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Aerospace SAFETY

THE MAGAZINE DEVOTED TO YOUR INTERESTS IN FLIGHT

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SPECIAL FEATURES

REGULAR FEATURES

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THE INSPECTOR GENERAL

Lieutenant General Joseph H. Moore has been assigned Inspector General, USAF. Former vice commander of the Pacific Air Forces, he replaces Lieutenant General Theodore R. Milton who moves to a new job as Comptroller General of the Air Force.

General Moore, prior to his assignment at PACAF, was commander of the 7th Air Force in Vietnam. He entered the military service as an aviation cadet in 1937 and was commissioned a second lieutenant in June 1938. When World War II started in 1941, General Moore was flying P-40s in the Philippines. He then served in Australia, returned to the United States and in November 1943 was sent to Europe where he remained until early 1945.

A graduate of the Command and General Staff School and the National War College, General Moore has served in a number of command positions and in 1959 won the Bendix Trophy for a record breaking flight in an F-105 in which he flew a 100 kilometer closed course at 1216 mph.

General Moore is rated a Command Pilot and holds the Distinguished Service Cross, Legion of Merit, Distinguished Flying Cross with one oak leaf cluster, Air Force Commendation Medal and Army Commendation Medal.

Following the death of a pilot who ejected too late from a crippled F-102, the commander of the 14th Air Force (ADC) expressed his thoughts on delayed ejection to all units within his command. AEROSPACE SAFETY recommends that all aircrews who fly aircraft equipped with ejection seats read, then think seriously about what these words say.

...d-delayed ejection decisions

Not too long ago, one of our operational units experienced a pilot fatality because of late ejection from a crippled F-102. It was apparent that this death fell into that ever-increasing category of unsuccessful ejections resulting from a delayed decision. Under the circumstances the loss of this aircraft was inevitable; the loss of the pilot was not!

In re-examining the factors involved in abandoning aircraft, i.e., whether to eject from a disabled aircraft, to stick with the bird while applying emergency procedures in order to effect a "save," or to attempt a dead-stick landing, I find one very important issue that is always prevalent—the "cockpit decision." No one, except the pilot himself, knows what conflicting influences exist at the time of his predicament. Were it reasonable to legislate exact rules upon which a pilot could formulate his decision, I would do so. Unfortunately, such guidance is unrealistic and does not exist.

The principal considerations are clearly established in each Pilot's Handbook in that section of the emergency procedures entitled "Ejection vs. Flameout Landing." Normally, *ejection* is the best course of action in the event of a complete engine flameout, or if positive control of the airplane cannot be maintained. If the pilot decides to attempt a forced landing—good; but the decision must be his. If, under the circumstances, there is any question in his mind as to his ability to get the aircraft down safely, *ejection* is the best course of action.

Pilot proficiency in SFO practice, his pilot experience, the availability of a barrier, and a pilot's reasoned confidence all go hand-in-hand with basic requirements for a suitable landing area, clear approaches, daylight VFR conditions and assurance of a satisfactory high or low key position being attained. For some pilots a marginal day in a sick, century-series aircraft over Tyndall would be adequate; for o[illegible]ear day with a T-Bird over the salt flats of [illegible]e inadequate.

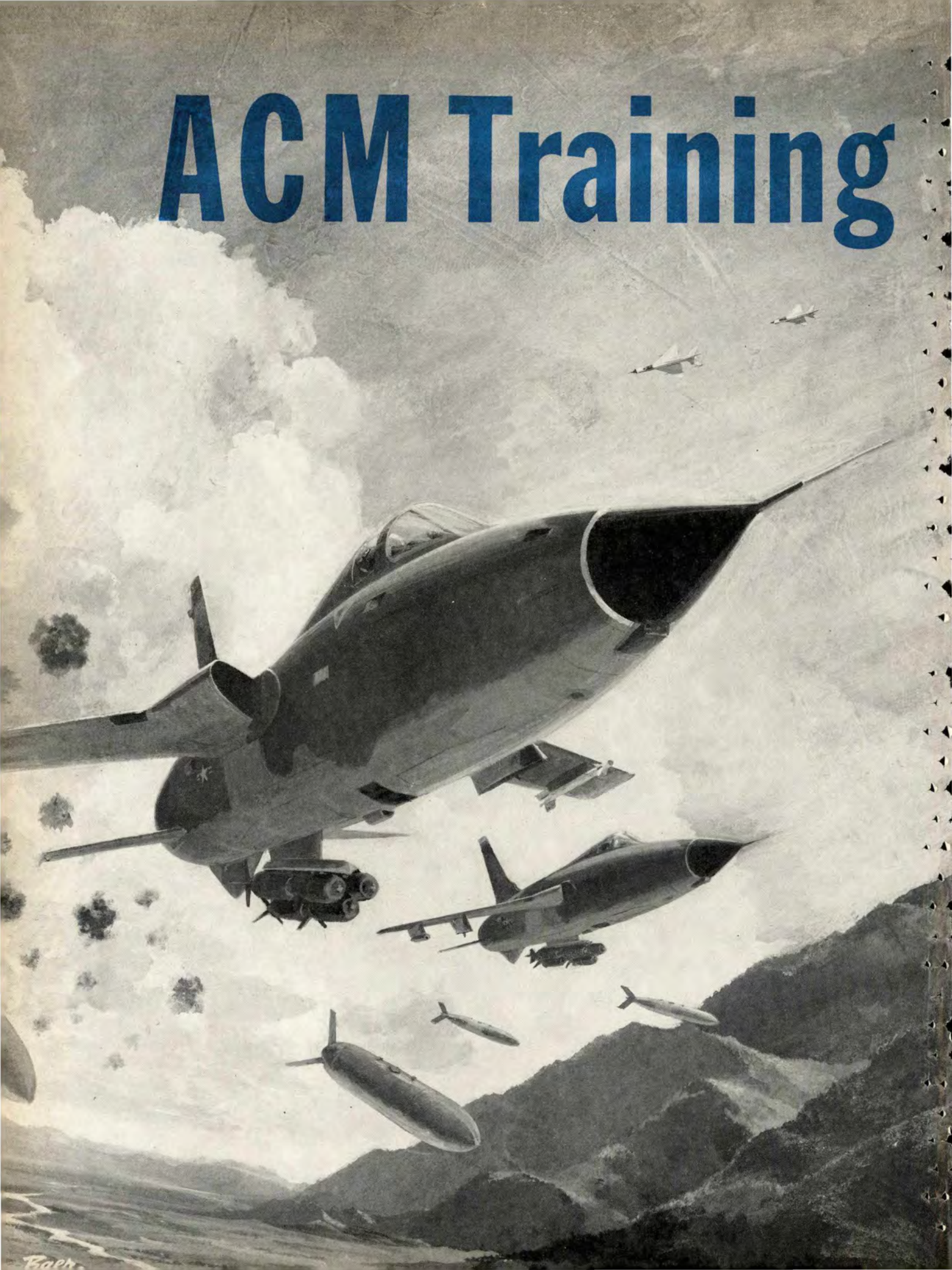
T[illegible] I want it emphasized to every jet pilot within the Fourteenth Air Force that "if at any time during the flameout approach, conditions do not appear IDEAL for a successful completion of the landing, ejection should be accomplished." Eject not later than the low key altitude—and certainly not lower than the recommended emergency minimum altitude established in the Pilot's Handbook. The word "ideal" is critical; it means exactly what it says. Remember that at that moment when conditions for a successful emergency landing do not appear ideal, the aircraft becomes valueless and ejection at a safe altitude is the proper and only course of action.

This letter reflecting my command policy is to be included in each unit's Aircrew Information File. It is also my desire that every jet pilot once again review ADC Programmed Instruction Text 62-8 entitled "Ejection vs. Forced Landing."

Walter B Putnam

WALTER B. PUTNAM, Maj Gen, USAF
Commander

ACM Training



Are the gains worth the losses?

Maj Robert M. Bond, Directorate of Aerospace Safety

The recent crash of an ANG F-84F aircraft that was engaged in supervised Air Combat Maneuvering (ACM) training reopened the question of whether the requirement to conduct this training for all combat ready aircrews is really valid. The central theme of concern seems to be "are we losing more than we are gaining?" or "are the airplanes that we lose in training worth more than what we gain in increased combat effectiveness?" This article will attempt to answer these questions.

In an effort to put this problem in its proper perspective, it is necessary to first define Air Combat Maneuvering (ACM) training. Since the current AF dictionary does not provide a definition, I will provide what I hope is a satisfactory one. For the purpose of this article, ACM training is *all the training conducted to provide fighter aircrews an understanding of the principles of aerial combat and in addition, a capability to perform those maneuvers necessary to effectively employ their aircraft either air to air or air to ground.* We are talking about the training, both academic and flying, that is required to make our fighter aircrews effective in hostile air environments regardless of their mission. *This training must be accomplished prior to the crews arriving in the area of conflict or penetrating into that hostile environment.*

The next step was to obtain data covering aircraft that have been lost as a result of a pilot losing control of his aircraft in some type of ACM, acrobatic, high G, or high angle of attack maneuver. The records surveyed covered the period between 1962 and 1966 and were grouped by type of aircraft. Over 600 unclassified major accidents were researched for this article; however, the statistics shown are only for those aircraft for which there is an approved ACM program outlined in the applicable directives. The aircraft involved and the number of accidents reviewed are as shown below. Primary causes only are shown.

1962-1966

Type A/C	Total Nr Maj Acdnts	Total Nr of "Loss of Control" Acdnts	Controlled ACM Program Without Other Pri Causes
A1E	30	2	0
F/RF-84	76	3	2
F-100	251	12	4
F-104	60	4	0
F-105	147	0	0
F-4	48	6	2
F-5	3	1	0

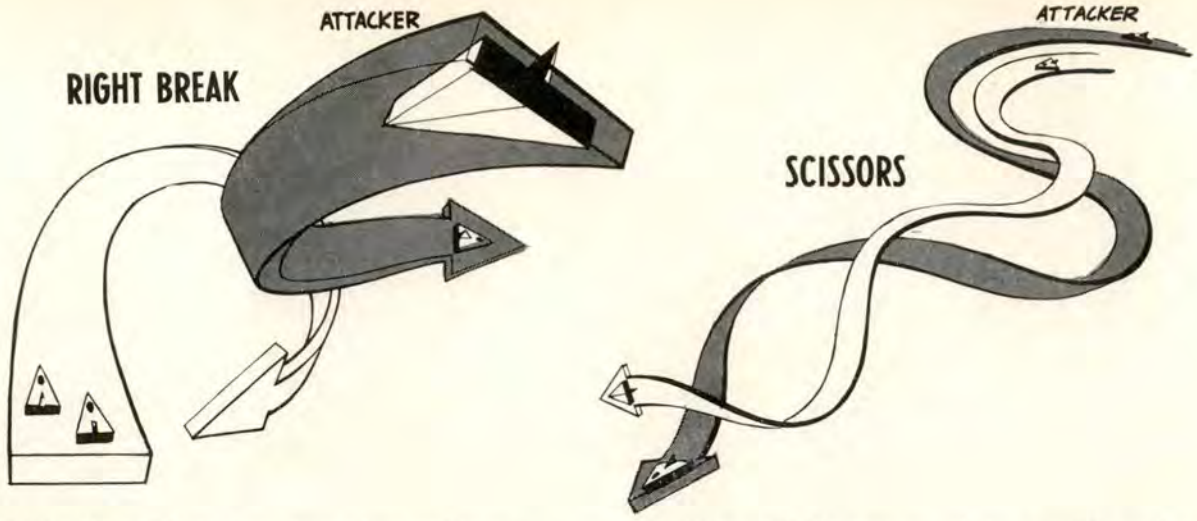
The various categories are self-explanatory with the exception of the column headed *Controlled ACM Program Without Other Pri Causes.* Within this column are grouped only those accidents in which the aircraft loss was not obviously avoidable. Not shown are those accidents that were coded as ACM missions, but which were the result of engine failure, major airframe component failure, or some obvious supervisory factor.

Now, let's discuss the requirement for ACM training. In other words, why is it necessary?

I think we will all agree that when operating fighter bomber aircraft in hostile air environments it will occasionally be necessary to evade enemy air defenses (air-to-air or ground-to-air) while penetrating to, or withdrawing from, the target. Our aircraft are going to be exposed to situations in which the timely application of basic combat tactics, team work and a high degree of pilot proficiency will be required to counter the enemy threat in order to survive, or more hopefully, "press-on" to and destroy the fragged target.

For the pilots assigned the counter-air mission, it is absolutely essential that the aircrews know both their own and the enemy's aircraft and weapon systems capabilities and, in addition, understand and be proficient in the art of aerial-combat/maneuvering. Firing of the gun or missile is the last small portion of the counter-air problem. Maneuvering into firing position is much more difficult and is of vital importance. There is an old "truism" that says, "A kill begins with positioning and ends with tracking." The air-to-air encounters that these aircrews can expect to take part in will normally be brief and victory or defeat may be decided in a few seconds.

At this point it may be appropriate to briefly touch upon the Air Combat Tactics (ACT) training program for the Air Defense mission. These ADC ACT programs are, for the most part, in their infancy. Now is the time, before we lose an aircraft and possibly its crew, to carefully evaluate these programs to insure that they are not only effective but are as safe as we can practically make them. During the period covered by this report we lost four interceptors due to the pilots' exceeding their capabilities and losing control of the aircraft in a maximum performance maneuver. We lost four additional aircraft due to what



appeared to be careless or negligent operation.

In addition to the attainment of these basic mission capabilities, there is another significant benefit that is a direct result of ACM training. The pilot becomes more proficient "across the board" in his aircraft. Consequently, he is less likely to have one of those "he exceeded his capability and lost control of the aircraft" type accidents and in addition, is better prepared to cope with emergencies.

The increase in overall aircrew proficiency as a result of an ACM program was graphically demonstrated back in 1959 at the Fighter Weapons School at Nellis AFB, Nevada. The Fighter Weapons Instructors Course had reopened in June 1958. In the first few classes the students completed air-to-ground gunnery prior to the ACM phase. The program was then changed to the extent that the ACM program preceded the air-to-ground phase. As a result of this change, it became immediately apparent that pilots were qualifying in fewer sorties and were attaining higher scores than were attained in the same number of sorties prior to the program change. In fact, the class average for the first two classes completing the course after the program change was approximately 20 per cent better than that of the preceding classes, which flew the air-to-ground phase first. This is a direct reflection of the pilot's increased proficiency in employing his aircraft as a gun platform. It is true that students in the revised program had an additional 10-15 hours in the aircraft prior to the air-to-ground phase. However, since all pilots attending the course were very highly qualified in the aircraft, I do not think the extra flying time had any significant effect on the gunnery scores. The prerequisites for attendance at the time were 1500 hours jet fighter time with a minimum of 500 hours in the F-100 aircraft.

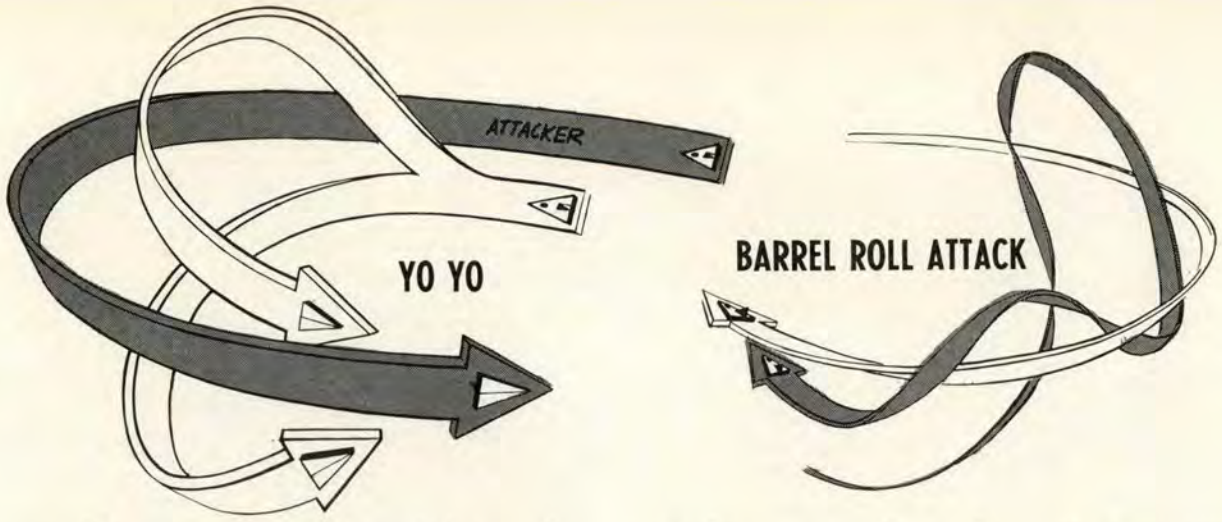
In peacetime, it is sometimes difficult to evaluate such things as increased pilot proficiency and confidence. As a result of the conflict in SEA, however, and the data available in some of our weekly and monthly commercial publications, we can make some valid conclusions. While these numbers may not be completely accurate they do provide us with a "feel" for the scope of the effort. According to those sources of information, there have been 60 enemy aircraft destroyed in aerial combat in SEA, while we lost 14 aircraft to enemy air action. In addition, during this period, there have been many significant air-to-air encounters. Each of these encounters required some maneuvering, either defensively or offensively, by our aircrews in order to survive or complete the assigned mission. It appears obvious that had our aircrews not had the benefit of ACM training prior to operating in this environment, our combat losses would have increased drastically.

By the end of April 1967, there had been over 1500 surface-to-air missiles launched at our aircraft. We lost 33 aircraft to those missiles. It is reasonable to say that for each of those missiles launched two or more aircraft made a maximum performance ACM type maneuver to counter the threat.

When we look at the total number of offensive sorties flown by tactical aircraft the statistics are, to say the least, impressive. It appears that we have flown over 225,000 tactical fighter sorties in this conflict. On each of these sorties the pilots were in positions that either did require or could have required them to operate the aircraft to its maximum performance.

It may be proper here to discuss briefly just what we mean by maximum performance in an ACM training program. While maximum performance flying encompasses all the speed and G ranges, the majority of the maneuvering is done at fairly high speeds and at less than the maximum attainable G.

In summary, during the five year period 1962-1966, we lost a total of 8 tactical fighter aircraft in approved, properly supervised ACM training. During the same time period we lost 615 of these same aircraft from



all causes. This means that the aircraft lost as the price of this training was 1.3 per cent of the total loss.

The return on this investment was the capability of our aircrews to destroy 60 enemy aircraft, safely cope with the threat of more than 1500 surface-to-air missiles launched at them and to effectively counter the many attacks by enemy aircraft on our offensive forces. It is important to note that the enemy air threat was directed primarily at our fighter bomber aircraft, and the SAMs were directed toward all our attacking forces. Therefore, the requirement for an effective, well supervised ACM training program is just as valid for fighter bomber aircrews as it is for those people tasked for the counter-air mission.

From the foregoing discussion, I think it is apparent that Air Combat Maneuvering Training should be continued for all tactical aircrews that may be required to operate their aircraft in hostile air environments. In addition, continuation training in these maneuvers is necessary to develop and maintain proficiency in both offensive and defensive tactics.

What can be done to make these necessary programs even more safe and effective? Commanders and supervisors at all levels should consider the following *types* of guidelines:

1. Minimum practical maneuvering airspeeds and altitudes for each type aircraft should be established and strictly adhered to.

2. Those ACM missions that are designed to teach the basic maneuvers and bring the pilot's skill up to acceptable standards of proficiency in maneuvers approaching maximum performance must be flown with, or supervised by, a qualified ACM instructor pilot.

3. Initial ACM training should be restricted to aircraft in clean configurations, except when they are configured for air-to-air missile tactics.

4. All students must progress from the very basic to the more complex maneuvers in a logical sequence and, in addition, must satisfactorily complete all required maneuvers of one phase prior to progressing to the next.

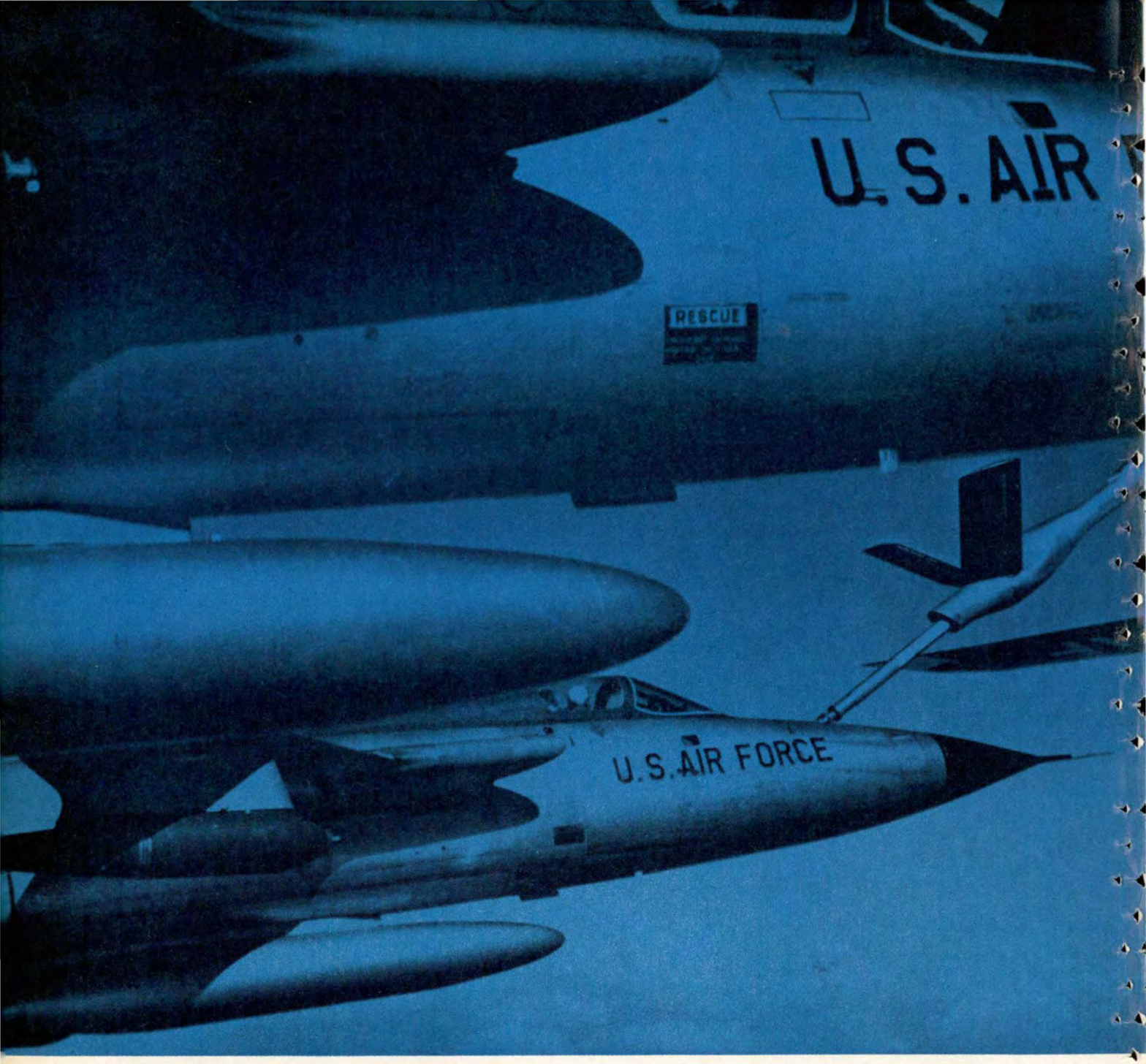
5. The training programs should be optimized for the individual types of aircraft and missions.

While I believe that these five suggestions will improve our training programs, there is one thing more than any other that will immediately increase their safety and effectiveness. It is this: Proper supervision and the acceptance by each individual pilot of the responsibility for the safe, effective completion of the scheduled missions will provide aircrews with this necessary training and at the same time minimize the loss of valuable combat resources.

There were several examples during this period where aircrews did not follow this basic rule; three are cited here.

- One very highly qualified fighter type pressed a little too hard one day, started a barrel roll type attack on another aircraft at low altitude and didn't make it.
- Then, there was the driver who pulled up from a low altitude dive, did a few vertical rolls, got into a spin, and ejected.
- Perhaps the classic example involved the troops on a low level navigation training mission. While enroute and from a very low altitude, the leader pulled the nose up, rolled inverted, paused momentarily, then rolled out. The Nr 2 man crashed into the ground while attempting to follow his leader. The lesson here appears to be obvious. The flight leader didn't accept the responsibility for the safety of his flight and, in addition, the wingman let himself get trapped into overextending himself.

For the price of eight tactical aircraft lost in ACM training over a five-year period, we have demonstrated an improvement in pilot proficiency, gained an excellent capability to operate and survive in hostile air environments, and enhanced flying safety through pilot knowledge of aircraft handling techniques. The price appears very small. ★



Midair Milieu

Vernet V. Poupitch
Directorate of Aerospace Safety

All of us live with a certain amount of fear; little fears we keep well under control and to ourselves. Fear of height, fear of a confined space (shades of survival school!), fear of water – to name a few. Most of us have only one or two such fears. However, without exception all pilots have one fear they share in common . . . the fear of becoming involved in a midair collision. This fear is well grounded (no pun intended). At the speeds we travel, a midair can be almost unbelievably violent. In addition, the see-and-be-seen concept is our only real defense during all or part of every flight we make. And a shaky defense it is.

Most Air Force midairs occur between aircraft in formation or aircraft from the same base involved in a training mission.

Most of us have the same mental picture of a midair. We visualize two speeding aircraft slamming into each other head-on, or at right angles, to disappear in a ball of fire from which sprinkles an aluminum confetti. A spectacular picture . . . but not nearly as accurate as, say, looking up from a several second check of engine instruments to find the windscreen completely filled by the tail of your leader's aircraft.

That's right. Most Air Force midairs are between aircraft in formation or aircraft from the same base involved in a training mission. Here are a few samples:

- Wingman ran into his leader. Possibly the pilot failed to detect a turn, or thought aircraft commander had the controls.
- Pilots searching for a target did not see each other in time to avoid a collision.
- Wingman focused attention on rough engine instruments and failed to maintain clearance.
- Pilot misjudged closure rate and hit lead aircraft.
- FAC controller collided with a helicopter, was not aware that helicopter was in the area.
- Both pilots looked the wrong way during cross-over.
- Formation turn in clouds.
- Underran tanker.
- Pilots searching for ground target and did not see each other.

At the risk of boring you, here are some from our cousins in the Navy, as summarized by the Naval Aviation Safety Center:

- Wingman split from leader at night to check light switches, lost sight of lead and collided.
- Lead of section passed to wingman because leader lost his TACAN in night GCA marshall pattern. Section leader dropped back 400 yards and concentrated attention in cockpit. When he looked up, running lights were dead ahead and collision ensued.
- Collision while aircraft were resuming course following hard break for simulated SAM evasion maneuver.
- Collision while attempting to fly a VFR RESCAP mission, at night, with low visibility and beneath a 300 foot ceiling.

Look this list over closely . . . each one of these accidents could have been avoided through use of better judgment, better control over the operation or by a more knowledgeable, wary attitude on the part of the pilots involved.

Before getting into specific recommendations, let's see just how much of a problem we have. In the 10 years, 1957-1966, there were 329 collisions. Last year's 40 midairs cost the Air Force 31 aircraft destroyed and 18 pilot fatalities. The human factor was the primary cause in 35 collisions, with various unsafe conditions accounting for the remaining five. Fourteen occurred randomly, that is between non-associated aircraft. Twenty took place during formation flight, six between aircraft associated in some other way.

Biggest contributor was the 0-1, with 10 collisions, followed by the F-100, 8, and the A-1 and F-84 with 7 each. Trainers—T-33, T-37, T-38—accounted for 14.

No one broke civil or military regulations and most of the pilots were old heads, both in total experience and in type.

Earlier studies of the midair problem suggested we could gain some help from conspicuity paint. But with most of the collisions occurring to formation aircraft or between aircraft involved in other tactical missions, it does not seem that bright paints would have been effective in preventing collisions, nor desirable for tactical reasons.

Now, what does all this tell us? First, it rather looks as if air traffic control is not a major factor in midairs. Remember the hue and cry of

Formation flight is the biggest contributor to midairs. Leaders and wingmen share responsibility for preventing collisions.

a few years back? The fantastic growth of civil aviation caused everyone to predict an equally fantastic increase in the midair rate. This has not proven to be true for USAF aircraft. No doubt placing all continental air space above 24,000 feet under positive control, increased use of IFR, and greater use of radar helped prevent the projected increase. Other factors on the credit side were having Air Force aircraft perform the maneuvering portion of tactical flight within restricted areas, the elaborate system the Training Command developed to control student flights to separate them from civil traffic, and the increased education effort on the midair problem.

When you analyze the current problem, it becomes apparent that the bulk of our midairs could have been prevented if the involved crews had used better piloting technique, had maintained better discipline or had more realistic operating procedures and improved ground control. Better instrumentation might have prevented some of the midairs by reducing the time needed to read the instruments or analyze a possible malfunction, and during intercepts.

So you can write an OHR in an effort to straighten out the instrumentation and take a careful look at your own personal operating procedures. Correct them—and, believe it or not, you *will* reduce your chances of becoming involved in a midair!

A lot of excellent guidance has already been published on this subject. For your convenience here are some extracts from *Aerospace Safety* and a U. S. Naval Aviation Safety publication which pertain to formation flying.

• Be briefed, know the route, anticipate turns, slow-downs and never fly tighter, or looser, than specified. Never bank your aircraft to the extent that visual contact is lost with your leader during join-up. Avoid wake turbulence whenever possible, especially on takeoff and landing. Remember, aileron alone has little effect in prop or jet wash; use rudder and aileron together if ever caught in the wash. When landing, adhere to the time interval. Think of the man behind. Watch for an abort by the man ahead during takeoff. Know each aircraft's call sign and position.

• When leading a formation remember these hints: Be as consistent as possible. Use minimum amounts of bank. Fly smoothly. Make no abrupt control or power changes. Use proper signals for gear, speed brakes, afterburner, peel off, etc., and give your wingmen and element leaders time to receive and understand all signals. Think ahead of your formation. Never take a formation into areas of poor visibility, low ceilings and turbulence. For large formations, send a weather ship ahead, if weather is forecast to be marginal. Know the limitations of the pilots in your formation. Adhere to altitudes and airspeeds. Fly slightly above or slightly below, not level with your leader.

The single overriding safety requisite of a good formation is a *good formation lead.*

• Make all formation movements, particularly lead-changes and cross-unders on signal and ensure acknowledgment of all signals.

• Don't attempt to join on a single light source unless you are assisted by internal or external radar guidance or some other positive check on relative motion. The astern, straight line rendezvous is particularly hazardous in this regard.

• Never look away from your immediate leader except when he is maintaining steady course, speed and altitude, and then only for the briefest of instants.

• Never assume, Ensure.

• BRIEF—BRIEF—BRIEF.

• Leaders must consider the effect of their actions on wingmen.

• Leaders, and pilots of single aircraft, keep the scan going.

In summary the pilot's eyes are still the best device we have available to provide separation when large numbers of aircraft must operate in limited airspace such as during tactical operations.

Speaking of pilot's eyes, how good are you at cross checking the gages and scanning ouside? Practice in instrument cross checking will make a pilot more proficient in this regard and probably will make him a better instrument pilot. And the faster and more accurately a pilot can cross check his instruments, the more time he has available to look outside the cockpit.

But eyes outside the cockpit won't help much if they don't know how to look. If your eyes are focused a few inches or feet ahead, they won't see much two miles away. Practice focusing on a cloud, the ground, a mountain peak and train your eyes to *really* see—out where the danger is. Then the SEE in *see and be seen* will mean something.

Another point: When you look up, out of the cockpit, give your eyes a moment to adjust to focusing at long range. Then scan straight ahead first, followed by a look in the other quadrants. Don't for example, look out to the left, then zap your eyes around to the right. You'll see more if you scan a small section at a time.

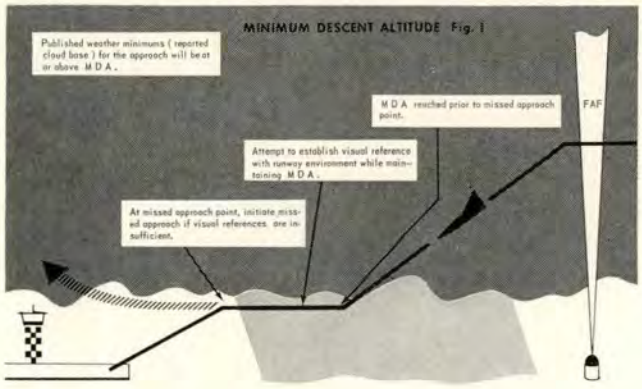
Finally, leadership and command attention can cure violations of squadron doctrine and SOP. But nothing can cure a midair collision after the fact. ★

the I.P.I.S. approach

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

MDA/DH

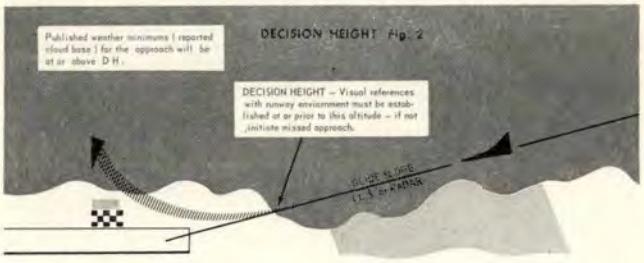
With the implementation of the September 1966 edition of JAFM 55-9, UNITED STATES STANDARD FOR TERMINAL INSTRUMENT PROCEDURES (TERPs), two new terms for expressing "landing minima" have been introduced in the FLIP (Terminal). They are *Minimum Descent Altitude* (MDA) and *Decision Height* (DH). As explained in the FLIP (Terminal) Special Notice, the MDA or DH is the number depicted in larger print in the "landing minima" box for each approach.



MDA is associated with non-precision approaches only and is the lowest altitude to which descent is authorized until sufficient visual references are established to assure a safe landing. If such references are not established at or prior to the Missed Approach Point (MAP) (determined by timing or a defined fix), a missed approach must be initiated.

DH is associated with precision approaches and is the lowest altitude to which descent is authorized. If sufficient visual references to assure a safe landing are not established at or prior to reaching the DH, a pilot has no alternative but to initiate a missed approach. Specifically, he should not level off at the DH and continue to fly toward the runway.

Prior to the implementation of TERPs, the minimum altitude for a non-precision approach could be determined by adding the ceiling value to the published field elevation. The minimum altitude for a precision approach could be determined by adding the ceiling value to the airport elevation, or in some cases the



touchdown zone elevation of the landing runway. This is no longer true. Now the MDA and DH are based on required obstruction clearance and system capability.

The minimum ceiling associated with an approach will always be *equal to or higher* than the height of: (1) the MDA above field elevation, or (2) the DH above the highest elevation in the first 3000 feet of the landing runway (touchdown zone elevation). This will result in the pilot having a better chance of breaking out at the MDA or DH simply because he will always be at or below the ceiling *value* (reported cloud base) when the weather is reported at minimums.

Runway Visual Range (RVR) immediately following the MDA or DH is also being published for some approaches. Where RVR is published, it will be used as the visibility minimum in lieu of the statute mile visibility minimum.

For a complete explanation of the new "landing minima" box, refer to the Special Notice in FLIP.

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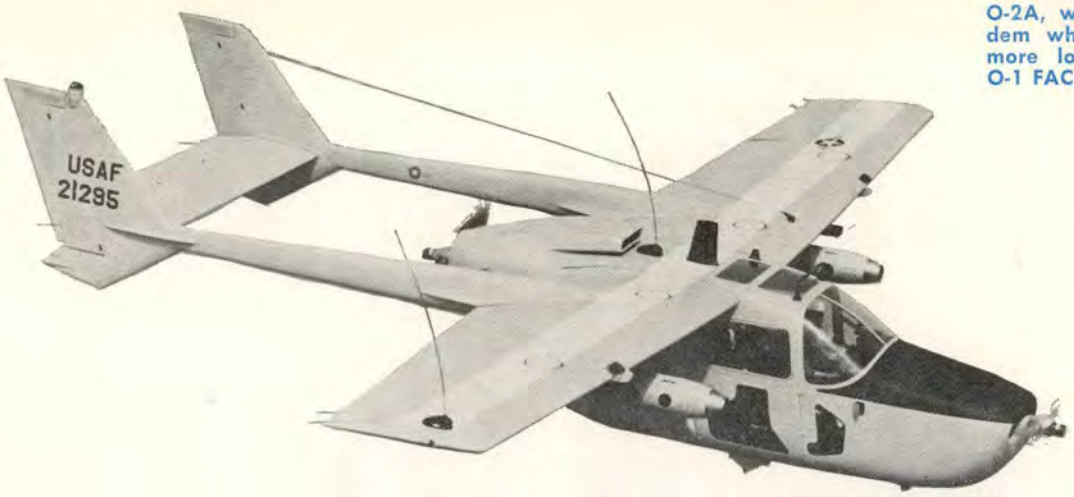
Keep those cards and letters coming in, troops. We will answer any questions pertaining to instrument flying. Those of general interest will be published in future IPIS Approach articles. ★



O-2A, with two engines in tandem which enables it to carry more load, is replacement for O-1 FAC aircraft.

New Bird For FACs

BOB HARRISON

Forward air controllers will soon begin to see a new bird appearing on their flight lines. Designated the O-2, this new twin-engine machine, with its engines mounted at the fore and aft ends of the fuselage, will offer more performance than the O-1, two-engine reliability, and additional protection for the pilot. The bird is essentially an off-the-shelf 1966 Cessna Super Skymaster with some modifications. The original Skymaster had a fixed tricycle gear, but that was changed in the 1966 model so the O-2 has a retractable gear.

Powered by a pair of 210 hp, fuel injected engines, the O-2 sports full feathering propellers, twin booms, and a high wing. It was originally designed by Cessna as a high performance, twin-engine aircraft that would provide fast, economical operation and be easy for a pilot with only single engine experience to transition into.

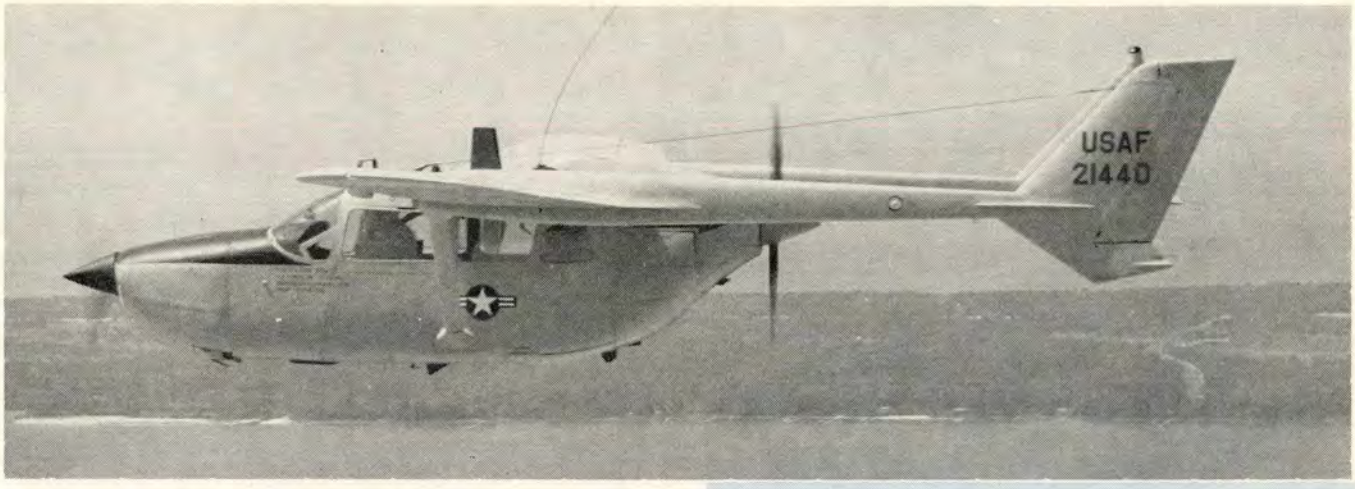
Two engines are great but mean more work for mechs.

When it was entered in competition at Eglin last year, the design won out as a replacement for the O-1 and was bought by the Air Force for use in two versions, the O-2A as a FAC aircraft, and the O-2B for psychological warfare. The latter version is equipped with a loud speaker and leaflet dispenser.

The aircraft performs well on one engine, although it does a bit better on the rear engine alone than it does with only the front engine operating. A word of caution, though: If one engine is lost at a critical point on takeoff and the gear is still down, it is recommended that the pilot keep his hands off the gear handle. The reason for this is that when the gear well doors open, they provide a substantial amount of drag that could mean the difference between a successful climbout and a back-into-the-ground situation.

In addition to the somber gray paint job, the military versions of the Skymaster will have some other distinctive characteristics not found on the commercial model. The O-2A, in addition to wing pylons for armament (including a minigun) and flares, has a clear plastic window over the forward cockpit area and cutouts covered with clear plexiglass in the door and fuselage wall just forward of the door on the right side to provide the pilot with better downward visibility.

One thing pilots will like about this bird is its rapid rate of climb immediately after takeoff. We flew it light at sea level, which may not be a true test, but it is amazing how the bird seems to climb practically straight up. At 4300 lbs gross weight, the A model will climb at 1000 fpm on a standard day. Performance specifications are shown in the chart on page 11. The



Psych-war version, O-2B, can dispense leaflets, has powerful loud speaker.

B model, incidentally, performs a tad better, but the design gross weight is 100 lbs less than for the A, and it is cleaner without the wing stations.

The O-2A comes with dual controls and two side-by-side seats, although two more seats can be added. And the right seat can be quickly removed to provide additional room for cargo. The aircraft is well instrumented and loaded with avionics.

While the O-2 has some definite advantages over the O-1—better rate of climb, higher speed, increased range—we can see some possible problems as to maintainability. It may not work out this way, but in addition to having to keep up with two engines, as compared to one in the O-1, the mechs will have to contend with electrically operated elevator trim control, the retractable gear, and a pair of full feathering props. In a combat environment this may be difficult; however, only time and operation experience will tell.

One other problem that has already been foreseen is the desirability of this airplane for uses other than what it was bought for. Its fairly large cabin, speed, and range could make it attractive as a small cargo and personnel transport, which means people will be trying to borrow the bird for those purposes.

Before the first modified airplanes were off the line, instructors and maintenance people had been trained at the Cessna plant in Wichita, and off-the-shelf Skymasters had been delivered to Holley Field at Hurlburt AB for training FACs. By now O-2s are being delivered and should be arriving in the field. Wonder not what these strange birds are, with their fore and aft engines and long twin booms. They are the FACs' newest weapon. ★

ESTIMATED PERFORMANCE, TABULATED, STANDARD DAY

	Primary Mission Clean Airplane (W/o Bomb Racks)	Typical Alternate Mission
T.O. Gross Wt—lbs	4,300	5,000
Payload—lbs	1,685	2,050
Range (NM)/Loiter Time—hrs 5,500 ft cruise 75% power Loiter 35% power 30 min reserve @ 75% power	295/3	118/3
Service Ceiling—ft		
Twin Engine	17,500*	12,500
Front Engine Only	6,300	Below S.L.
Rear Engine Only	8,400	Below S.L.
Rate of Climb—FPM		
Twin Engine (Sea Level)	1,000*	850
Front Engine Only (Sea Level)	280	Negative
Rear Engine Only (Sea Level)	360	Negative
Take-Off Distance—ft		
Ground Run (Sea Level, 59°F)	845	1,665
Total Distance Over 50′ Obstacle (Sea Level 59°F)	1,490	3,000
Ground Run (8730′ density altitude or 5600′ elevation 90°F)	1,500	N/A
NOTE: 1,000′ ground run at 8730′ density altitude limits gross weight to 3600#		
Landing Distance (Sea Level)—ft		
Ground Roll	590	1,165
Total Distance Over 50′ Obstacle	1,500	3,000
Speeds—kts		
Maximum Speed at Sea Level	155*	150
Cruise, 75% Power at 5,000′	151	140
Stall Speed—MPH		
Flaps Down, Power Off	66	71
Flaps Down, Power On	57	61
No Flap, Power On	67	72

*Guaranteed

For the following we are indebted to Major Bill Bailey, Director of Safety, 834 Air Division, APO San Francisco 96307, who sent it to us, and the unknown author who wrote these words of wisdom.

Dear FNG (Fighting New Guys)

You know it wasn't too very long ago that I stepped from the sleek Blueball, gave that gorgeous round eye stewardess a wink and headed toward the Commando Ops for a year of war. I thought I was pretty hot stuff. Hurlburt instructors had shown me how to assault a 4000-foot dirt strip with 4000 pounds of cargo. They taught me how to fly at 200 feet above the Florida swamplands. They even gave me a brief course on props and engines, so how much more training did I need?

Let me tell you I was really good! I got my theatre check out of the way, bought myself a Seiko watch and a Canon camera and became a full fledged Commando. One day I shut an engine down on a 54,000-pound airplane because the carb air temp was full scale hot. No other indications, but I knew I could make a single-engine landing with no sweat. Then there was the time I decided to be a tiger and flew a shuttle at 50 feet indicated. Those VC aren't such good shots, they only hit me one time. Of course they were lucky and messed up some wiring that had the bird out of commission for a few days.

Pretty soon I forgot about using a checklist, other than to keep pictures of Playmates in. I would turn up AFRS loud enough to drown out those GCI sites, who kept coming through with some jazz on artillery firing and fighter strikes. I always managed to find the fighter strikes and make a few passes of my own anyway.

By the way, did you know that the engine on this plane will run on one mag? You don't get too much TOP out of it, but then again when you leap off from an intersection of a 4000-foot runway there isn't room to stop if you want. Like I said, I gave up using a checklist.

Speaking of engines, I remember when I used to run them at 2400 rpm and 44 inches to get back to the club a few minutes earlier after the last shuttle. Invariably I would have to argue with TSN tower for a straight in. That entry on downwind wasn't for Commandos.

Then there was weather flying. I thought nothing of taking off and climbing out through the clouds (VFR). Too much trouble trying to find a hole to climb up through. Add this to my weather penetrations and inattention to traffic advisories and I was something else again.

Well, one day I reported to Ops and there they were, my PCS orders! I had survived ten months of war and now I was a SHORT TIMER. I got to wondering just how come I'm still alive and how am I going to stay that way for two more months? My first response was, it must have been my skill and cunning that were responsible for my survival. No, that wasn't right. The truth of the matter was that I was damned lucky. I certainly must have violated every safety rule that was ever devised.

It was time for a change, and quick. Out came the checklist, shoulder straps were fastened, aircraft was properly pre-flighted, I was at a safe VFR altitude enroute and I wasn't adverse to making a circle over the field during approaches or after takeoff. I listened to the GCI words of wisdom and took my turn in the landing pattern. I started treating the airplane and the engine like they were going to have to take me back to the USA. You know, it is enjoyable to fly like a SHORT TIMER. It certainly makes things easier for everyone, and besides, it is added insurance you will walk on that Blueball all in one piece.

So FNG, as I sit here waiting for my last flight, admittedly with apprehension and a case of go-homeitis, I thought I might pass my new found outlook on flying to you. After all, it took me ten months to figure it out so it must be worth something. Perhaps you will disregard what I have to say, but I'll still find satisfaction in knowing I got the word out. You may find satisfaction in knowing that flying like a SHORT TIMER is good insurance towards becoming one.★

WATER WISDOM

Summertime is funtime on the water. To keep it fun, keep it safe. Our thanks to Miss Michell Hagerstrom, daughter of Col James P. Hagerstrom, Deputy Chief, Flight Safety Division, Directorate of Aerospace Safety, and to Ski-Way Marine, Colton, Calif., for ski equipment. Photographer, MSgt Bob Cooper.

SKIING — When towing a skier have two people in boat, driver and one other watching skier. Tow skiers in open water only, never near swimmers, docks, or other obstructions. Never pull a skier at night. Insist on skier wearing life jacket or buoyant belt. Either stop motor or put in neutral when picking up skier.

KNOW YOUR BOAT — its capabilities, condition and capacity (don't overload). The condition of your trailer is equally important: the frame, tires, lights, trailer hitch and wheels (are bearings greased? Water can wash grease out leaving rust and corrosion). How are the brakes? Don't cram boat full of camping and heavy equipment which will affect balance of boat. Know local trailer laws both for safety and to prevent being cited by police. If you are new to boating try to locate a class of instruction. The Coast Guard, local schools, or probably your base conducts these courses free or for a small fee.

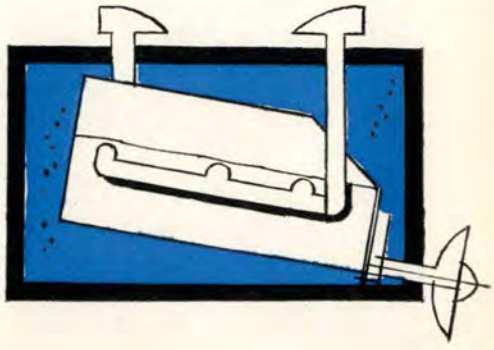
WEATHER — Go-boating-itis in bad weather is no way to prolong your life. Check the weather with your base weatherman. Even if the forecast is good let someone know where you are going because local weather conditions sometimes can't be forecast exactly. Wind and fog are major enemies of the boater, and account for many tragedies. Don't risk your boat and your life on the highway in strong wind.

NO HORSEPLAY — The sure road to tragedy is via horseplay. This applies not only to the operator but all others in the boat. Many jokers are haunted by the fact that their antics resulted in death or permanent injury to others. All boaters should be aware that reckless and negligent operation of a boat that results in danger to others may be punishable by a fine up to $2000 and/or a year's prison term.

RULES OF THE ROAD — Boats approaching from your right have the right-of-way. Near shore, dock, in channels and near swimming areas there will probably be speed limits or restrictions against boats. Always pass on the right, and give way to the right when approaching another boat head-on. Sailboats and rowboats have the right-of-way. Watch and control your wake near other boats, near shore and docks.

ACCESSORY EQUIPMENT — This includes skis, buoyant cushions, life preservers, paddles, ladder, anchor, line (rope), fire extinguisher—whatever is necessary for your outing. It's also a good idea to have a tool kit, first aid equipment and flashlight aboard. A compass and extra can of gasoline are a must when operating out of sight of land. A checklist is a good idea; before you leave home, check condition of all items.

MOTOR — DON'T SMOKE WHILE FUELING! Make sure of proper oil-gas mixture for outboards, proper venting for inboards. Avoid and clean up fuel spills and keep fire extinguisher handy. Make sure motor is in good condition—a motor that fails can lead to trouble. Check propeller blades, for some motors a spare propeller might be a good idea.



The story you are about to read actually happened to an Air Force Aero Club pilot; in fact, he wrote it.....

Flight Service reported the weather along my route as 500 feet scattered, 10,000 feet overcast. Another station along the route was reporting a ceiling of 600 feet and my destination was 10,000 feet broken. I was assured that it was VFR weather.

I completed my flight planning using a wind of 290 degrees at 18 knots at an altitude of 8500 feet. I calculated my heading to be 304 degrees direct from home station to destination and estimated time enroute of two plus 30. When I arrived at the aircraft my passenger had completed servicing the aircraft and had loaded the baggage.

Preflight, taxi, takeoff and climb out were normal. While climbing through 3000 feet on a heading of 304 degrees, I noted two layers of clouds directly ahead. The lower layer was thin but appeared slightly cumulus, the upper layer was definitely cumulus and a ceiling.

About 50 miles out on course, I got above the lower layer at 6500 feet. I leveled at 8500 feet, trimmed the aircraft, and leaned the engine for cruise at 2500 rpm. About 30 minutes (70 miles) out, the clouds below us were still slight and scattered; and I had just passed under the first of the ceiling, 10,500 by my estimate.

About ten minutes later, the clouds under us were becoming broken and beginning to build up. The layer above us stayed about

10,500 feet and solid. I could still see what I thought was all the way through the front. From what we could see of the ground, we were about four miles north of course; and I corrected to 300 degrees. In another ten minutes (about 50 minutes from takeoff), the clouds above were still about 10,500 feet and solid. The layer below was building up but was still broken. As a precaution, I started to climb to 9500 feet.

An hour out, the clouds below still had occasional holes through which we could see the ground. The clouds above us remained the same. At this time I estimated our position minutes short of a range of mountains. Cruising at 9500 and observing occasional clouds at our level, I contacted an FAA radio and gave them my estimations of cloud layers and altitudes. Only a few minutes later, I found myself dodging clouds at our level; but I still kept the ground in sight occasionally. I contacted another FAA radio, gave my position as ten minutes out from their station, and made sure they understood my altitude to be 9500 feet. This call was logged by them at 1312 hours.

Immediately after that call, I found myself hunting holes in the clouds at my level and almost completely cut off from the ground. Since my position was in the vicinity of a 7800-foot peak, I pursued my course. I entered one hole in the clouds which was a dead end and made a 180, being careful to maintain my altitude. I then proceeded in an easterly direction for about one minute and found a larger opening to our left. It looked considerably better than the first one, so I decided to try it. I was able to follow this opening for several minutes before it closed off and forced me to make another 180. The only way out now was to descend through a hole in the clouds below.

I was barely able to keep my turning radius inside the opening in the clouds. The ground was much closer than I had expected because we were farther north than I realized. We found ourselves flying at 7000 feet with only a few hundred feet between us, the ground and the clouds. We had tuned in an FAA VOR station as we descended and found that we were on the 090 degree radial off that station. Having no plotter, I could only guess how far north we had gone. Heading north at a very low altitude we observed that we were over the southern rim of a large canyon.

The canyon apparently was clear of clouds and rain, so we decided to descend into it and follow it west. We then initiated our first MAYDAY on 121.5. The FAA area radio received us through their feeder station but could not contact us because we were too low.

I flew down the canyon immediately below the rim and slightly away from the southern wall from which the wind was blowing, ready to ascend and land should the clouds get any thicker or lower. We were able to follow the canyon for about 25 miles. We repeated the MAYDAY call and gave our problems and approximate position about every two minutes. The situation became intolerable when we rounded a bend in the canyon and found ourselves about a mile and a half from an on-coming rain storm and cloud bank which filled the canyon. At this time we climbed out of the canyon toward the south.

Once over the rim, we spotted what we thought was a runway. We called the FAA radio and told them that we had sighted a runway and were going to attempt a landing. I circled to the left and rolled out on the downwind leg. My base leg was one continuous turn, which, due to the wind blowing from the south at approximately 15 knots, put me out of line with the runway. I then decided to land on a nearby road. After a closer look I changed my mind and decided to stick with the runway because the road was very rough and narrow. Looking back and observing the clouds closing in, I changed my mind and landed straight ahead on the road.

As far as I could tell there was absolutely no damage to the aircraft. I expected only the wheel fairings to be clogged with mud. To avoid missing a chance at the next break in the weather, we began to taxi back on the road toward the runway. The road was muddy and very slippery, and the surrounding ground was a foot or two above the road. Our main gear was wider than the ruts and we had to keep the nose gear in the rough roadway center. After taxiing about half a mile, we came to an intersection in the road, stopped the engine, and walked to the top of a hill to look for the runway. We couldn't see it, but we recognized the terrain and determined the direction in which to proceed.

After getting the aircraft over this hill, we encountered small trees close to the edge of the road. Some we were able to taxi around; some we had to pull the aircraft around manually. After a mile or so of this, we came to a dip in the road where our prop hit a rock and tossed it against the nose wheel fairing. We taxied along to where the road leveled out and shut down the engine again. I made another inspection of the aircraft and found that the nose wheel fairing had been bent so that it was almost touching the wheel. The prop was bent, starting about six inches from one tip.

I started the engine again and ran it up, checking for vibration or loss of power. I observed nothing except a slight hissing sound, so I resumed taxiing. About two miles farther, we encountered small clumps of trees on either side of

the road and were forced once again to pull the aircraft manually.

We stopped and walked up to look at the runway and found it very muddy and covered with tumbleweeds. Our best bet was to wait for a clearing in the weather and to spend the night in the aircraft if necessary.

The road between the airplane and the runway was the best surface we had found for possible takeoff. We stepped off 360 paces from the runway to a tree close to the road and 270 paces from that tree to the aircraft. While waiting in the aircraft for clouds to clear, I checked the takeoff tables and found that we needed approximately 1200 feet of runway to take off over a 50 foot obstacle at our altitude of approximately 7000 feet. We had almost 1900 feet and some of it was down hill. This would help compensate for the condition of the road and the prop.

Soon we saw a good-sized break in the weather between us and our destination. I started the engine, ran it up, checked the mags, pushed it up to full power, selected half flaps, released the brakes and tried to take off downwind. I did not feel that we were accelerating fast enough to make the takeoff so I aborted and went on up the hill toward the runway. After turning the aircraft around, I tried an upwind takeoff downhill. I selected three-fourths flaps halfway down the runway. We lifted off and turned to avoid the trees with the airspeed indicator reading zero. We leveled off and got airspeed indications. As we accelerated, I pulled up the flaps and headed west toward the clearing in the weather.

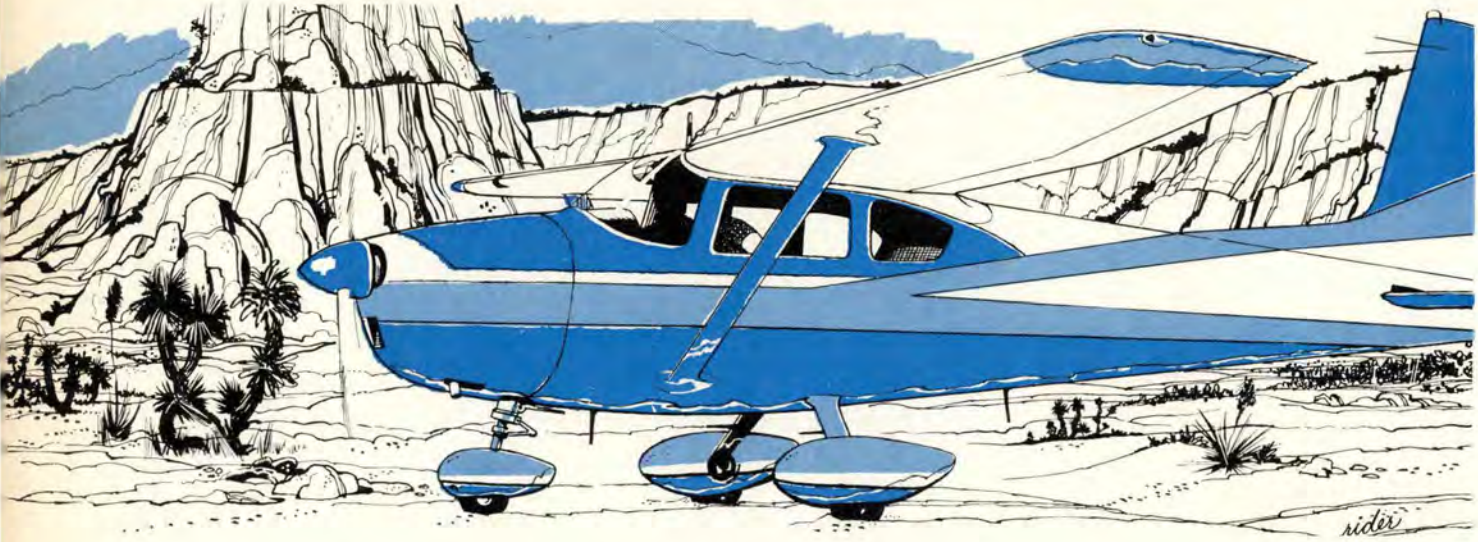
I observed that I could not turn off the instrument lights, probably due to the nav light damage. At this time, I called the FAA radio and told them that we were airborne again and approaching a lake which we could see shortly after takeoff. They logged this report at 1746 hours. We flew above the terrain and below a scattered cloud layer, continuing almost straight to our destination with only light turbulence.

After we landed and tied down, we noticed that the nav lights on both wing tips were missing. During the flight we had experienced no excessive vibration from the bent prop, only the slight hissing mentioned before.

I went over to the Flight Service Station and talked to them about my flight. They informed me that I would be required to fill out an accident report if the damage exceeded $300.00. As far as they were concerned, that would be the end of it. I called my home base and gave them a verbal report. The next morning an oral report of aircraft damages was given to me, and I arranged to have a written evaluation mailed to my home base.

It was my opinion that the weather would be too bad for a VFR flight back home even if the aircraft were airworthy.

I believe that my only error on this flight was in not returning directly home upon encountering the first dead end in the weather front.



A few of this pilot's more glaring errors:

- *He did not find out enough about the enroute weather.*
- *He proceeded too far into rapidly deteriorating weather, and cloud dodging carried him off course to an unknown position.*
- *He had inadequate navigation equipment, no plotter.*
- *He tried to taxi across country.*
- *He took off in a damaged aircraft.*

He is probably the luckiest living Air Force Aero Club member. ★

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C.

REPLY TO ATTN OF: DEPUTY INSPECTOR GENERAL FOR INSPECTION AND SAFETY, USAF Norton Air Force Base, California 92409

SUBJECT: Are Accidents Inevitable? How Come?

TO: Editor, AEROSPACE SAFETY

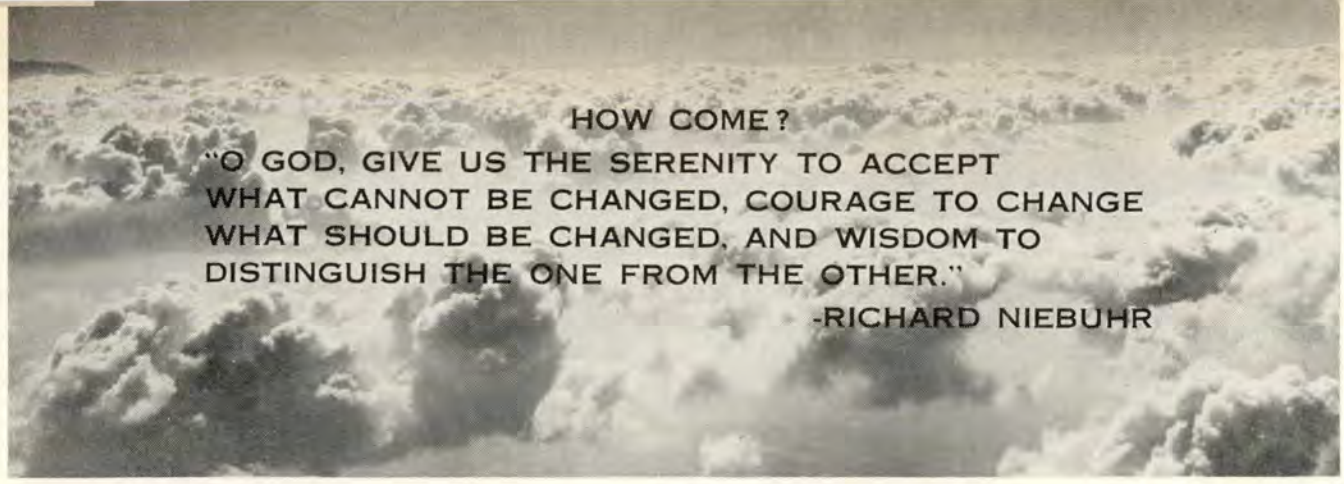
During a discussion with a friend, a highly qualified pilot--one who has been in the aircrew standardization business for many years, he made a statement to the effect that in spite of system safety engineering, there would be C-5A accidents. Moreover, that we in Safety would have to face the reality that accidents are inevitable.

These remarks seem to be well founded. Look at the box score for what could be termed the "U. S. Highway Massacre" for the past few years:

Table I (U.S. Highway Deaths)

	1962	1963	1964	1965	1966
Total Fatalities:	40,804	43,564	47,700	49,000	52,700

Unless one has experienced the loss of a loved one, a personal friend, or has been involved in but survived an automobile accident where others were less fortunate, these statistics are meaningless. Certainly, every knowledgeable person would agree that this is a terrible blight on our nation's development. But, isn't this a fact of life today? Isn't it reality that living in itself is inherently dangerous? Isn't this indicative that as a nation we appear to have developed an insensitive attitude toward death? Yes, there seems little doubt that we have achieved the serenity to accept what cannot be changed. We seem to have succeeded in hiding our minds behind an impenetrable barrier--a cocoon of callousness that permits us to go about our business with an air of courage and wisdom. On the other hand, having been in the safety business for many years, having witnessed and having been involved with the tremendous progress that has been made in accident prevention within the Air Force, there is not the slightest



doubt that the Air Force can and should be proud of its record, the efforts made, and the contributions for making aviation safer. Look at the significant reduction in our aircraft accident rate:

Table II Air Force Aircraft Accident Rate
(All Accidents)

1951	1952	1953	1954	1955	1956	1957	1958
51.4	45.2	39.0	27.1	20.2	16.8	15.3	11.8
1959	**1960**	**1961**	**1962**	**1963**	**1964**	**1965**	**1966**
9.6	6.7	7.2	8.3	6.1	5.8	5.9	6.3

This is irrefutable evidence that we care about the individual; that we not only accept the responsibility but take definite actions to protect him. To further the point and put it another way, it is a well founded conclusion that had there been no aircraft accident rate reduction over the past 15 years, almost 4000 more aircraft would have been destroyed and approximately 2500 additional Air Force pilots would have been killed in accidents. Yes, there is no question that the Air Force—they, we—you and I do care about the individual. Lest we get carried away with a deep sense of satisfaction, before becoming smug with that warm inner glow of self-righteousness and esteem, are we really that good? Look at the credibility of tying our achievement—our progress—to the rate reduction record. Remember, our rate is our measurement for applauding our efforts, for receiving awards. But, what about the loss side of the ledger for the past five years?

Table III Air Force Aircraft
Accident Losses

	1962	1963	1964	1965	1966
Aircraft Destroyed	302	246	261	262	262
Aircraft and Passenger Fatalities:	373	219	333	477	315

On one hand, we can be proud of our aircraft accident prevention achievements, our rate reduction, but on the other, must we accept these losses year after year as a fact of life? Is it reality that there is no solution for the problems and barriers that have prevented our reaching that magical, mystical zero rate? Is it reality that accidents are inevitable? We in System Safety Engineering ask, "How Come?"

How come we read in the morning newspaper, see on television, read in *Aerospace Safety*, TAC Attack, Combat Crew, MAC Flyer, Navy APPROACH and many other publications, and in daily messages that the F-100 pilot ejected because of no elevator control? How come the commercial jet had to land gear up? How come the C-141 burned on the ramp and people died? How come the KC-135 and B-52 collided in mid-air? How come the fire in the silo killed many people? How come the young airman died on his motorcycle? How come the colonel was fatally injured in the automobile accident?

Traditionally, we in the Air Force base our accident prevention efforts on history. This is a sound approach, for in order to program an effective cure, a thorough analysis of the problem must be made. Thus, we analyze the causes of accidents and concentrate the cures where needed. Cures such as increasing skill levels with new and different training programs, advancement in simulator technology, safety surveys, operational hazard reporting programs, near-accident (incident) reporting programs, refinement in accident investigative procedures and advancement in investigator skills, improved educational techniques for safety, and command leadership in safety. All have a definite role and have contributed to the success of accident prevention. But, in actuality, the majority of our tried and proven techniques which have brought us success thus far are based on the after-the-fact approach. Have we reached a plateau – a leveling off point? The losses reflected in Table III and the aircraft accident cause

factors percentages depicted in Table IV indicate that we may indeed have achieved the ultimate in safety —the lowest rate or the irreducible number of losses.

Table IV Primary Cause Factors—Air Force Aircraft Accidents, in per cent.

(* less than .5 per cent.)

	1962	1963	1964	1965	1966
Pilot	30	33	31	38	37
Other Crewmember	1	*	2	*	*
Supervisory	5	4	3	6	4
Maintenance	8	7	8	7	6
Other Personnel	2	2	1	1	2
Materiel	41	39	39	32	35
Airbase/ Airways	1	1	1	*	1
Weather	1	*	1	*	*
Miscel.	2	3	3	2	6
Undetermined	9	12	11	14	9

These statistics reflect that there seems to be no promise of improvement. If this is true, we are faced with two choices:

- We can adopt the air of serenity based on our powers of wisdom that we cannot change the inevitable, and therefore accept a certain number of lives lost and equipment damaged or destroyed by accidents.

- Or, we can search and discover additional approaches to supplement our current techniques for accident prevention — new methods to continue progress toward that illusive accident-free environment.

Of the two, we in System Safety Engineering say that only the latter is acceptable.

Pet phrases to the effect that, "The ever-increasing complexities of today's weapon systems demand . . .," or "In light of today's accelerated technological pace . . .," in my opinion should be relegated to yesterday's worn-out cliché file. Certainly the pace is accelerated; certainly the systems are more complex. But, I submit that our lot is not unique; our situation is not new. Henry Ford, Albert Einstein, Orville and Wilbur Wright, and thousands of others of previous decades, centuries and even civilizations were faced with similar problems.

Today, we in System Safety Engineering are confronted with, "We just can't make it Murphy-proof!" We ask, "How come?" If in a little over 50 years we've come from Kitty Hawk to space exploration, it can't be that big a job. "We just can't make it idiot-proof!" How come we can't? If in the few years since Sputnik we've been able to go from nothing to Supersonic Transport and lunar landings, it can't be that tough a task. It's got to be done! What's more, it's going to be done! It's going to be done because some people, when they're told "You just can't eliminate the human factor from accidents," or "Accidents are inevitable," will ask: "How come?"

The attainment of new methods which will prohibit accidents will probably demand as much, if not more effort than has been expended in all aeronautical and space programs to date. But what a fantastic reward! No more locking devices to be left out or lost. No more actuators to be reversed. No more cables, plumbing or wiring to be crossed. No more landing short. No more missed checklist items — and on and on and on. A pipe dream? Perhaps, but the alternative is totally unacceptable as military and civil aviation as well as space exploration continue to progress.

Fortunately, a few years ago the Air Force recognized the need for accident prevention measures to be applied during systems development — in other words, before-the-fact accident prevention. Perhaps this stemmed from the philosophy which was demanded and followed during design and development of

nuclear weapon systems: *"There will be no accidents!"* Regardless, System Safety Engineering as a concept was introduced during development of certain missile systems. Its success was remarkable, and in April 1965 the Air Force established the requirement for across-the-board application of the concept for *all* systems development. This means that all ground (explosive, biological, chemical, traffic, industrial, etc), nuclear, missile, space, and aeronautical systems that enter the conceptual phase for development for the Air Force will receive system safety engineering to a certain degree from the beginning of the conceptual phase throughout its life cycle.

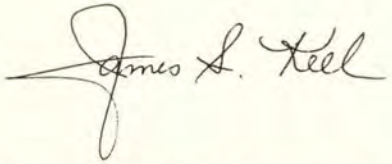
Simply stated, the System Safety Engineering concept is an extension of the Air Force accident prevention program which requires people – trained safety/-engineering types – to analyze and evaluate the total system. For example, during the design phase, they conduct a minute examination of each sub-system design, they conduct fault and failure analysis using computer techniques, they evaluate the man-machine relationships, they look at the entire spectrum in which the system will operate (operational, maintenance, support, command-control, logistics, etc), and *they identify hazards.*

Finally, they recommend solutions to the decision making authorities. These people are blue-suiters and civil servants from all levels of the Air Force and people from industry. Their job begins when the system is approved by the Department of Defense for development, continues through the design, manufacturing, and operational phases, and ends when the system is retired from the inventory.

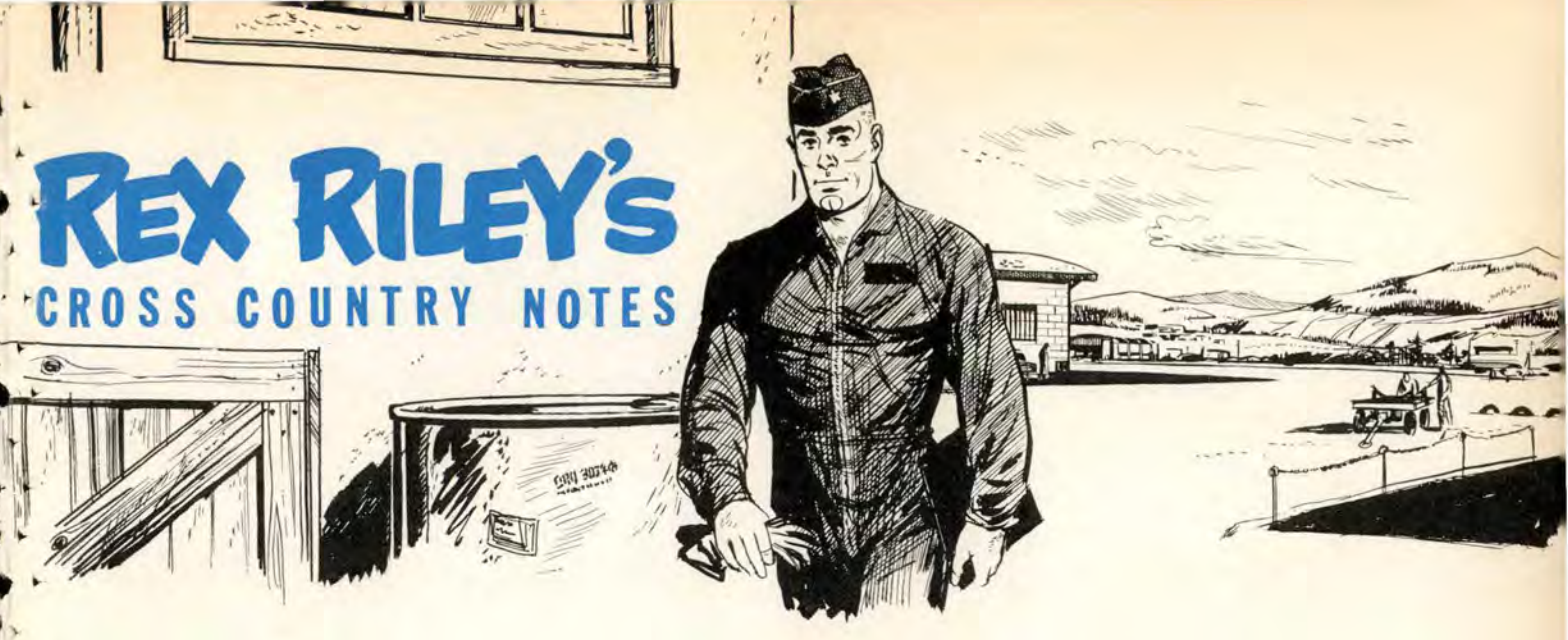
Although System Safety Engineering got off to a slow start in the C-5A program, it has progressed rapidly. Literally hundreds of improvements have been made during the design phase. Safety engineers and personnel from the prime contractor, the many sub-contractors, the System Program Office and Aeronautical Systems Division, Headquarters Air Force Systems Command, the Military Airlift Command, and the Directorate of Aerospace Safety constantly work at improving product design. There is no question that application of the System Safety Engineering concept has significantly contributed to the design of a safer transport aircraft. Unfortunately, System Safety Engineering in its embroynic stage has not been refined to the extent that we can confidently predict an accident free environment for the C-5A. But, do we believe that C-5A accidents and loss of life are inevitable? Certainly not! We believe that, through continued and vigorous application of system safety throughout the life cycle of the C-5A, a major contribution will have been made toward making that mystical zero accident goal a reality.

We in System Safety think the goal can be achieved. We think the day is close at hand when system safety will be demanded by the American Public and the Department of Defense. We think System Safety Engineering, given proper authority along with design, production and operational requirements will eventually, and shortly, eliminate the nagging thorn in the side of all aviation.

Don't tell us that "It can't be Murphy-proofed," and don't tell us that "Accidents are inevitable," for we in System Safety Engineering want to know, "How come?" ★



Colonel James S. Keel, USAF
System Safety Engr Gp (AFIAS-S)
Directorate of Aerospace Safety



REX RILEY'S
CROSS COUNTRY NOTES

GUARD CHANNEL. Is there a "cut-your-buddy's-throat-week?" The obvious answer to this ridiculous question is "certainly not, and that ain't all, there never will be in my outfit!" None of us would consciously sell a fellow aviator down the river, but any of us might unconsciously do so unless we pointedly guard against it.

Not long ago a routine radio check digressed into a casual, nonchalant conversation – on 243.0 mc, GUARD CHANNEL. Because these clowns were blocking the emergency frequency, a flight leader switched it off so that he could continue to properly monitor his formation. Shortly thereafter, his wingman descended into the clouds in an uncontrolled maneuver and was told to eject. The flight leader was off "guard" so he was unable to determine if the wingman ejected as ordered (an emergency beeper-radio is automatically activated on 243.0 mc upon ejection). Guard Channel is no place for idle chatter, no matter how abbreviated; an emergency may occur in the vicinity at that precise moment. How would you like to have that one on your conscience?

HOW MANY times have you landed at sunset and thought, "Ah, I made it in while I could still see. Good deal?" The late Admiral Luis deFlorez explained why it might not be such a good deal. I quote from the RCAF Grapevine:

"For a period of one hour after sunset a pilot can be expected to undergo a serious loss of his ability to perceive the relative depth of objects. If the sky is overcast or if the weather is inclement, this danger period will occur before sunset. Of particular importance is the fact that the decline in depth perception occurs gradually (at first) and continually. Thus, without special knowledge the pilot may over-estimate his ability to make a landing during the twilight period. It is also probably well recognized by all pilots that the ability to perceive landmarks is seriously interfered with after complete darkness has set in. But the rate and the amount of loss of this capacity during the twilight interval is probably not so well known.

"The situation with regard to the loss of stereoscopic acuity during twilight may perhaps resemble the circumstances when the oxygen supply is reduced during flight ascent. In the latter case the pilot is adversely affected by the oxygen lack in such a way that he does not notice or feel the need for oxygen. The consequent loss in intellectual function may lead to failure to don the oxygen mask before unconsciousness occurs. In the case of reduced illumination after sunset, the loss of depth perception also occurs gradually and may pass unnoticed. Confidence in the ability to judge the relative distance of objects, as is necessary during landing or while flying formation, may continue for some time, even though the ability to make such judgment has been seriously reduced. The fact that the objects can still be seen, even though their apparent spatial location is uncertain, probably enhances this confidence. It seems important, therefore, to stress the fact that stereoscope ability undergoes an often unrecognized and marked impairment during the twilight period."

HAIL DAMAGE reports have been coming in all too frequently. In one case the primary cause was pilot factor because he allowed the aircraft to penetrate an avoidable thunderstorm. The AC and navigator further contributed by accepting the bird, knowing the airborne radar was not up to snuff. Add the finding that flight crewmembers lacked general knowledge concerning the definitions of FEW, SCATTERED, and NUMEROUS thunderstorms, and you will conclude that we fly boys had better shape up or stay on the ground when there are "thunderbumpers" en route.

Steering Ol' Shaky

Ray E. Hines, Douglas Aircraft Company

C-124 nosewheel failures are being reported so frequently that a possible misunderstanding of the steering system appears obvious. This applies to faulty taxi techniques as well as improper maintenance. Since the Globemasters are being used more and more by Air National Guard and Air Reserve units, mention of some of the problems associated with the nosewheel steering system is in order.

The primary point for pilots to remember is that the aircraft should be in motion before they attempt nosewheel steering. The purpose of the cable from the drum on the steering column to the nose gear strut is *not* to turn the nose gear. *This cable connects the steering hydraulic panel, which in turn controls the flow of pressurized fluid to the steering cylinder.*

The pilot should also note that the nosewheel turns in direct proportion to the degrees of turn of the steering wheel in the flight compartment. When the steering wheel is turning, hydraulic pressure controlled by the steering slide valve is directed to the proper side of the steering cylinder. Turning the nosewheel equalizes tension on the steering cables, and the slide valve returns to a neutral position. If the pilot forces the wheel and does not give the system time to operate, he will merely break a cable or cause other damage. The system will try to operate when the aircraft is not in motion, but the friction of the tires will cause extreme loads on all of the steering components. This will cause early failure. The maximum turning angle of the nosewheel is restricted to 45 degrees to either side; therefore any attempt to force the aircraft into a sharper turn will only cause damage.

Another fine point for the pilot to remember is that sometimes during taxiing he might lose nose wheel steering momentarily. This is caused by rocking of the aircraft which overextends the nose strut and closes the steering shutoff valve. When this happens, chances are the nose strut has been improperly serviced. The proper adjustment of the nose strut, regardless of the load, is 10.4 inches measured from the center of the upper torque arm bolt to the center of the lower torque arm bolt. There have been other instances where the strut was overextended because of tail-heavy loading. In that event the pilot would have no steering available and would have to be towed to the maintenance area. The steering shutoff valve is necessary to close off hydraulic pressure to the steering system when the nose strut is extended and the gear retracted.

Maintenance personnel should be familiar with the operation of the nosewheel steering system, and should have knowledge of the basic trouble-shooting procedures. One primary concern is proper servicing of the strut to the correct extension.

In addition to improper servicing and operator error, there are three probable causes for the nose gear not steering properly. A mechanic preparing an aircraft for flight should know about:

- Improper rigging of cables,
- Defective steering cylinder,
- Defective steering glands.

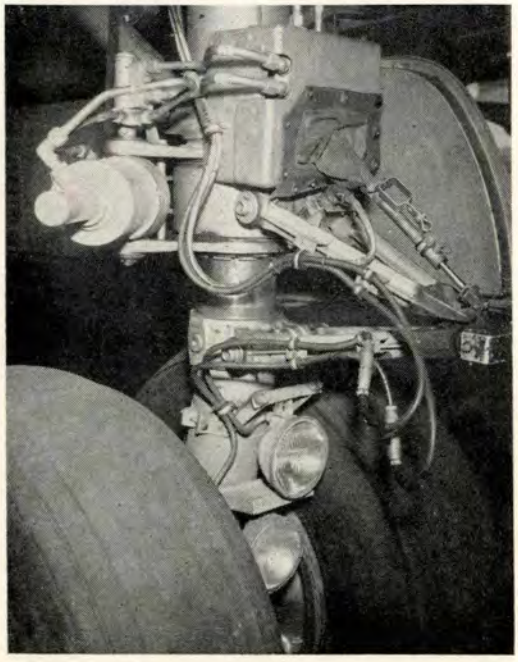
The complete isolation procedures and remedial actions are

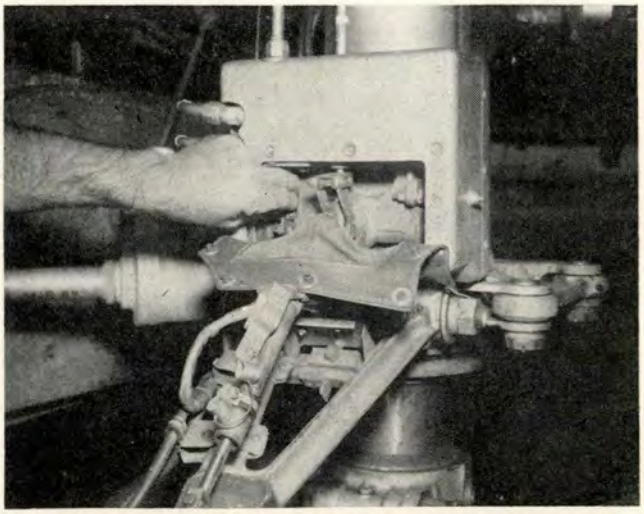
listed in the system technical orders. A simple steering system check can be made by opening the cover of the steering assembly and pushing up or down on the link of the slide valve. It should move in both directions without binding, and return to the neutral position of its own accord. If any sticking or binding is present, check the system and find out why. It could be loss of link spacers or washers, loose cables or frozen pulleys. Here again, refer to the tech orders for proper procedures.

Despite the fact that the nose wheel system is simply engineered and *should* be relatively carefree, many problems are generated by using personnel. Don't YOU be one of those persons. A little knowledge of the system will do much to cut down on the number of failure reports. A safety film, in which items of particular importance to inflight safety are emphasized, is available through base film library services. It is described as FTA 492e, FLIGHT SAFETY C-124C—The Aircrew Preflight, B&W, 15 min. ★

The nose steering which does not turn the nosewheels. It actuates the valve to direct hydraulic pressure to do the steering.

Flight crews should carefully check the nose steering system before taxiing.





The proper length of the strut is essential to effective nosewheel steering.

SPEAK UP—The big transport stopped short of the runway as Nr 2 for the active. While the crew was accomplishing an engine runup, the Nr 1 aircraft, an F-4C, was cleared to line up. As the F-4 moved toward the runway, the crew of the transport noticed a large puddle of liquid about five to six feet across and half the length of an F-4, which appeared to be fuel. Then as the F-4 engines started accelerating, the transport crew noticed an unusual flame pattern from the right engine, which was repeated when the F-4 started takeoff. Shortly after takeoff, both of the F-4's engines flamed out and the fire warning lights came on. The crew ejected safely. The transport and the F-4 were on the same radio frequency until the fighter was cleared for takeoff. After that, a message could have been passed through the tower, but wasn't. Large puddles of liquid and abnormal flame patterns aren't normal. Speak up when you see something unusual on another aircraft and give the other pilot the word.

SAFETY FILMS continue to become available through the local base film library or film servicing facility. If your base has no such service, the films may be ordered from the Air Force Film Library Center, an Aerospace Audio-Visual Service (MAC) unit, 8900 So. Broadway, St. Louis, Mo. 63125. In some instances, related articles have been published in *Aerospace Safety* and are so indicated.

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SFP 1348 NUCLEAR MIGHT—Ready But Safe—Nuclear Safety in the Air Force. Color, 19 min. Depicts effectiveness of nuclear program in preventing detonation of nuclear weapons by fire, crash or sabotage. Discusses security control, the no-lone system, SAC alert restrictions, and weapon safety devices.

•

TF 6050 THE PERCEPTION OF ORIENTATION Color, 37 min. This film analyzes pilots' problems of perception as related to orientation. Depicts nature of flight disorientation, its causes, effects, prevention and countermeasures. (Article "Spatial Orientation Trainer," Jan 1967.)

•

TF 5809 TERRAIN AVOIDANCE IN LOW LEVEL NAVIGATION Color, 31 min. Describes ground and contour mapping and terrain avoidance modes in radar navigation. Illustrates operational techniques and calibration procedures for each mode. (Article "Thru the Valleys and Over the Hills . . . SAFELY," Mar 1967.)

•

TF 5929 THE HC-130 RECOVERY SYSTEM Color, 21 min. Discusses the HC-130 recovery system used in rescuing downed pilots. Explains assembly

and preparation procedures. Describes role of rescue crew. Demonstrates two-man pickups and operations at night and over water. (Article "More Muscle for Rescue" July 1965.)

•

TF 6023 FLYING SWEPT WING T-TAIL JET TRANSPORTS Color, 21 min. Explains performance characteristics, flight features, design configuration, and operational aspects of swept-wing, T-tail, jet transports. (Article: "T-Tails," May 1965.)

•

TF 6048 VISION IN MILITARY AVIATION—Inflight Recognition and Closure. Color. 20 min. Depicts inflight recognition of other aircraft and dangers of high performance closure speeds. Examines visual limitations, speed relationship, distance and elapsed time and cockpit distractions. Presents tips on scanning, judging distance, and quick action. (Articles: FAA Advisory "Collision Avoidance," Mar 1966; "Too Much Togetherness" and "Look Out and Live," Sept 1965; "Problems of Tomorrow," Oct 1964.

SEVERAL CONSECUTIVE guard channel checks lasting about 60 seconds each were monitored by fighter planes in the local area. Such transmissions so distract pilots performing training maneuvers that they are inclined to discontinue monitoring the emergency frequency. An OHR was submitted and the responsible ground station was contacted during the investigation. Do your part to keep guard channel uncluttered by reporting violators.

DO IT YOURSELF. The Form 781 and pilot's check list were lying on the rear canopy rail of the F-4C. A ground crewman was helping the rear seat pilot strap in and asked permission to store the 781 in the publications case. After receiving clearance he attempted to store the form but his elbow struck the bulkhead mounted initiator actuating mechanism and fired the canopy initiator. There was no aircraft damage but sixteen manhours were required to clean the system and replace the squib.

The primary cause was design deficiency and UR's have been submitted. The incident could have been prevented if the local operating procedures had been followed: "The pilot is the only person who will store items in the cockpit." Don't let "George" do it to you.

THE FARMER said he wouldn't charge for the uprooted fence because he was planning to remove it anyway. The aero club pilot overshot because he applied power to avoid two golfers standing in the middle of the runway and reapplied power to avoid a bench. By this time, he had used up two-thirds of the runway and still wasn't on the ground.

If you think this airport leaves something to be desired you're right; the first half of the runway doubles as a fairway for the local golf course. Obviously, we should all avoid this type of "slapdab" airfield; but, there is another lesson here which applies to every pilot regardless of what he is flying: "Execute a go-around when things don't look right." Of course, there are times when fuel won't permit another pass but this should be the exception rather than the rule.

EXPO '67 BOUND

When General and Mrs. Perry Griffith (659 Delta) returned recently from Expo 67 at Montreal, we put the arm on him for some advice to aero clubbers planning to make the same trip. The General was 'way ahead of us. That was why he was here, he said. So here are a few tips on getting to and from the Exposition and some comments on the state of aero clubs in general.

Aerospace Safety: Well, General, we hear you and your missus have been on another bug smasher. To Expo 67.

General Griffith: Yes, and we visited 10 aero clubs, one of them Army. Five were repeats from last fall. I met several people who had read my article on aero clubs in the April issue of this magazine. At one base the article had been made required reading in the PIF for club members, and the recommendations had been implemented. Everywhere, I think, an improvement exists. We were stuck at an Army post in the middle of a severe weather area. Their aero club was well run, and they owned a current list of all clubs, of all services, too. Someone is cooking in their fun flying light plane business.

Aerospace Safety: How about Montreal?

General Griffith: Read my article in *Private Pilot* Magazine that hit the stands 1 July. It contains do's and don'ts for small plane travelers to the Fair. But here is some encapsulated advice: If going for a few days, go during the week—not at week's end. Ascertain U. S. Customs stops for your return. If from the midwest, launch into Canada from the Selfridge Club. Refuel and meet Customs at Oshawa, Canada, about halfway to Montreal, at a private flying club that won't quit. It is a show place. The wives run the snack bar, and it's good. If you RON, they'll haul you to town. Their spirit is super. In Montreal, you will land at RCAF, St. Hubert, five miles east of town. The civilians have a hangar for transients. Tie down is $1.50 per night; hangar fee, $4.00; gas—cheap. Taxi to town, $4.00; return, $7.00! You can rent Hertz at St. Hubert, and as flying club members you get 20 per cent off. A chopper also goes to the Fair, six bucks C. (Exchange rate is about $108.00 C for $100.00 U.S.) For hotel reservations, write LOGEXPO, Admin. Pavilion Cite du Havre, Montreal. Don't RON without a reservation unless you have a sleeping bag. Write S/L Leopold Brochu, Dept. of Transport, St. Hubert Airport, Montreal, for further aerial dope. ★

Fallout

LETTERS TO THE EDITOR

MUD BANK TOWER

Thanks to General Griffith for the exceptional (and exceptionally factual) article in the April issue (page 17). It dignifies the efforts of every aero club and the program's many proponents and, we pray, will enlighten and motivate those opponents who manifest: "Ignore it, perhaps it will go away."

After four years of close association with successful (a word synonymous with command support) aero clubs, I am fully convinced of, first, the need; and secondly, the real value of the aero club program to all ranks and all services. I have observed the same facial expressions on a 3-star Navy Admiral (submariner), on an airman third class, on a young wife, a doctor, and a dentist—after that first solo. That alone motivates us to devote that extra time, effort, and argument.

We cordially invite General Griffith, on his next flight east, to call Seymour Johnson Tower from 6459 Delta, visit and observe a club with beautiful facilities, ideally sited, with all 1967 model training aircraft, and a dynamic membership. We ask that the good General do his own refueling, but we will hangar him overnight and assure him of courteous service at base ops when he decides to file outbound.

Commander's support? We have it: the base commander, two wing commanders (one a member, the other owns his own Cessna 185), a division and a numbered Air Force commander.

Please accept this expression of gratitude from every USAF aero club member for the entertaining, revealing and, above all, potentially effective article.

Col Francis N. Thompson
Pres, Board of Governors
Seymour Johnson AFB Aero Club
Goldsboro, N.C. 27530

NOT USABLE ARRESTING GEARS

The article entitled "J-BAR/A-GEAR Equipment" under "The IPIS Approach" in *Aerospace Safety*, May 1967, was welcome as we have also discussed the notation; however, there is room for further clarification. A casual survey of the majority of Air Force bases listed in the FLIP IFR Supplement designate the arresting gear located on the approach end of runways as "Not Usable." My question is, does this really mean not usable, or does it mean not usable except in an emergency? If it means the former, what should I do after losing utility hydraulic system pressure in an F-4C aircraft if T.O. 1F-4C-578 has not been complied with, for example? If it means the latter, aren't all the arresting gear engagements more or less made only in emergency?

The approach-end arresting gears here at Wright-Patterson AFB are listed as "Not Usable"; however, the Base Operations Officer assures me that in case of emergency, and with sufficient prior notice, they could be used for approach-end engagement.

I suggest that the A-Gear notation be expanded to define those installations that are truly "Not Usable" and those that are "Usable for Approach-End Engagement with Prior Notice."

Lt Col Donald F. Casey
ASD, WPAFB, Ohio

Editor's Note: Your timely suggestion has been passed on to our engineering section and the Directorate of Aerospace Safety is currently taking action to implement it. You are absolutely right in that J-BAR/A-GEAR Equipment is for emergency and precautionary use only. The reason that so many barriers are listed as non-usable is because so many are interconnected MA-1/BAK 9 or 12 systems. The interconnecting feature necessitates lowering the MA-1 before the BAK 9 or 12 can be used. This is the reason for the prior notice requirement. Some will remain listed as non-usable because there is not sufficient overrun prior to the barrier, or the condition of the overrun is not conducive to safe handling.

KUDOS TO AWS

The article "Runway Visual Range" by Lt Col Henry E. Sievers, appearing on pages 2-5 in the June issue is excellent. We found it most interesting and the information presented is certainly of value to each of us. In fact, we have acted to insure that each forecaster in this Wing has an opportunity to read the article. We wish to congratulate him for his successful contribution to *Aerospace Safety*.

Lt Col Claude T. Driskell
Chief, Aerospace Sciences Div
Hq 4th Weather Wing (MAC)
Ent AFB, Colorado 80912

BYLINE

Our apology to Mr. T. F. Laughlin (page 17, June issue) for an error in his byline. His article on turbulence was taken from and with permission of the ICAO Bulletin. Since no other affiliation was shown, we assumed he belonged to the ICAO. Actually, Mr. Laughlin is a Group Research and Development Engineer at Lockheed-California Co, Burbank.

AN OMISSION

In the Aerobits column of the July issue, page 26, it was recommended that the static source selector be switched to alternate, with "George" in control of the T-29.

We neglected to specify that the altitude hold function must be OFF when performing this check.

☆ U. S. GOVERNMENT PRINTING OFFICE 1967 251-220/11

WELL DONE

MAJOR CHESTER R. YANDOW

4756 AIR DEFENSE WING, TYNDALL AFB, FLORIDA

Major Chester R. Yandow was flying a target mission in a T-33 when severe vibrations, more violent than compressor stalls, began shaking the aircraft. The engine began to decelerate and the vibrations became so violent that the instruments became a blur. Major Yandow immediately turned toward home base and began squawking emergency.

As engine RPM decayed, the vibrations subsided; when the RPM stabilized at 24 per cent, he could read the instruments. The throttle was ineffective, except that when it was pushed full forward RPM rose to 35 per cent, but the tail pipe temperature began to approach overtemp.

To save the battery, Major Yandow shut down all unnecessary electrical equipment except the TACAN, VOR and standby inverter. About 30 miles from base the TPT rose to 750 degrees, so the engine had to be shut down. At about this time RAPCON began providing vectors, but within a short time reception became so weak that all communications were lost.

Major Yandow soon sighted the base, but he could make no radio contact. He turned off the UHF, hoping to avoid complete depletion of the battery, in order to conserve enough power to run the emergency hydraulic pump long enough to get a safe gear indication.

As the aircraft neared the base the windshield frosted over and the canopy fogged up. Without boost, there was a tendency to overcontrol; however, a flameout pattern was flown to a safe landing. Major Yandow peered over the windshield in order to maintain directional control on the runway.

Inspection revealed complete disintegration of the turbine wheel, apparently as a result of bearing failure. A hole, the size of a large dinner plate, was torn out of the fuselage when the turbine wheel failed.

Major Yandow's outstanding airmanship warrants a WELL DONE! ★

MISSILE SAFETY AWARDS

The following units have been selected to receive Missile Safety Awards for calendar year 1966:

AAC	21st Composite Wing Elmendorf AFB, Alaska
ADC	29th Fighter Interceptor Squadron Malmstrom AFB, Montana 4751st Air Defense Squadron Eglin AF Auxiliary Field, Florida
PACAF	18th Tactical Fighter Wing Kadena AB, Okinawa 12th Tactical Fighter Wing Cam Ranh Bay AB, Vietnam 366th Tactical Fighter Wing Da Nang AB, Vietnam
SAC	321st Strategic Missile Wing Grand Forks AFB, North Dakota 410th Bombardment Wing K.I. Sawyer AFB, Michigan 381st Strategic Missile Wing McConnell AFB, Kansas
TAC	USAF Tactical Fighter Weapons Center Nellis AFB, Nevada
USAFE	86th Air Division Ramstein AB, Germany
ANG	149th Fighter Group Kelly AFB, Texas