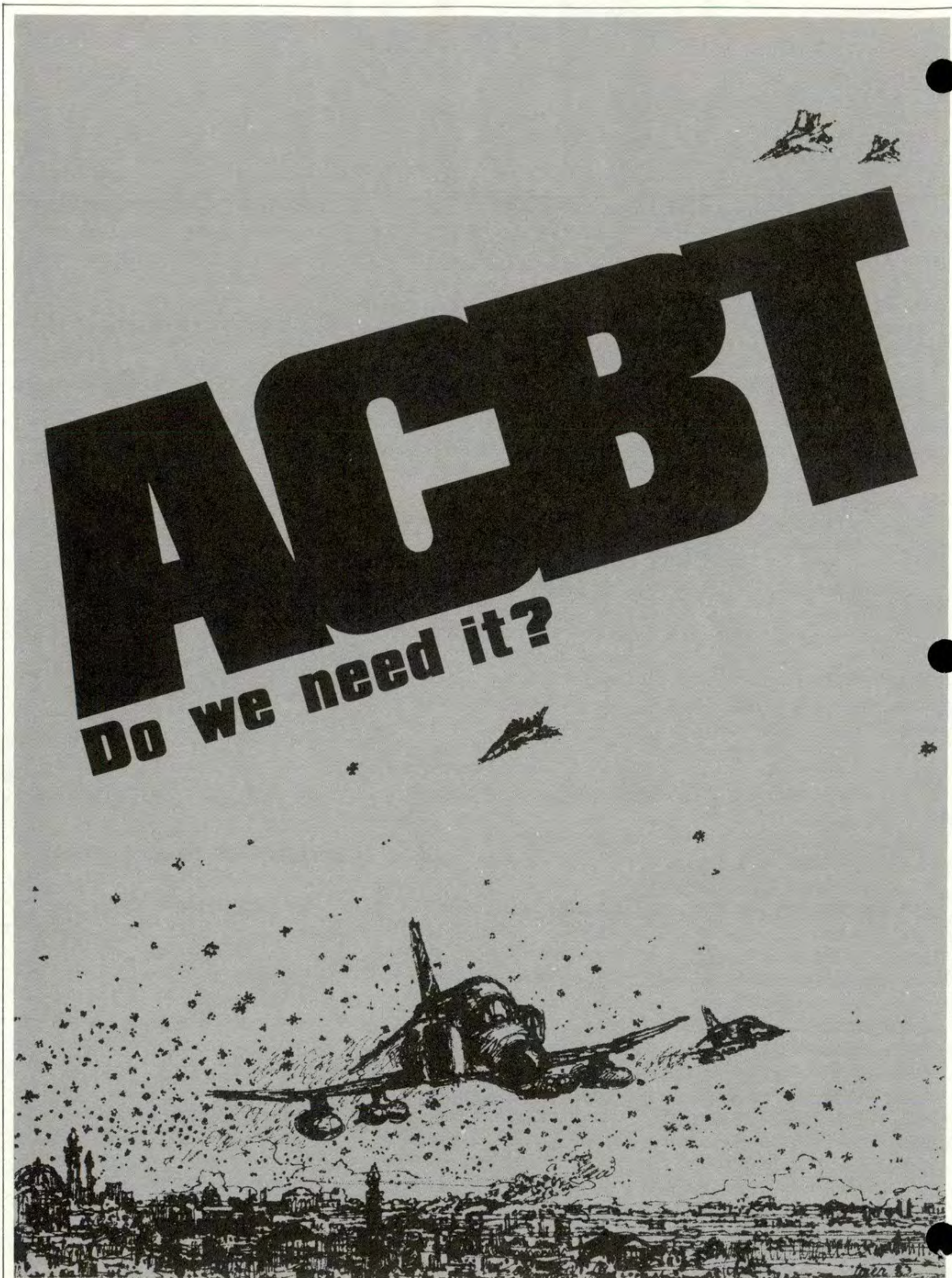

ACBT
Do we need it?

CAPTAIN JIMMY CARRIGAN
149th Tactical Fighter Group (ANG)
Kelly AFB TX

"Hey, man, we don't need that ACBT jazz — we beat mud, pound ground, move dirt! (Besides, it scares me.)" Sound familiar?

Unfortunately, it seems to be a widely held opinion. I can't tell you the joy I'd feel as a pilot, 3d Class, DRCPB, Peoples Republic for the National Liberation Front, if I knew that every A-10, A-7, F-4, etc., that I saw was being driven by folks that either couldn't or wouldn't, interfere with my progress to "ACE" status! Why, my little red commie heart would be in AB! We really owe it to potential adversaries to give 'em more of a challenge than that.

"Why air-to-air training?" There are probably many things that could be said in answer to that question. I've researched this topic and would like to let some of the "thinkers" on this subject speak for themselves. They do it so well, I wonder what I'm doing here in the first place. I see myself as a disciple of their "gospels," but I intend to get in a few licks of my own.

Aggressive air combat training promotes safety. Most contemporary thought on air combat training recognizes the need for the aircrew to be able to fly safely and confidently throughout the performance envelope. Nearly all CCTS/RTU training programs have air combat as the basic skill upon which to accomplish other phases of the training. Even TACM

Aggressive air combat training promotes safety

51-50, Vol I, para 6-57b says, "When BFM/AHC is specified in the MQT program for any aircraft, it will be completed prior to the start of any air-to-surface flying training. . . ." *Approach*, the Navy flight safety magazine makes a typical statement on the subject.

"Interestingly, safety records invariably improve as more ACM phase training is conducted. As LCDR Bob Brich, former safety and ACM phase training officer, puts it 'Continued exposure to the air combat maneuvering environment is vital in promoting safe aggressiveness. Not only do fighter pilot skills increase as a result of intensive ACM exposure, but accident potential decreases as familiarity in operating at the aircraft's limit is gained. Realistic intensive training in a controlled environment is the safest and most effective way to insure combat readiness when it is needed."

Not wanting to hurt the Marines' feelings, here is equal time for how the Leathernecks feel about it.

"Many of us still have the attitude that ACM and safety are mutually contradictory terms or, at best, the two philosophies have reached only a shaky compromise. Virtually every ACM requirement, from the rules of engagement to the face-to-face brief, is safety oriented. Both those of us who decry the restrictions and those of us who enforce them tend to forget the basic purpose of ACM — survival — or, safety at the expense of the enemy.

"A safe fighter pilot is a mature, responsible *professional*. He is current, qualified, and realizes he must continually practice his trade to maintain and improve his skill. Experience is what will save him when he must play the game 'for real.' A safe fighter jock is one who accomplishes his combat mission and returns every time.

"Experience and currency can only be gained through realistic training. Realistic rather than real, only in the sense that training must be nondestructive. If the rules change when the 'balloon goes up,' then our training is not realistic and in the long run it is destructive. Flying what we teach and training what we fly in a demanding, realistic, professional ACM program will minimize our losses in peace time as well as in conflict.

"ACM and safety are not contradictory terms; they are, in fact, mutually inclusive. A professional fighter pilot is a safe pilot."

No one has been killed doing pop-ups for surface attack! They were killed because they didn't give the correct answer to the question, "Can I get there from here?" Transfer of aircraft handling skills from the air combat arena to the surface attack arena is very important. Had more crews realized that turning room required exceeded turning room available, they might be with us today. Maybe their training programs were at fault for not allowing them to develop, at 20,000 feet, correct perceptions that would keep them alive at 200 feet!

No one has been killed doing pop-ups for surface attack! They were killed because they didn't give the correct answer to the question, "Can I get there from here?"

This idea is explained fully by Captain T. Dyches in *Fighter Weapons Review*.

". . . The next requirement is that the pilot must be able to decide whether or not he has sufficient turning room available to allow him to arrive at the track point with the proper dive angle, aim off point, and airspeed established. This analysis of turning room available versus turning room required to complete the attack is extremely critical. There is nothing magic or difficult about it. In fact, it is very basic — basic to all maneuvering that is done

continued

Seizing the initiative gives one th[e]... of being subordinate to i[t]...

ACBT – Who Needs It? continued

by tactical fighters. It is nothing more than basic fighter maneuvering applied to the bombing problem. Unfortunately, too many people in the fighter community think that BFM is something that only air-to-air units should do.

"I have heard several people say, 'Air-to-ground units should be out learning how to drop bombs, not how to dog-fight. Our mission is beating the dirt, not killing MIGs.' To these people I would like to politely reply — 'Baloney!' Basic fighter maneuvers are the tools that allow a fighter pilot to competently perform *every* mission he must fly, including the air-to-ground mission. A good understanding of BFM is required in order to recognize spatial relationships. Having a good feel for what the airplane is doing without referring to the instruments frees the pilot to concentrate on other problems.

"If an air threat is encountered during ingress, in the target area, on egress, it must be dealt with. A knowledge of BFM would certainly be helpful here. After the pop-up has been initiated and the target acquired, BFM is the vehicle that must be used to achieve the track point. The same angle off, range, closure, energy state, and turning problems are present in the pop-up attack. The solution to these problems is properly applied basic fighter maneuvering. The man who has been well trained in BFM doesn't have to spend a lot of time worrying about how to get there from here.

"He knows how to get there or perhaps more importantly, he recognizes when he can't get there because he has been trained to fly his airplane smoothly and competently throughout its entire flight regime. This ability gives him time to think about other things such as applying a correction for the winds or making an intelligent compensation for a small delivery error. This will obviously result in a much higher probability of destroying the target. On the other hand, the man who hasn't been adequately trained in BFM has a very low probability of killing the target. First of all, he may not recognize when he is at other than planned parameters or he may recognize it very late when there isn't time to do anything about it. Even if he does realize the fact that he isn't where he should be, he won't know what to do about it because he doesn't understand the principles of BFM and can't apply them. This is the man who will consistently miss the target in a typical first look tactical scenario.

He is also the man most likely to kill himself.

"As you all know, we have experienced a number of accidents in the past few years during pop-up deliveries. Various factors have been cited by accident boards all trying to put their fingers on one thing: Why did this accident happen, and what can we do to make sure it doesn't happen again? Restrictions have been imposed. Some people have simply stopped doing pop-ups. Abort criteria have been developed. Still we are having people run into the ground! Why?

"*In all cases the reason people kill themselves in a pop-up delivery is because they fail to properly apply BFM!* They don't recognize the preplanned release parameters. They don't recognize the track point. They don't recognize the turning room required to achieve the track point. Finally, when turning room available becomes less than turning room required to pull out above the ground, they die. If only they could recognize the lack of turning room soon enough, they wouldn't run into the ground. How do we train people to recognize these things and react properly once that recognition occurs? A strong BFM training program, married to a well thought-out building block approach to air-to-ground training is the answer. When such training programs are implemented, there will be a dramatic improvement in

right to create the necessary situation instead In (air) combat a white flag cannot be raised.

Col V. Babich
"Development of the Principles of Air Combat,"
Soviet Press, Jan. 82.

bombing accuracy as well as a decline in accident rates."

Safety is very important in the tactical fighter business because it conserves resources. However, to unnecessarily constrain for "Safety at all costs" makes being "combat ready" only a phrase. A curious paradox exists here. How do we go about doing something inherently dangerous (training to get shot at) in a safe manner? Obviously, it takes a compromise. Losses tolerated in combat would be unacceptable during peacetime training. Yet to fail to do the job in combat because of the lack of training could result in our having to change our FOX II calls to "ATOLL's, comrade!"

This quote from Colonel Richard K. Ely in the June 1980 *TAC Attack* gives another view of the safety-versus-training question.

"No one will question the value of a safe approach to our duties; but what is a safe approach? It is not the most cautious nor is it the slowest. It is not just safety for safety's sake. It is the use of tech data, checklists, self-discipline, common sense — it is professionalism.

"We must remember safety is not the final objective. It is a by-product of doing the job correctly. It's the bonus resulting from the proper execution of procedures and a knowledgeable approach to operations.

"The next time instead of saying 'We have to be safer,' you should say 'We have to do the job right.' The emphasis will then be where it always should be — on effective mission accomplishment.

Now, my all time favorite. I hope it becomes one of yours.

"When I carry my knowledge, training, and experience across the FEBA, I want to know that I have had the opportunity to develop my skills to the extent of my own capability and not to the extent dictated by some weaker link in the chain. The stakes are too high for anything less."

It's absolutely imperative that we have enough realistic air combat training sorties to meet our needs. Some of the reasons for this have already been noted, but to expound further: If I were allotted only one sortie a week and were told that I might have to do any kind of mission (TASMO, TASLO, Weasel, etc.), then I would want it to be an air combat mission! In fact, now that several units are doing TASMO, good flying skills are perhaps more important than over land since the visual ques and perceptions have changed. Popping over water with no horizon is not the place to decide that you really don't know how to handle the beast! Without a good ACM program, there is usually a noticeable lack of air sense and air awareness on the part of aircrews.

We must insure each aircrew has the skill to max perform safely throughout the envelope, on any kind of mission.

To continue to be effective, our training should be challenging and stimulating. Bored aircrews don't learn and are usually the ones who feel it necessary to show off for some excitement.

It seems that since Red Flag, DACT, and other realistic training, there has been a marked decrease in pure "showing off. "There's no need to when aircrews feel like they're training realistically. It's difficult to quantify aircrew morale given a good realistic ACBT program, but fighter crews like to compete, and I can see only good coming out of that. It's a rare occasion in life that something good for you is also desirable.

We must insure each aircrew has the skill to max perform safely throughout the envelope, on any kind of mission. Most WSEP reports, for instance, indicate that the single most glaring weakness is the inability to BFM the target. Confidence has a lot to do with BFM; confidence that can be gained through many air combat sorties.

Although the following thoughts are for the F-4, a similar approach is probably applicable to any aircraft. Sixty percent of all the air combat sorties should be clean if at all possible. Clean aircraft allow aircrews an opportunity to develop a "feel" for the aircraft. Some 6-7G readings are to be expected and for a clean airplane this would not be an over G. Also, the fuel savings would be substantial over a year's time, with little if any effect on training. In fact, three clean sorties could be flown for about the same fuel as two tanked sorties, with greater learning effectiveness.

ACBT continued

On day 1 of the "war" we will be able to strap on any kind of ordnance but we can't strap on training. Yep, I know, you have a DOC and a COB, but . . . I don't think it unreasonable to believe that we could be called on to do anything anywhere in the world. If that happens, it'll be too late to train. However, aircrews confident of their ability to fly the aircraft should be able to adapt to any situation. Most aircraft have multiple capabilities. I can't imagine a theatre commander not requiring anything that might be needed regardless of aircrew qualifications. That means aircrews should have multiple capabilities also. The best way to insure at least some capability in multiple missions is to have drivers capable and confident in handling their machine. Those are very desirable by-products of a good ACBT program. And if you don't believe it, look at what I found the other day. This is from an article in the *Air Reservist*. The speaker, a long-time fighter interceptor pilot, emphasizes the importance of being ready for any mission.

"I've been flying for ADC my entire active duty and Guard career. During that time, units I was assigned to were deployed three times — the Cuban Missile Crisis, Southeast Asia, and the Pueblo incident — and the threat we found opposing us each time was fighters, specifically MIGs. Although our wartime mission is continental bomber defense, if we were deployed elsewhere we might face fighters. Also, fighter-to-fighter training teaches better airmanship by providing us with experience in the total capabilities of the machine."

On Day 1 of the "war" we will be able to strap on any kind of ordnance but we can't strap on training.

And, as if I needed more, Captain Bill Hinton, ANG Fighter Weapons School, comes along with this:

"The answer is still the same, and addresses the same concept. If you are striking targets in a high-threat area or just flying around therein, you will be engaged by enemy fighters and will be performing a large variety of air-to-air tasks, whether you like it or not. The Soviets don't care what your DOC is. More importantly, the very nature of combat justifies, even demands, warriors to kill the enemy whenever and wherever found."

What do you think the DRCPBs would think if they knew everything in the sky from the U.S.A. contained "tigers" willing *and* able to rip their noses off? Captain Hinton again:

"The perception the bad guys have of our air-to-air capability has as significant an effect on their decision to press or not, as does the reality of our effectiveness."

If you're saying, "Who was this clown? All he's done is to compile a bunch of quotes on the subject of having good air-to-air skills. Why, he presented a research paper instead of an original piece!"

Shack! But absorb what all of these sources are saying. And, as if that weren't enough, here's a parting shot for you. It comes from the guys in black hats:

"Seizing the initiative gives one the right to create the necessary situation instead of being subordinate to it. In combat a white flag cannot be raised."*

I think we need to be prepared. Ain't no second place finishes! ■

* (Col. V. Babich "Development of the Principles of Air Combat" *Soviet Press*, Jan. 82).

ON COURSE

OOPS!

This "On Course" logo was supposed to be in the white space you were looking at on page 27 of the December issue. We're sorry, kind contributors at ATC/DOTO.

Why Did I EJECT?

MAJOR ROBERT FINKENSTAEDT
Oklahoma City Air Logistics Center
Tinker AFB, OK

■ I don't know. It came time to leave and I left.

It was one of those days when everything seemed to build up on me. The IG team was here inspecting our operation. I had spent most of the morning watching my aircraft ETIC slip until the weather was below test flight minimums. Just after I made a decision to use the airplane to give one of my crew chiefs an engine run recertification, the weather began to break. I filed my flight clearance, fought with a B-52 and C-135 crew for the attention of the SOF, grabbed my equipment, and headed for my airplane.

After fixing several preflight discrepancies, I monitored the engine run check and finally climbed into my aerospace machine at take off time. I think you can see by now that my normal flight was quickly turning to a shambles. Although it had nothing to do with the final outcome, experience has shown me that once things start going bad they never get any better, and extra attention should be given to flying the airplane.

When things become nonstandard, be careful! My hopes for a relaxed taxi were dashed by a lot of traffic trying to get off after the weather break, an Inertial Measurement Set (IMS) running south until it's hat floated and an Automatic Maneuvering Flaps fail light. I should have given up right then, but I still had hopes of salvaging the mission, and because of a 20-minute wait in the arming area I was able to coax the IMS back into the state. continued

Why did I eject? continued

Finally cleared for take off, I breathed a sigh of relief, lined up on the runway, and did my pre-take off checks. I started my take off roll and watched with disgust as my TOT climbed past my nondouble datum temperature limit. Turning on double datum had no effect on the TOT, but it was now within limits, and I turned my attention to getting off the ground. After one last look at the TOT and airspeed, I began my rotation. The nose came off the ground and as my mains lifted off, the aircraft went into a hard right yawing roll.

I immediately kicked off the automatic flight control system and put in full left rudder and some left aileron. I estimated I was about 20 feet off the ground, in a 90-degree bank (anything over 45 degrees seems like 90) and at a 45-degree angle to the runway. I was headed toward two big maintenance hangars, one of which housed my flight test office. I knew that the aircraft had no intention of flying, and I was too low and at too great an angle of bank to eject.

As I was approaching the edge of the runway, the aircraft started to stall, and the left wing dropped back to below 20-degree bank. I knew I was close to the edge of the ejection envelope but that looked like my only chance, so I pulled the handle with my left hand while still holding left aileron and rudder.

The rocket shot me up the rails forcing my eyes closed. I remember saying, "Come on chute, please open" and just after that I felt the tug of the chute opening. I was looking directly down at the aircraft as it hit the parking apron, cartwheeled, and exploded. My next thought was to get away from the fireball, which was uncomfortably close. I pulled down on the back risers to move backwards and shortly thereafter landed on the cement parking apron, executing a perfect PLF (feet and tush) (explitive, edited).

How close can you come? Major Finkenstaedt's seat, parachute and survival kit as they were after landing. Note the aircraft wreckage in the background.
(Photo courtesy of Debbie Shaw, Allied Resources, Inc.)

I released my chute which was dragging me toward the fire, and took stock of myself. Other than a very sore rear end I was OK and looked back at the now wildly burning aircraft. I wondered how I ever got out and what had happened to cause the crash.

As it turned out, the right outer wing had folded and was torn off the aircraft at lift off. The outer wing was found less than 1,000 feet from where the aircraft left the runway. Witnesses said I ejected with about 10 feet altitude in about a 15-degree bank and had one and one-half swings in the chute before landing on the ramp.

In retrospect, ejecting in a slight bank probably kept me from landing in the fireball. Close, yes, too close, but everything worked as advertised — as I knew it would. I think that is a partial answer to my opening question.

Now that the excitement is over and I've had time to reflect on what happened, I think there are two main reasons for my survival, not including all the luck I have saved up for years and heavily borrowed on for the next hundred years. The first big reason is the ability to recognize when the aircraft is no longer controllable and a crash inevitable. I have flown single-seat fighters for most of my 18-year career and I know from experience when I have control and when the aircraft has control. Situations can develop during a flight which require immediate action.

Most of the time a think-react criteria is the best course of action. In some situations your thinking must be done beforehand since your time to think before reacting is considerably reduced. This usually occurs while you are close to the ground, e.g., take off, landing, low level, weapon delivery.

I divide my take off into three parts: From start to nose wheel rotation, from rotation to lift off, and from lift off to 200 feet. After 200 feet I should have more airspeed and time to spend thinking before I react. Runway environment (buildings, ditches, barriers), airspeed, aircraft structural abilities in off-runway conditions, and previous problems with the aircraft are all part of my memory.

In this case I knew that the grass was soft, and once off the runway at that speed the aircraft would probably dig in and break up. Even if I did regain control I would be headed toward the maintenance hangars which I couldn't have cleared. Once I knew I was going off the runway, my decision was made. I suggest that every pilot understand his aircraft and think about what can happen in uncontrolled situations.

The second reason for my survival, and the one I credit with being counted on the side of successful ejections, is my undying (pardon the pun) faith in my ejection system. I knew the capabilities of my system and I knew I couldn't successfully eject during my initial bank. Fortunately, I was able to get the aircraft reasonably level before it hit the ground. I had no idea what the bank angle was when I left since I wasn't looking at the attitude indicator, but I felt I was OK, and that was the best I could get.

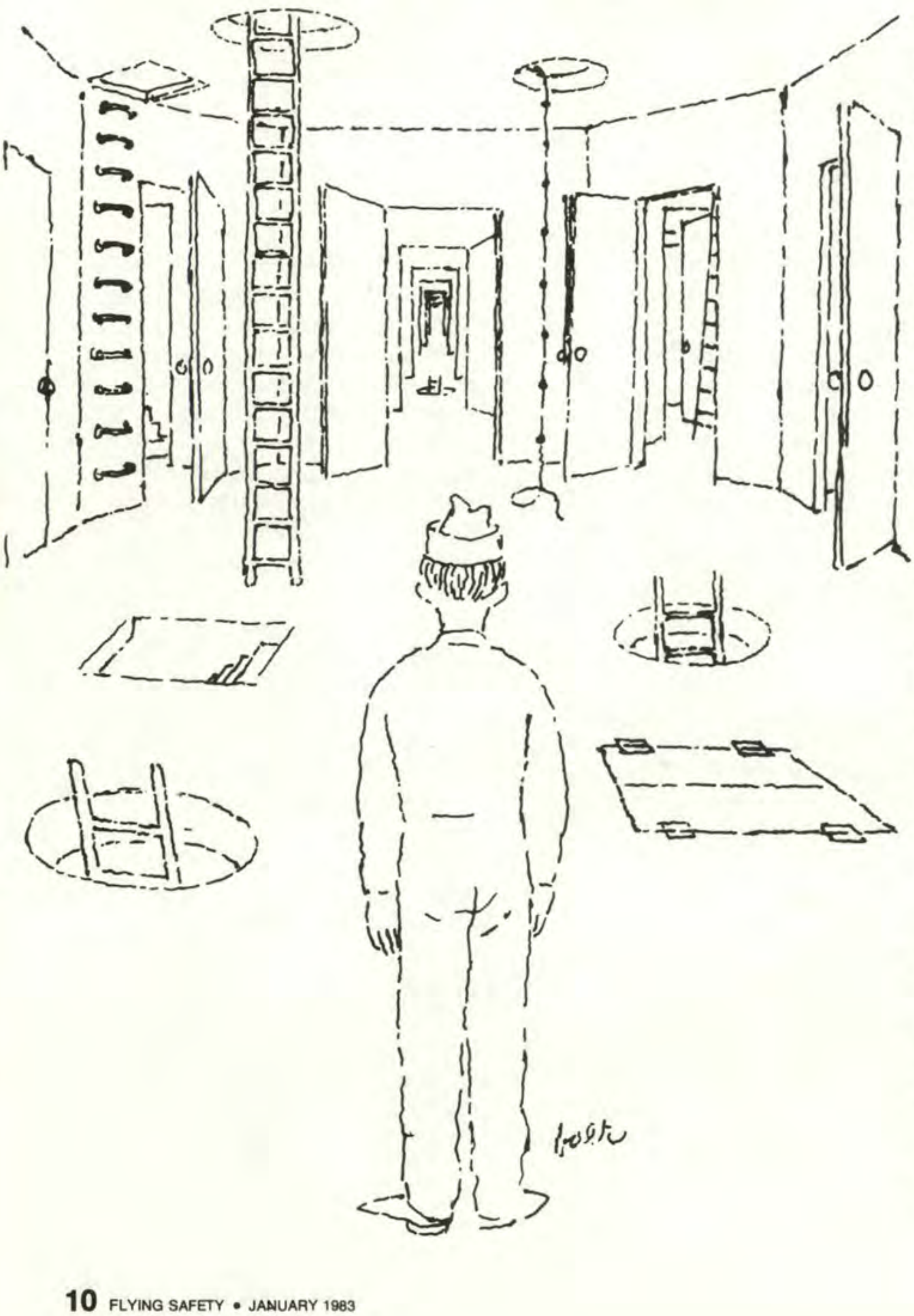
Why do I have such faith in my ejection system? Because I know that fighters crash, but very seldom do you hear of an unsuccessful ejection when initiated within the ejection envelope. I have said many times "If the aircraft doesn't want to fly — fine. I will walk back and get another." I know, for instance, that I have a 0/0 seat that will shoot me up 285 feet, and it will take the parachute 4-to-6 seconds to get full deployment. Will it always work within these parameters? Of course it will. There is no other conclusion unless you like toasty toes. Did I know when I pulled the handle that I was in the envelope? Of course not, but I did know that I was close, and I had a better chance relying on the parachute than the airplane. Besides, sudden stops give me headaches.

Some of the things I do to insure my seat works are: I always check for clearance to the handle before I taxi since there is not much room to reach it. I preflight the chute and seat carefully prior to getting in the cockpit, including the chute inspection booklet. I know most of my parachute packers and visit the parachute shop occasionally to watch them pack. It increases my confidence in the chute when I see how careful they are. Once you realize that the seat and chute can some day save your life, you will take the extra time to be the final inspector of your system and gain the confidence to say "My chute will always work."

I hope you'll never be forced to eject from an ailing airplane, but if you are it'll pay off if you can detect when you've lost control of the aircraft and if you know the capabilities of your ejection system. ■

DECISIONS, DECISIONS

ANCHARD F. ZELLER, PhD
Directorate of Aerospace Safety



■ Decision making is an ordinary process. From the time one gets up in the morning until going to sleep at night, the most constant, conscious activity is probably decision making. Most choices are not particularly critical; but for the airborne pilot, decisions often are closely related to whether he lives or dies. Some studies have shown that in fatal accidents the decision process was the factor most frequently blamed, not information-gathering or skill in carrying out the decision, as we might expect.

There have been many studies on the decision making process and on judgment, two things closely related but not identical. Decision making may be almost purely mechanical, while judgment implies a more dynamic process. Decisions are such an important aspect of high-risk activities that a brief review of what is known about decision making may prove beneficial. The goal is to get not only greater understanding of the process but perhaps some suggestions for improvement as well.

Routine Decisions

The two extremes in decision making are the routine and the unique. Routine decisions might be further classified as periodic or continuous. Routine, periodic decisions are not ordinarily critical. The choice of what to wear in the morning does not usually precipitate a major crisis, nor does

ordering something to eat from a menu, another periodic, routine choice.

Continuous, routine decisions have more potential for difficulties than periodic, routine ones. The worker on an assembly line who performs essentially the same activity to a standard stimulus or the pilot monitoring his instruments during a routine flight are examples of continuous, routine-type decision making. These decisions consist mainly of monitoring, and in these cases minor omissions are usually not critical.

When activity is predetermined, the entire process ordinarily involves little stress. This kind of decision making is, however, conducive to boredom, lapses of attention and overconfidence. A major component of these decisions is anticipation. The next chain in the sequence is expected and the predetermined response follows. Such routine activity can disintegrate quite rapidly into a full-fledged emergency. The individual who combines anticipation with boredom or failure of attention may mistakenly believe certain events have occurred and take action accordingly. The pilot who routinely responds to a gear check without actually checking the gear and then lands wheels up has been trapped by this kind of routine.

Unique Decisions

In contrast to routine decisions, there are others which occur infrequently (sometimes only once in a lifetime). These may be of a nonemergency nature or they may be emergency decisions.

One kind of nonemergency decision concerns the situation. After high school, there is the decision of whether or not to attend college and then, frequently, the emotion-packed decisions of which college to attend. Whether to join the ROTC, whether to apply for UPT, whether to enter the business world. Many, if not most, of these decisions are not of an emergency nature, but they do serve to set a course which may be followed throughout life or until the situation is changed by some other major decision.

Another type of nonemergency, unique decision is that which is associated with cognitive processes. These kinds of decisions often involve a long series of problems to be solved prior to the ultimate decision. Such decisions occupy a great portion of the thinking of scientists, engineers, or others dealing in similar logic sequences. Despite the unique character of each sequence, the process may almost become routine and continuous in nature.

There are still other unique decisions, precipitated by the flow of events which must be made quickly. These emergency decisions may come from continuous monitoring of a situation or as a complete surprise in a unique setting. The pilot who finds his plane high-jacked has had routine monitoring interrupted by a series of events which require different decisions than he had anticipated. More commonly, an inflight emergency quickly brings about the same need to reconsider and select a course of action which had not been foreseen.

One secret of success is the ability to anticipate and be prepared for important decisions, or at least have the resources to deal with unanticipated situations in a rational and logical way.

Recognition

Regardless of the nature of the decision, a number of steps are involved in its making. First, the need for a decision must be recognized. This would seem to be an obvious requirement, but one of the most frequent problems associated with aircraft accidents is that there is lack of recognition, or lack of timely recognition, of the need for a decision. In a real emergency, this decision may well make the difference between life and death.

Typical of this is the requirement for a decision to eject following the conclusion that continued flight is untenable. Repeated review of ejections indicates that the biggest single factor in ejection fatalities is this failure or delay in recognizing the need to eject.

The failure to perceive the necessity of a decision may be due to a variety of things such as ambiguous, incomplete, or erroneous information. While such problems certainly make faulty decisions understandable, this

DECISIONS DECISIONS

continued

understanding does nothing to minimize the effects which follow no decision or a bad decision in an emergency.

Also, while the information may be complete, the sequence or manner in which it is absorbed fails to provide enough cues to trigger a decision. One of the simplest examples of this is the failure to heed a bright red stoplight because of preoccupation. The pilot who complacently watches a speck on his windscreen grow larger and larger without reaction is a victim of the failure to react to cues of impending trouble.

Background Resources

Another aspect of the decision choice is the background resources which the individual has to apply to the situation. In general, these resources are ready-made as opposed to those which are created.

Ready-made decisions, also called template matching, involve having learned a great variety of specific patterns which precipitate a preconceived response. Here the decision process at a minimum involves only recognition and then action. This form of decision making is basically what is taught to Air Force pilots with bold face procedures. The individual is not required to assess, only to act. This approach is fraught with a great many hazards, notably the fact that we cannot anticipate every possible combination of events.

A second consideration is that partial recognition may result in action which is inappropriate, even fatal. A third problem is that, memory being fallible, the patterns once well known and practiced may be forgotten, confused, or may have been replaced by more recent patterns which have rendered some previous activities invalid, even lethal. One of the best examples of this is the pilot who, having learned to eject by pulling side handles, reacts to his emergency with an activity which is no longer appropriate. The ejection handles have been replaced by emergency egress handles in this seat.

Another difficulty with the canned reaction approach to emergencies is that while the first response would normally be correct, the situation may involve features which require a more considered form of response. Time becomes a critical element and is frequently the one consideration which is at an absolute minimum. Considered action may require considerable problem solving which is time consuming.

While we can discuss differences between routine and unique decisions, in actual practice this distinction disappears. What started out as a routine decision may rapidly change to a unique one.

Criticality

There are a number of variables involved in the decision making process. Some of these should be examined separately for a better understanding of the dynamics involved.

The first is the problem of criticality. This brings up two questions: Can the need for a decision actually be recognized? Can it be dealt with?

The chess master faced with an opponent's unexpected move may require some organization or reorganization of thought, but his problem does not compare with that of an emergency room physician faced with the victims of a catastrophe whose lives depend upon the speed and precision with which he makes and executes his decisions.

Another aspect of criticality is an assessment of the probability of success or failure. If the effect of a faulty decision will be catastrophic even though the right decision will provide a desirable conclusion, then there may well be considerable procrastination in making the decision.

Still another factor related to criticality is that the knowledge that the decision involves a high probability of unpleasant failure may create such emotional turmoil that the individual finds the process short-circuited. A logical and rational decision does not appear to be possible. Again, drawing from accident experience, there are those rare circumstances in which panic develops to the point that logical analysis is discarded in favor of an inadequate emotional response.

Personal Variables

The variety of personal responses to the decision process is certainly a

continued on page 2

ARE YOU READY?

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■ This is the second in a series of four articles dealing with cold weather survival. The first article, "You're Next," presented true survival episodes, posed questions, but gave no answers. This article will take a look at the preparation for cold weather flying and give some answers to questions asked about the first two survival episodes of last month's article.

Winter is here; snow-covered peaks and chilling rain are an everyday occurrence. Life support shops should have modified their kits to prepare you for winter survival. Unfortunately, not all shops can provide adequate cold weather equipment and clothing because of space and weight limitations of the kit; therefore, the preparation is up to the aircrew member. When preparing yourself for winter operations, you should: (1) Know your operational environment, (2) Know your issued life support equipment, (3) Supplement issued equipment, (4) Know the clothing requirements for your area of operation.

First, consider the terrain. Will you be flying over tall, rugged mountains or flatlands where high winds will be a major problem? Will you experience a dry cold or is rain common. Are there areas where adverse weather will prevent air search for days at a time? Will there be lakes, or larger bodies of water? Is it or could it be a tactical environment? Some of these questions should cue you to other considerations for the area you operate in most frequently.

Be familiar with the equipment the Air Force provides. A visit to the life support shop will prove informative. Does life support provide you with everything you need? What is the possibility you will have each particular item after reaching the ground? Based upon these considerations and findings you should become more aware of additional items required.

Supplement issued items by making yourself a personal survival kit. Items you may consider for this kit include: small pliers, .025 brass wire, matches (waterproof), band-aids, iodine, pocket knife, sharpening stone, fishing equipment, and a compass. You may choose to include a few other items. Properly packed, these should fit in a band-aid box, soap box, or plastic cigarette box. Be sure to tape it securely closed to overcome the temptation to open it for everyday use. It's a good idea to put it in your flight suit each morning, as you do your wallet. Store it in a pocket that is less likely to rip out upon ejection or bailout. Heavy items will tend to rip pockets directly exposed to the wind blast, such as the pockets sewn on the arm or lower leg.

continued

Saying you should have the proper clothing seems an understatement, but it can hardly be overemphasized. Fortunately, the Air Force shares this concern with aircrews. AFR 60-16 requires MAJCOMs to prescribe the minimum essential items. Flight clothing should be selected for the type of terrain, environmental conditions of the geological area, availability of flight following service, and anticipated timeliness of search and rescue. Fire-protective outer clothing must be worn except when winter flight clothing is required by climactic conditions.

The unit has the final say-so for optional clothing items. Most units provide a variety of items, including winter flight jackets with or without hood, quilted underwear, long cotton underwear, leather gloves with wool liners, and a variety of other articles of clothing. When selecting clothing, you must consider not only the environmental factors, but the resulting restriction of movement in the aircraft, especially in the smaller single- and dual-place aircraft. Instead of one large bulky jacket, consider the more reliable and comfortable layer system which may consist of normal underwear, long cotton underwear, quilted underwear, and the flight suit. This is more likely to give you freedom of movement and better insulation.

Know your aircraft and duties, then try different clothing combinations. This is the only way for you to know which works best while still getting adequate protection. For winter flying, carry a wool stocking/watch cap. You'll be more protected in case of an unplanned landing/ejection.

The helmet can supply excellent protection. However, it cannot be worn in all circumstances, so an adequate hat is a must. All aircrew members must use the nomex gloves. But, since the nomex glove is tight fitting and does not provide much insulation, it would be a good idea to carry a pair of leather gloves with wool inserts. Mittens are usually the warmest and are your best choice.

Feet are the part of the body most commonly affected by frostbite during survival episodes. For some reason, this is the part of the body most neglected. Proper foot gear is a must. The insulated quick-don flight boot does provide some protection in relatively cool, dry climates but is inadequate in a wet-cold or extremely cold environment. These boots can only be supplemented through the proper use of socks, correct fit, and proper condition. Avoid at all costs new or tight-fitting boots. New boots must be well broken in or they will cause considerable discomfort during your stay on the ground. A tight-fitting boot does not allow sufficient layers of socks and greatly restricts circulation.

When buying winter socks, select wool socks instead of synthetic. Buy a wool/nylon blend. They do not shrink as readily as 100 percent wool. Look for a guarantee on the sock that says "Shrink Treated." Providing your boot will accept the extra bulk, a nylon inner sock is highly recommended. Nylon absorbs very little moisture and transfers moisture away from your foot more readily than other materials. This additional layer also adds insulation and traps a thin layer of air between the two socks for additional warmth. Do not use cotton socks during the winter! Cotton absorbs water very rapidly, stays wet longer, and is slower to dry than any other material.

Finally, have a pair of boots large enough for two pairs of socks. Having two pairs of socks with a tight-fitting boot is worse than a single light pair of socks. This may mean separate pairs of boots for winter and summer wear.

Compare the protective clothing you wear to the helmet a motorcyclist wears while riding. You may never need it, but when you do it will be a life saver.

In last month's article, "You're Next," there was a story of two survivors of a B-52 incident. As you may recall, the pilot found himself hanging upside down in an tree. He lost his knife trying to cut himself free, then finished the job with part of a ration tin. When he reached the ground, all he had was a flashlight, matches, parachute harness, and jacket. Even though he had had a survival kit during ejection, it was tangled in the tree. He had not disconnected the raft from the kit while letting it down — the line connecting the kit and raft was hung up on a limb. He tried to get it down, but couldn't. Once he was on the ground, the kit was in the tree to stay — radio and all.

Many of his problems could have been avoided had he followed proper parachute descent procedures. Immediately prior to a tree landing, the survival kit is to be jettisoned from the harness. At night it is difficult to determine the type of terrain you're in. In this case, the parachutist could have made that determination because the snow-covered fields were clearly visible from the darker trees. This upside-down hangup could have been avoided as well as the loss of his knife.

Here a problem arises. How can you determine that magic moment just prior to entering the trees at night? There is no fool-proof answer. One way is to watch the horizon. When it appears you are getting close, jettison that kit. Then listen for it. Can you hear it hit the trees? If so, you're lucky — finding it won't be too hard, because you won't be that far away.

After the pilot made it to the ground, he did the right thing. He got a fire going and sat down to take stock — the best thing to prevent further shock.

The next morning it was snowing heavily. He decided to walk to the top of the hill for a general observation. About one-eighth of a mile to the northeast was what he thought to be a road. Later on, knowing choppers couldn't make it in, he decided to walk. If there wasn't a road, he knew he could make it back to his fire and parachute. Fortunately, there was a road. A vehicle came by, picked him up, and took him to a phone where he contacted base operations. In general, after getting out of the tree this survivor did things correctly. He did not attempt walking at night. When he did move, he had a definite objective and plan.

A personal survival kit (with the items mentioned earlier in this article) would have been of some help to him. The band-aids would have helped. He had incurred some small cuts around his mouth. It would also have provided necessary equipment for a lengthy stay since his issued kit was 30 to 40 feet up in a tree.

The second survivor in this incident handled things differently. He too found himself hanging in the trees. Since he had been a passenger he didn't have a survival kit and lost his helmet during bail-out. After cutting himself loose from the parachute, he worked his way to the ground. In the distance, he could see one rotating airway beacon. He rolled his parachute up crudely and set out for the light. (He based this decision on a morale factor, feeling that doing something was better than just sitting around, waiting.)

After traveling 10 to 15 feet, he realized carrying the parachute wouldn't work. So he spread the canopy out in a small area, just large enough so it could be seen from the air. Since it was snowing, this was not a very wise move. He then struck out toward the beacon, not realizing it was 35 miles away! After almost 3 and 1/2 hours of walking and losing sight of the beacon, he decided to stay put for the night. Suddenly he wished he had stayed with the parachute or taken it with him. At least he could have made some type of shelter and rolled up in the rest of it.

At about 3 in the morning, he got a small fire going which gave him some warmth. At dawn, he used the sun that shown slightly through the clouds and moss on the trees as a heading indicator and headed southeast. He realized he back-tracked part of the course he covered the night before when he lost sight of the beacon, and was walking in a circle. At about noon that day he saw what he thought to be a farm house. While walking toward it, he encountered two hunters who took him to safety.

After his recovery, the survivor said "I stated earlier that I made my first real mistake (trying to walk out at night), and I want to reemphasize that point. I did it more as a personal morale factor. I probably hiked three times as far as necessary in order to get to the nearest road." He also said, "Each crewmember should, and I believe this is very important, make up a personal survival kit consisting of some basic equipment such as waterproof matches, a small compass, fish hooks, band-aids, and items of this nature that can be fitted into a small bank-aid box." He went on to stress "Had I stayed with my chute, I might have been picked up sooner."

All survivors in this incident were properly dressed for their stay on the ground, thanks to stringent local clothing requirements. They were wearing quilted nylon underwear, heavy flying suits, and thermal boots. Even though he wore thermal boots, one man had to be hospitalized because of frostbite. He spent two nights on the ground. Another man, completely paralyzed by his fall to the ground, was found the evening of the second day. The stringent clothing requirements probably saved his life.

Now I ask you, "Are You Ready?" Next month "It Happened!" ■

Lower The Boom. . .

MAJOR ARTHUR P. MEIKEL III
Directorate of Aerospace Safety

■ A recent increase in air refueling mishaps has prompted a great deal of interest on the subject. There were 28 such mishaps through October 15, 1982. A straight line prognosis for 1982 predicted 35 air refueling mishaps which compares with previous figures of:

1978 — 50 mishaps
1979 — 40 mishaps
1980 — 32 mishaps
1981 — 30 mishaps

1982's pessimistic forecast was based on a variety of factors. For one thing, the KC-135 will be flying more. Also being considered is the increased exposure of KC-10s and the fact that C-141B receiver pilots are still in the learning process and are therefore relatively inexperienced.

Through October 15, 1982, the mishaps, broken down by month and receiver aircraft are:

J	F	M	A	M	J	J	A	S	O
B-52G	C-141 F-4D F-15 A-10 C-141	F-4D C-141 F-4D A-10 KC-10 F-4D B-52G E-3 RF-4	None	C-141 A-10 B-52D E-3	B-52G F-4D RF-4	F-106	F-4E B-52D	B-52G B-52H	MC-130

. . .On Mishaps

Do you want the good news or the bad news first? The good is that April 1982 was the third month in 5 years with no air refueling mishaps. The bad news is that it followed the worst month for air refueling mishaps in the last 5 years.

An integral element in the exploration of a problem is the study of trends. Throughout 1982 there were fewer inadvertent boom contacts with receiver aircraft. From 16 receivers damaged in 11 mishaps in 1981, the 1982 number dropped to two aircraft damaged. The mishap numbers for the last 3 years are 2, 11, and 2.

On the negative side, B-52 pilots are pushing inner limits at night and crushing ice shields. In 1980, six out of seven bomber mishaps were night "extra-inner" limit mishaps. In 1981, this occurred only twice. But in 1982, six of seven B-52 mishaps involved wrinkled ice shields at night. In most cases, breakaways were not called, and damage, initially, went unnoticed.

The difficulty of night air refueling, as with many aspects of flying, is that in a matter of seconds you can go from a nice, smooth flight to a catastrophy. Safety reports invariably recommend "brief all pilots." So consider yourself briefed.

A new recommendation concerns eye exams for boom operators to include depth perception and night vision testing. Present flight physicals do not include these important aspects of vision. SAC and Brooks are working on enhancing the physical exam to include these additional tests. The problem not only concerns boom operators but receiver pilot's vision as well. For every boom operator who failed to recognize a "close encounter," there was a receiver pilot who failed to recognize rate of closure and correct the situation.

Besides the B-52 mishaps in 1982, two of four C-141s and two E-3s fit the same mishap parameters (night, inner limit, ice shield, late recognition of closure, etc.).

Thirteen of the 28 mishaps through October 15th, involved fighter aircraft. This figure — less than 50 percent — continues the positive trend which began last year. Eleven mishaps involved A-10s and F-4s. The three A-10 mishaps include two cracked windshields and one fuel spray damage to aircraft components. There were two A-10 refueling mishaps last year. The eight F-4 mishaps are slightly ahead of 1981's seven, but below 1980's total of twelve. Six of the mishaps occured at night. Four occured because the receivers exceeded the refueling envelope limits with the boom still in contact. Signal coil problems caused two.

It's a pleasure to report that the ANG's A-7s, all C-135 receivers, F-FB-111s, F-16s, and C-5 aircraft are absent from the list of mishap receiver aircraft. Congratulations are in order.

There's also good news about the KC-10 tanker. After several nozzle failures last winter, improvements made in March of 1982 have resulted in no subsequent nozzle separations.

The C-141 refueling corps experienced four mishaps in 1982. Two occured in February, one in March, and one in May. Turbulence was a factor in one and autopilot off operation in another. As the C-141 receiver force becomes more experienced, the numbers should improve.

Future air refueling mishap rates will drop as boom operators and pilots become more cautious of their inner limits; as aircrew members who have doubts about depth perception and night vision have comprehensive eye examinations; as F-4 pilots and boom operators trigger some disconnects earlier; and a whole bunch of professional people keep up the good work. ■

HOW LOW CAN A PILOT GET?

CECILIA PREBLE
Assistant Editor

■ It should come as no surprise to anyone with more than a few hours of jet time that we lose airplanes and aircrews in alarming numbers while flying in the low level environment.

In the modern world of sophisticated antiaircraft weapons, the conventional wisdom of raising the operating floor doesn't work.

We must train as we plan to fight. But it also does no good to train realistically if our losses are so high that we offset the benefits. Clearly, we must find a better way.

Captain Milt Miller, an instructor at the ANG Fighter Weapons School, Tucson, Arizona, has been working on this problem for several years. As an A-7 pilot, he obviously has a very personal interest in low level tactics and has done a great deal of research. The following article is adapted from a briefing and interview which Captain Miller gave to *Flying Safety* magazine.

Because of the volume of material, the briefing and interview have been divided into two articles which will appear in the January and February issues.

Captain Miller's solution is built on a three-pronged approach:

- Controlling the sequencing and timing of all tasks
- Controlling the low altitude physics
- Controlling the pilot's visual system.

In this article we will discuss some of the problems with low altitude flight and his proposed approach to these problems.

"I don't want to put this thing forward as the solution that nobody will ever die again if they listen to what I have to say," Miller says. "All I'm saying is I suspect they'll increase their tactical capability, or if they hold that the same, some will probably save themselves."

The culprit in most of these accidents is turning and looking, which is defined as making a high-G turn and looking other than where the nose is going.

It is Captain Miller's position that 50 feet straight and level is indeed safer than a 200-foot, 5-G turn, given typical pilot deviations.

The pivotal question then, is "how low?"

"The answer is a very definitive, "it depends." To draw a conclusion, you must assess your flight environment, aircraft capability, and pilot capability."

The two aspects of flight environment are the physical aspect, which includes bushes, mountains, water, and whatever else is out there, and task loading, which is what the pilot is attempting to do.

"It would be great if the only places we flew low were like an ILS where we could clear everything out of the way for five miles around the airfield, sterilize everything, survey, tell everybody to put red lights on everything that sticks up, put a bunch of regulations out and control the whole process."

Unfortunately, the pilot cannot design his environment. Although controlled procedural solutions work well in controlled environments, it becomes difficult to squeeze a procedure into uncontrolled environments, "because when you do, a guy will try to take one of a couple of different procedures he's learned and try, no matter what, to make it match the environment. And it doesn't work."

And just as variables can change rapidly in flight, so does task loading, one of the most dynamic aspects of flight.

Aircraft capability is the second major consideration in deciding how low to fly. How is the aircraft equipped and how does it perform? An aircraft that has a radar altimeter and heads up display (HUD) has a distinct advantage over one that does not.

Pilot capability is assessed from a physiological as well as a mental standpoint. Many Israeli fighter pilots, who by many slick wing captains' standards are considered among the most capable, don't drink, don't party, watch their diet, take vitamins and are meticulous about their physical condition.

As task loading fluctuates, so does the pilot's ability to complete tasks, based on his training. "If I can throw the switches 40 percent faster than somebody else, that gives me 40 percent more time to do something else. The tasking affects the pilot capability, the pilot capability affects the tasking."

The purpose of Miller's task management-based decision process is to train pilots to control their task loading. The focal points are the three elements listed earlier: The environment, the airplane, and the pilot.

The result of this system should be an organized process for accomplishing the pilot's tasks. This solution is not necessarily the same for any two pilots.

"At any one moment, even though we are supposedly physically doing the same thing, some of our tasks will be the same and others won't. I may be looking at the radar altimeter while you're looking over the side to assess your height. Both are equally successful if the guy's been trained, but you have to prepare him to get this information, assess it correctly, add it to his own capabilities, and reach a solution. That way you can cover the up sun, down sun, in the rain, out of the rain, and all those other infinite varieties of combinations of environment, task loading and pilot capability."

continued

An understanding of the various types of tasks is integral to the control of task sequencing. To begin with, there's terrain clearance tasking, which is any task, mental or physical, that establishes, maintains, and predicts terrain clearance. There are four basic functions within terrain clearance: Controlling the aircraft, controlling processing time for the other tasks being accomplished, controlling the vector, and controlling altitude.

The other tasks are divided into two groups: Critical and noncritical. Critical tasks require immediate aircrew attention for successful mission accomplishment. These tasks are performed in addition to the primary task of avoiding the ground.

"I have to acquire the target, I've got to turn right here, I've got to hit the pickle button. It's what's going on in the mission. Critical tasks involve getting where you're supposed to be, at reasonably the right time and doing your job. These tasks involve command, control, and communications; navigation; and threat response."

These tasks will alternate in order of importance depending on where the pilot is in the mission. Noncritical tasks are identical to critical tasks. The only difference between them is the amount of time allowed for the performance of one or the other. Noncritical tasks can be accomplished in a flexible time window. Something which a moment ago was noncritical may suddenly become critical and then noncritical again.

"These are the three buckets we're going to throw all our tasks into: Terrain clearance tasks, critical tasks and noncritical tasks, time being the distinction between the last two, and avoiding the ground versus doing everything else, the difference between terrain clearance tasks and the others."

Now to assess whether the pilot can perform all the tasks he's stacking up for himself, examine the physiological and psychological aspects. Part of the pilot's physiological and psychological state is stable but parts can vary

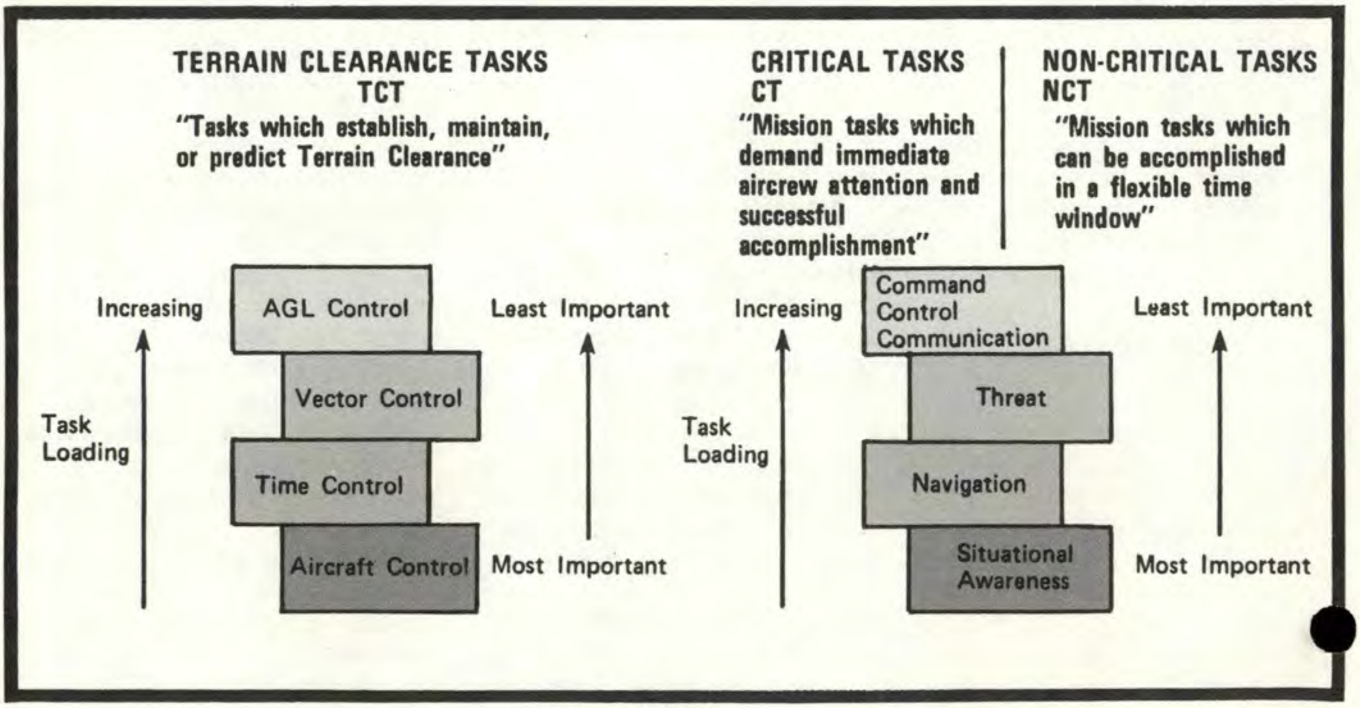


Figure 1

om moment to moment. Here is where interaction between task loading and the capability to perform comes into play.

"If I take a list of tasks and pull one out and substitute an unfamiliar for a familiar task, a pilot's capability drops. If you're running along and I say do a 'remote mark,' which is something you haven't done for six months, the uncertainty bell goes off and your instantaneous capacity to perform just dropped, because you've substituted an unfamiliar task when you had been cruising along doing familiar tasks. I may not have increased the number of tasks, just substituted, producing a change in your task loading.

"Let's take an example to clarify all the terms. Take some time points out of a mission. They may be in sequence. They may be hundredths of a second, a couple of seconds, or a few minutes apart. The idea is that at any moment in time, a guy has certain tasks stacked up for himself, nd he is going to accomplish them n sequence. His mission critical and noncritical tasks bobble around and sometimes there isn't much to do and the task loading is low (see figure 2 for time point #1). He's approaching the IP and getting his act together, (time point #2) as he gets right to the IP, he lowers his altitude, snaps wings level and does his update (time point #3). Right here he says, 'I have intentionally set myself up to do nothing but control terrain clearance (time point #4). I'm going to use low altitude to defeat the threat and temporarily minimize mission tasks to fly at the lowest possible altitude. At the pop point (time point #5), I will intentionally reduce terrain clearance tasking by pulling it up a little and take on a whole bunch of mission critical tasks.'

"He pops up or acquires the target. He immediately dumps a whole lot of stuff on himself but he intelligently lowers his terrain clearance tasking to make room. The pilot still may not be getting all the mission stuff done. He may not be checking six, he may not be doing the radar warning receiver (RWR) the way he wanted to. There's a little bit of uncertainty about where the target really is — he is overtasked. He acquires the target and delivers and takes on formation tasking for the rejoin time point #6). He comes off the target, overtasked, in a hard right turn looking for his wingman. He's now doing the infamous turning and looking act. He's looking far to his right or he may even be dumb enough to look to his left as he's slicing back down to the dirt, exceeding his own capabilities to handle the real world physics. He's now on the wings of luck. The real trick right here is teaching a person to diagnose over-tasking and then control it."

The key is usually stress, stemming from the fact that tasks are not being accomplished. When you know you're not getting your job done, or it's taking you too long, or you're experiencing any number of problems, "you're operating somewhere below where you want to and you'd better do something about it.

continued

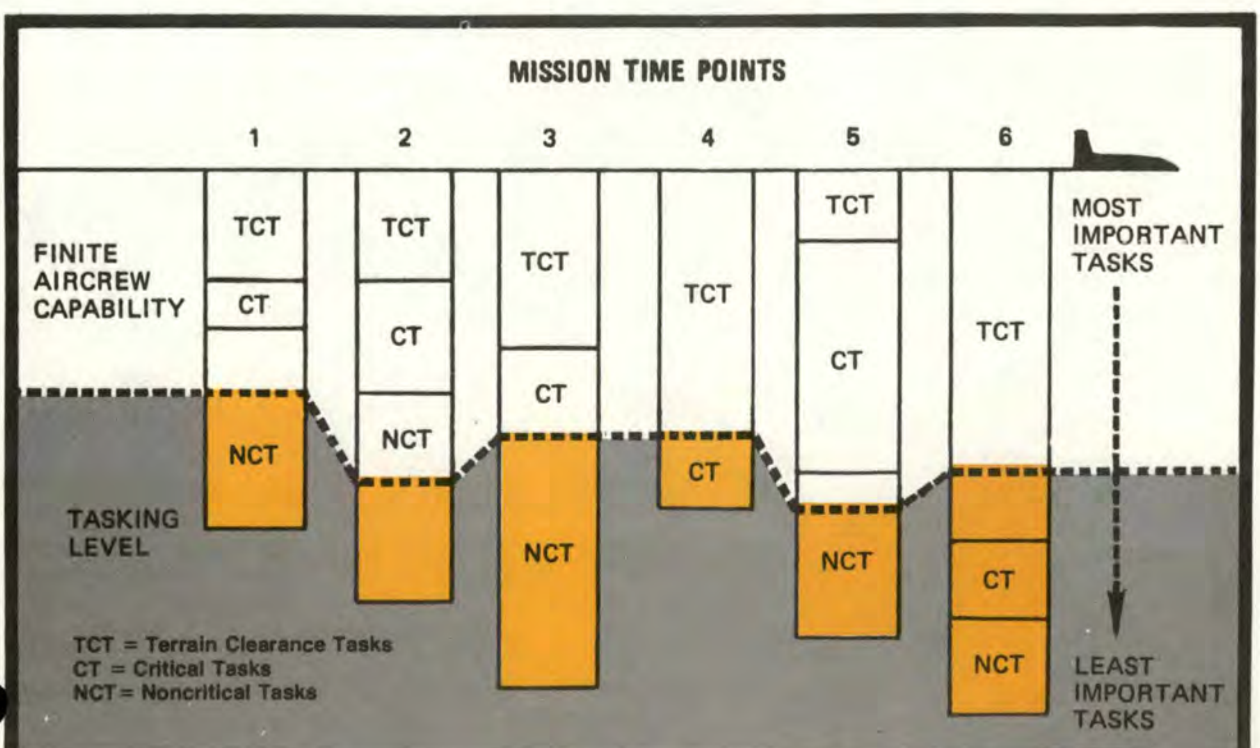


Figure 2

"If we get in a jam for task loading, we dump the least critical tasks first. We don't arbitrarily blow up the balloon till it explodes, instead we let air out in a controlled manner to reduce the pressure. Noncritical tasks go first, followed by critical tasks and, hopefully, never terrain clearance tasks. Of course, the last thing we ever unload is aircraft control, so theoretically, we'd hit the ground in control before we'd hit the ground uncontrolled. We don't want to get that far but at least we have the tasking in some sort of reasonable hierarchy." Task loading is a focal point of Miller's training program.

The program Captain Miller espouses centers around intentionally overstressing students so they'll modify the tasks they can control, such as altitude and maneuvering, and decide not to try something they don't feel capable of completing. If pilots learn to stack their tasks, the emotion is removed from the decision process.

"Each pilot makes a controlled decision about where he is operating. If the flight lead is higher, it may well be because he is communicating and navigating — he's got a big stack of critical tasks. Meanwhile, the wing man is sitting there going, 'ho hum,' with few critical tasks. And that's fine. Operating altitudes vary depending upon the individual task loading."

The operating altitudes at which task stacking comes into play are minimum altitude and critical tasking altitude. Minimum altitude is where the accomplishment of only terrain clearance tasks demands the full use of all available aircrew capability (time point #4). "It may be 50 feet in some environments, it may be 5,000 in others. It will be dependent on environment, airplane capability, and pilot capability. On any given day, change any one of these inputs and your minimum altitude will change, or could change."

The second operating altitude of concern here is critical tasking altitude, where the accomplishment of all critical tasks, plus terrain clearance, demands the full use of all available aircrew capability (time point #3). Here the pilot is doing all the critical tasks but none of the noncritical.

Disregarding standard definitions of the low altitude environment, Miller has developed one of his own. It is generic and applies to the individual, based on his task management process. "The low altitude environment is the operating envelope where terrain clearance is the priority aircrew tasking. When avoiding the ground is my number one task, I'm in the low altitude environment. I don't care if I'm at 15,000 feet, looking over the canopy rail ready to split S down and intercept the bogies while my wingman's right next to me looking at 2 o'clock high. The physics of the airplanes are identical, but our task loading is not — I'm in a low altitude environment and he's not.

"Another way to look at it is based on free time. Free time is defined as the time available to accomplish other tasks besides terrain clearance. You go out and do some critical and noncritical tasks. You start a timer in the back of your head — time control — and when it beeps — time to go back and look at the ground again. If you base all your timing references on terrain clearance and vary free time depending on where you are you're in the low altitude environment. Any time I'm on an instrument approach I personally consider myself in this mode using course, altitude, and position to control terrain clearance."

When it comes to the physics of low altitude flying, Miller's approach adds considerably to standard training. "We had a generic individual training program called comfort level concept. It was individual, it was generic, but it relied on the guy figuring out his own internal algorithm to making decisions and it didn't give him much to go on. You supervised him and let him go out there and practice under the assumption that if he did this a few times, he was going to develop an algorithm that was good enough to hold him together and that he would intuitively be able to figure out what the inputs were and what the sensitivities of each one were. I maintain that's not good enough."

The trouble lies in the fact that pilots are inadequately prepared to understand the inputs presented by the physics. "It doesn't matter whether you have the greatest decision logic going on in your head, if you have the wrong inputs, you're going to die periodically, if you get in that spot. In this case, periodically is as good as all the time, at least for me.

"Now, let's take the infamous steady state dive. How close are you to dying given typical deviations of the pilot at a typical airspeed? I'm at a hundred feet, cruising at 480 knots relative to the ground and I let my nose drop down a half degree. From a hundred feet, how long will it be before my nose hits the ground? It will take more than five seconds. I may either perceive myself as really smoking along or as being comfortable, depending on the situation. The real physics may not be obvious.

"Perception of speed and time to impact are dependent, in many respects, on the visual environment and experience. The more time a pilot spends flying wings level, the more experienced he becomes at estimating the amount of free time he has. Typically a guy is rolling along, he looks away for one second and says, 'well, I didn't die, and the airplane didn't move.' He builds up a certain psychological reference point of free time. He may start out with one second attempting it ten times without incident. As he tries two seconds, then three, he finally finds out that at seven he nearly kills himself. 'Wow — that's too close, it must be somewhere less than seven and greater than one.' I think we should look at it in a little more detail."

Let's talk about turns. Everyone knows it takes more G to hold level flight as bank angle increases, but how much more? At high Gs, 2 and 1/2 degrees of bank equates to one full extra G for level flight. Level turns at high Gs aren't easy. Typical fighters operate between 4 and 5 Gs and within that window, a 5-degree overbank means hitting the ground in three to five seconds from 100 feet.

"I consider a 10-degree bank deviation to be the typical deviation if the guy is looking away from his vector (see Figure 3). Here the 4 to 5G, 100-foot impact occurs in the two- to three-second window. What happens when a guy looks over his shoulder? What are the typical stick inputs when you turn? You pull more G and you roll, however, I will dare say that most people are not trained to add nearly the necessary amount of G on the stick for 3 degrees of bank increase during the high-G turns. This altitude loss from overbank is an acceleration and it so dramatically reduces the time to die from your typical wings level flight that you absolutely must learn to respect it.

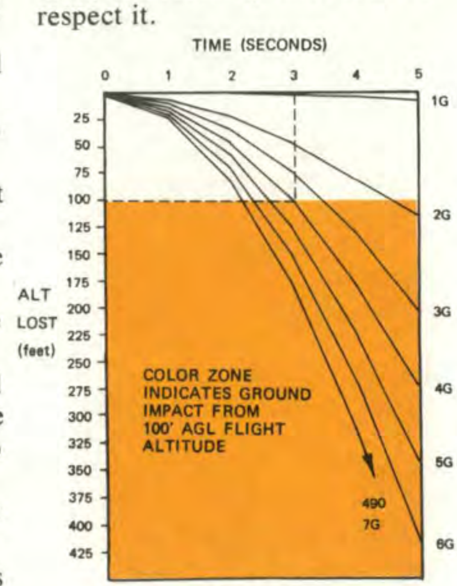


Figure 3

"Let's take a look at vertical velocity and flight path angle as a function of the same conditions. In this case, the pilot is losing altitude, he's overbanked by 10 degrees in a 4-G turn from 100 feet, and he's started his descent. What is going to be his life saving cue? Assuming that we give him a two-second reaction time to stop his descent and get his nose back up, he gets one second to detect the problem. In a 4-G turn, it's highly unlikely that

continued

he'll detect the initial 12-foot altitude loss after the first second, so he's probably not going to key on that. He shouldn't key on vertical velocity either. After the first second he'll have about 1,500 feet per minute actual vertical velocity going down, but he may or may not have anything registering the drop on any of his instruments yet. But if he has a HUD, he will be able to see his flight path angle decreasing. Aircraft structure will also work as a cue for flight path angle.

"While turning, if the nose moves laterally, it can only come from two sources; yaw or decreasing flight path angle. You should know if you have yawed the aircraft and learn to REACT IMMEDIATELY to the lateral drop as an indication of overbank for existing G and impending impact. It is the most obvious cue, particularly when you compare airplane structure versus something 6,000 feet or two miles away. This cue also helps keep the pilot looking out the front of the airplane.

"Most people don't hit the ground looking out the front window. Instead, they've started a turn and are looking someplace else. *The trick is keeping the crosscheck time short.* We all know that, or we should know it, but most pilots asked to complete a questionnaire didn't indicate anywhere near the necessary change from level flight, compared to the real world physics." A false sense of physical stability based on wings level flight is erroneously carried into the turning crosscheck.

There is also dive recovery altitude, another fundamental to consider any time the nose is pointed at the ground. What is the altitude loss of the airplane as a function of flight path angle and airspeed? The old air-to-air rule does not work. The best dive recovery is not the tightest and best turn, unless you instantaneously have the required G. "If there's any delay in G onset, slow is always better than fast, because you always end up coming down at a slower rate and thus lose less altitude."

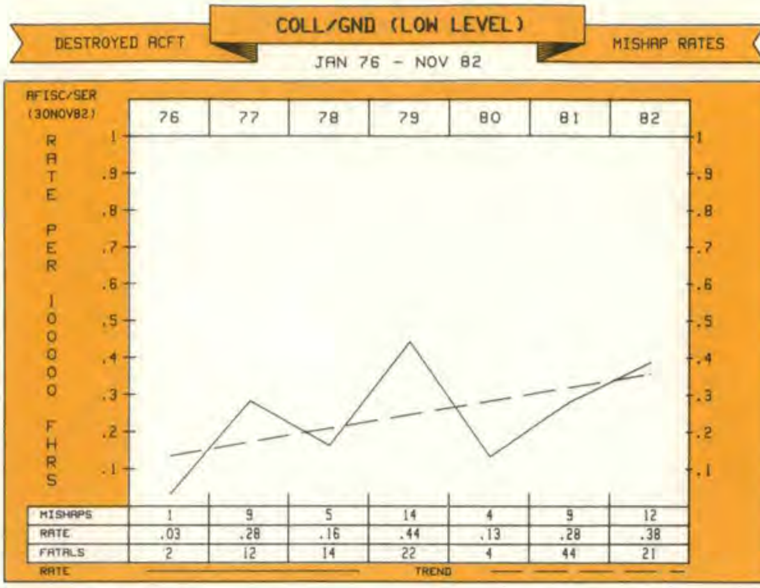


Figure 4

Since 1976, the Air Force has had 54 mishaps in which aircraft were destroyed when they collided with the ground during low level maneuvering; 119 lives were lost in these mishaps.

So low altitude physics is always a factor, whether you see it or not. The time to die varies significantly, bank being the trickiest part. "Bank will alter the physics much more quickly than a change in altitude because an increase in altitude hardly affects time to die in a turn. In the earlier example, impact from 200 feet only takes 1.2 seconds longer than from 100 feet. This should tell you that bank saves you faster than anything else. Pitch is fairly stable. The danger there is the fact that you pick up an erroneous (if you haven't been educated otherwise) concept of free time for a given altitude. So say you have something in your airplane that says I'm at a hundred feet. Carrying that conclusion of free time into a turn means serious trouble.

"Turning and looking, that is, looking away from your vector in a tight, near-level turn, is probably a death act. If you want to look and turn, do it *climbing* and looking and turning. This is a must, both for survival and maximum low altitude performance. Mission effectiveness demands low altitude proficiency and that demands high intensity maneuvering very close to the ground.

"I think it is absolutely imperative that people put this type of physical objectivity into low altitude flying. The simple one-line solutions do not work. Physics show that 50 feet, straight and level, over a smooth terrain on a dry lake bed is indeed safer than a 100- or 200-foot high-G turn. Altitude alone does not control terrain clearance."

In the next article we will define the visual factors of the flight environment and categorize them so that you can, at least in a relative sense, tell when you're transitioning from a good to a better or worse environment.

We must understand the low level visual environment. Once you combine an understanding of low altitude physics and the visual limitations of our bodies with the concept of task management by terrain clearance, critical and noncritical tasking, you have a realistic, workable, low altitude training program. ■

DECISIONS, DECISIONS

continued from page 12

variable to consider. There are those who function best in a high-pressure setting and those who disintegrate to the point of panic. Some individuals in an emergency situation experience a time lengthening and on subsequent recall of the details find it impossible that so much could have happened in such a short time.

The other extreme already mentioned is an individual who recalls entering the bottom portion of a loop but remembers nothing further until rescued. Most people probably fall somewhere between these two extremes, but in fact there is a great difference between responses to tension and those in less emotional circumstances.

Another personal response variable is the ability to time-share or divide attention, ensuring that the entire emergency situation is viewed in perspective without undue emphasis on any one facet. Overconcentration of attention is well documented by a number of accidents in which the entire crew has become so preoccupied with some other consideration that they forgot the basic rule of all flight — terrain avoidance.

This inability to appropriately divide attention often occurs because the pilot is overtasked. At other times, however, it is related to the temperament of the individual.

In this regard, the individual's perception of who may have precipitated the emergency is an important variable in the rationale of the response which follows. In Vietnam when ejection was precipitated by enemy action, the success rate was an extremely high 95 percent. In contrast, other operations normally experience a less favorable (75 to 80 percent) success rate. The differences have been postulated as the results of certain lack of personal responsibility in the first case, and a lingering suspicion under more normal operations that the individual will be held responsible.

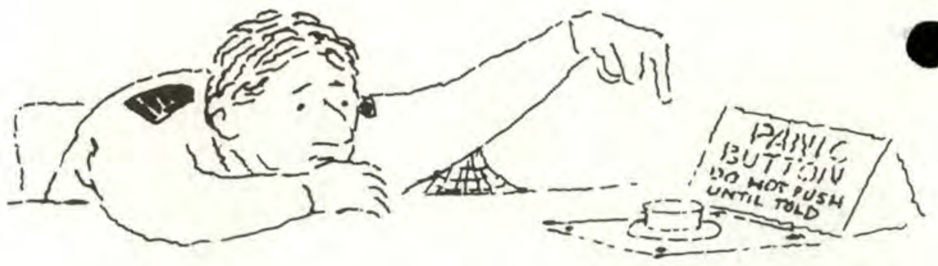
Source of Information

Consider the form in which the problem is presented. It may come as the result of a series of visual stimuli as presented to a pilot in combat. It may come as a verbal request with varying amounts of details defined. Or it may come as a written request setting precise limits. Regardless of the format, the next step is the initiation of mental processes varying from simple reflexes to long-range abstract analysis.

The role of time becomes a highly critical variable. Simple reflex activities in which the stimulus leads to a preconditioned response may occur in a fraction of a second. Abstract decisions may require a lifetime. The individual may never come to grips with the problems presented so a decision becomes one of default rather than positive action. This kind of decision making is extremely self-defeating. While the individual may "luck out" occasionally, there is usually a feeling of defeat when one knows that one's own emotional resources were not sufficient to reach a decision.

Group vs Individual

Still another variable frequently involved in the decision process is whether the decision is to be made alone or with other people. There are individuals who prefer to control their own destinies. Others prefer being part of a coordinated team effort. There are unfortunate instances in which an individualist has a defined role in a team setting. This frequently leads to problems in communication and sometimes to more serious difficulties. Everyone is acquainted with the aircraft commander who dominates the crew, insisting that his is the role of decision, forcing everyone else to act as followers. Accidents have occurred because a member of the crew has been so cowed (by this authoritarian commander) that he fails to supply needed information for fear of a rebuff. While strong individualism is frequently a sign of maturity, it can also be a signal of a basic insecurity. It can create anxiety in subordinates who perceived it as implied criticism. While there are no guaranteed solutions to such situations, a preconceived and accepted division of labor, with the tacit assumption that as mistakes are noted they will be mentioned, makes crew or team functioning much more successful and less stressful.



DECISIONS, DECISIONS

continued

To Act Or Not To Act

In the decision making process, there are always two different kinds of decisions. A decision to act or a decision not to act. Once the decision is made to act, an individual may stop considering important variables. Accident records are full of examples of individuals who, having analyzed the situation, made a decision as to the problem and the course of action to follow. Unfortunately they continued to follow the action or sequence of actions even though later information indicated that they had misunderstood the basic problem.

This failure to reject a hypothesis once accepted is a pitfall which pilots particularly should avoid because of the critical time constraints on so many emergencies. A corollary to this kind of mistaken evaluation is that even though subsequently the individual perceives that his incorrect analysis initiated the course, it cannot be changed. When it is not clear what action should be initiated, the decision not to act is frequently the most appropriate one. But this has pitfalls which can cause problems.

When a decision not to act is made, there should be a corollary decision: when will the problem be reapproached? This may involve time, new information, changing goals, or some other series of variables which will then make the decision process easier.

Automation

People are reluctant to accept that a mechanical system controls their lives. Carrying automation of responses to an extreme has led to the suggestion that there be a panic switch in aircraft which would assess all of the variables in an emergency situation, alert the pilot, and direct him to activate a switch to initiate the emergency response sequence. It has been suggested that even this last decision on the individual's part might not be necessary for the switch could be activated automatically.

The Role Of Learning

Whether discussing decision making in terms of judgment or the activation of some predetermined response, a number of questions arise. Do some decisions come naturally or are they all learned? If they are learned, how are they learned and can a better system be developed for teaching them?

There is also a requirement for determining gradations of the decision making process so that tasks requiring greater decision making ability can be matched to individuals capable of performing this function. A definition is also required in order to measure the role of training, and to assess the kind of training which is to be used to improve decision making. The definition and measure of immediate judgmental decisions would seem to be the most difficult. Facility in creating and solving decision trees is something which can be quantitatively measured and which can be marked by increasing complexity and difficulty.

The preceding definitions serve a purpose in communication. The problem is whether or not they can be converted into some form of measure which can differentiate sound decisions as opposed to questionable ones, and whether or not they can serve as a vehicle for assessing learning progress. Experience would indicate that static processes can be measured before and after instruction so that quantitative assessment of progress can be made.

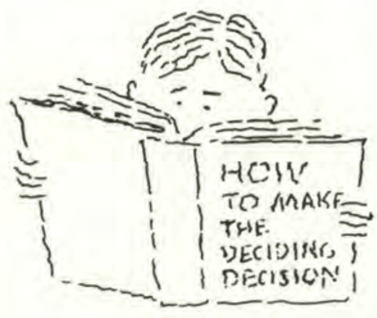
Judgment and the decision

process can be partially measured. Where they cannot be measured, both original measurement and incremental improvements are hard to document. As was noted previously, the approaches to decision making have involved the teaching of static patterns and the teaching of integrating processes. The first of these would seem to be readily amenable to systematic instruction. The second is questionable.

Let's consider the decision making process as a systematic organization of available material which, when processed, results in a course of action. The decision may be tentative or firm and the action may be either initiated or held, but some end point has been reached. Judgment, in contrast to either the process or the decision itself, is a quality applied to decision making which makes maximum use of all of the materials to arrive at a correct decision.

The term "correct" certainly must be considered in decisions. Incorrect ones may be the result of inadequate information, a faulty process or poor judgment. To illustrate some of the differences, one who decides to embark upon a life of crime has used poor judgment. But, if, once the decision has been made, the criminal activities involved are initiated with caution, prudence and safety, the decision making process is intact and functioning well and the individual's decisions are well developed. Sometimes the judgment supplied in the decision making process is not as easily evaluated. The pilot in a disabled aircraft, who may either eject and see the aircraft land in a school yard or stay at the controls with death as an almost certain result, is faced with a composite of judgment and decisions which can only be assessed in light of his own past philosophical orientation.

A respected aviation specialist suggested that all pilot reactions



should be of the template matching variety. He believes that a pilot could be taught to handle the greater portion of any combination of difficulties by reflex responses either individually or in a series.

The method taught for handling emergencies in some of the newer, high-performance aircraft incorporates more dynamic and fewer specific procedures. In defense of the bold face approach, it should be pointed out that in none of the astronauts' missions to date have emergencies been faced that have not previously been considered.

Concerning specific responses to specific combinations of events, consider the individual's memory. Unless procedures have been practiced often and recently enough, formerly well known procedures may be forgotten.

An intermediate step between the purely automatic responses and dynamic responses is the use of procedures to integrate the information available in a systematic way. The results of this concept have been the standard courses of problem solving and decision making which develop rules of engagement for processing information so that a decision becomes almost automatic.

One disadvantage of this for the airborne pilot is the critical element of time. Leisurely, systematic plotting of information variables is not possible. This approach can be taught so that even those individuals with a minimum of ingenuity can, by a systematic documentation of their problems, sometimes improve the probability of reaching a correct decision.

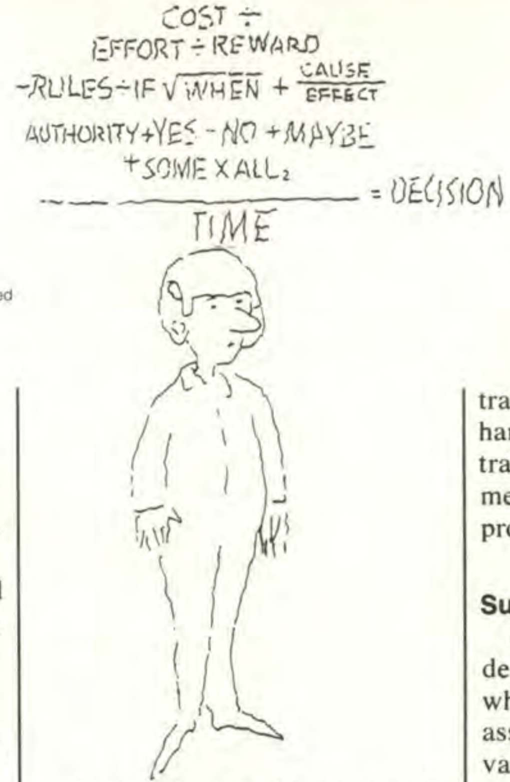
The other end of the spectrum from rote reflex response is dynamic reasoning. While this may be improved by formalized information about the reasoning process, it is probably (of the three approaches) the one which least lends itself to being taught. Improvement in this area is the result of learning principles, not specifics. It is this quality, nevertheless, which is most necessary in situations where time is at a minimum and rote answers do not appear to apply to the particular situation. Whether or not this process can be taught, it can probably be assessed. The development of a test or tests to assess this capability in pilot candidates could be advantageous.

Experience

Another consideration is the fact that there are both novices and journeymen in any setting. There is little question that test pilots can routinely handle emergencies which a line pilot in a first assignment would find overwhelming. Since the line pilot does experience the emergencies, however some method must be developed for helping him cope with situations which require more maturity and experience than he has.

To increase competence beyond experience level, various training aids are used. These may vary from paper and pencil exercises to high-fidelity simulators which duplicate the aircraft with great precision. As was mentioned earlier, NASA's experience is that none of their space missions developed surprises. This was related to the fact that extensive simulation had been used. When, in terms of experience, the first moon landing was attempted, the procedures were not foreign to astronauts.

DECISIONS, DECISIONS continued



The airlines likewise have maximized use of simulators in upgrading or cross-training pilots, often without any recourse to the aircraft itself. The record of success validates the approach. The Air Force has been less systematic and perhaps less enthusiastic about the use of training aids, but here too experience has indicated that procedures and the elements of decision making can be developed to exceed the experience level which the individual has achieved by flight alone.

The general goals of training are relatively clear. First, training serves as a method for weeding out the marginally capable. Next, it is a safe process of teaching those with the desired skills to respond in an optimum way, using what they know or what they have learned. Finally, it should ease the transition so that what has been learned during training can be readily transferred to the real world.

Training Variables

Variables in training have been considered so extensively that only a brief reminder of some of these will serve to put them in a decision making context. As in any training, there are the people to be trained, and there are aptitudes and talents which differentiate the trainees. While the decision making aptitude is much less tangible, it is as much a part of the individual's total organization as is musical or artistic talent. Additionally, there are the same variables which play a part in training for any other function.

Among these is the stress under which the individual operates. This includes both personal stress and that imposed by the system. Questions related to motivation are also important. Does the person really want to learn or even see the reason for learning? Has he decided to make an effort?

Assuming that people are well selected with the appropriate background capabilities and the desire to learn, the next area of consideration is the system. This involves a curriculum and its presentation, which may include lectures, demonstrations, and hands-on exercises, and use everything from textbooks to computer data instructions. An important part of teaching is the instructor. In the Air Force context, instructors may vary from the pure academician to the simulator operator; and in FAIPS, a flight context from FAIPS to combat veterans. The goal of the system is the development of proficiency in handling both routine operations and the emergencies in the real world which may be associated with these. While much Air Force training is associated with the handling of emergencies, there is no training directly related to the mechanics of the decision making process itself.

Summary

From this general survey of decision making, the decisions which evolve and the judgment associated with making them, various conclusions follow. First, decisions are a major factor in accidents. Also, some people are better at making decisions than others. They anticipate, they manage their resources, or, in pilot terminology, they stay ahead of the aircraft. Another positive conclusion is that decisions by default are dangerous.

All can profit by training, but we can only conjecture how much. The more canned patterns involved, the easier the decision making process becomes, particularly under highly emotional conditions where thought processes are interrupted or distorted. This conclusion has to be accepted with reservation, however, because total dependence on these kinds of responses can lead to failure, even death, in new circumstances.

There is no substitute for analytical thought and considered judgment when there is time for the analytical process. Under time constraints in highly critical situations, even though preprogrammed decisions are useful, there is also no substitute for clear reasoning and analytical thought. ■

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UNITED STATES AIR FORCE

Well Done Award

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

CAPTAIN
Jay F. Reed

SECOND LIEUTENANT
John A. Kozura

56th Tactical Training Wing
MacDill Air Force Base, Florida

■ On 23 March 1982, Captain Reed and Lieutenant Kozura were flying a UH-1P with six passengers on a routine training/range support mission. Lieutenant Kozura was in mission qualification training, and Captain Reed was the instructor pilot when Lieutenant Kozura started a descent to transition to range altitude. At 700 feet AGL, during the descent to range altitude, Leiutenant Kozura noted that the power turbine rpm was low. He increased throttle to the maximum, but was unable to attain normal operating rpm. At the same time, Captain Reed noticed an unusually high fuel flow reading and smelled fuel. He took the controls and initiated an emergency descent. Lieutenant Kozura monitored the engine instruments and cleared the aircraft as Captain Reed turned into the wind and found a field suitable for landing, which was crucial at this low altitude. At approximately 150 feet above the ground, Captain Reed increased collective pitch to slow the descent. The low rpm warning light and audio system activated indicating the main rotor rpm had decayed below safe levels. Captain Reed, realizing that a safe landing could not be accomplished with any further rpm decay, quickly lowered the collective to maintain what was left of the rotor rpm. He was able to cushion the aircraft to a safe touchdown using full collective. After the passengers egressed, Lieutenant Kozura visually checked the engine deck and found a massive fuel leak. The quick, decisive actions by Captain Reed and Lieutenant Kozura allowed a safe landing before fuel starvation and imminent engine failure. WELL DONE! ■


DON'T WAIT
Till It's Too Late