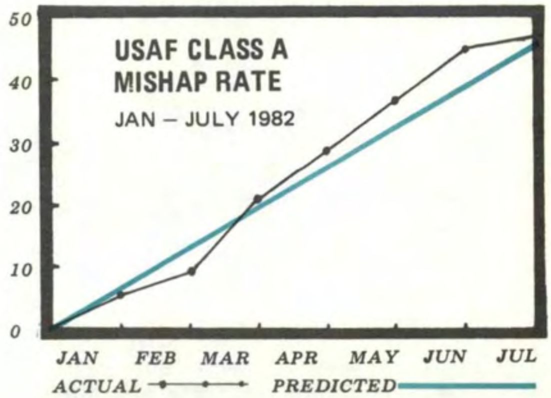
flying

SAFETY

AUGUST 1982

HOW IT WENT



I WAS THERE

■ As mellow yellow leader slips smartly up the slot and off into the sunset in his sleek and shiny supersonic "Super Sabre C," I would like to leave a couple of thoughts in passing.

You didn't have to be an athlete to appreciate what had happened — in fact, you didn't even have to be a hockey fan. Americans were rightfully proud of their Olympic Hockey Team, and the whole world knew it.

We had won. The gold medals and ceremony would be anticlimactic. The sight of young Craig with the flag draped around his shoulders warmed the hearts of some and kindled a fire in others.

Before I RTB, I must tell you that I have known a thousand such moments during my Air Force career. Too many times to count, I was there when it all came together. I have seen what can be done when everyone from Blue 4 to the boss gets it on. It's the kind of magic we all shared at Lake Placid.

We Americans love to win. In our business of defending our country's freedom, 2nd place is not an acceptable alternative to winning! Winning doesn't demand in-depth analyses of why we won. The sacrifice, hard work, discipline, and courageous spirit are simply taken for what they are — the winning combination — the right stuff.

Not so with failure. We really don't like to lose. Losses demand explanations — How? Who? Why? In time, and at times, we pause to recite our litany of lessons learned.

It takes more than that to win. Where I went to school it only counted as a lesson learned if you didn't do it that way anymore. You either changed something or kept on losing. The gentlemen from whom I learned the art and science of flying fighters were veterans of WWII and Korea. Contrary to bar talk, they were not supermen. They had their limitations. They worked hard to minimize them. They worked at being the best. No spots, no strokes, no points — the best. Not one of them ever debriefed "the perfect flight." There was always some small imperfection somewhere between going up the ladder and climbing down. They were never completely satisfied with their performance — or mine. The canopies weren't lined up in the arming area, an incorrect or undisciplined radio transmission, you stacked too low/high, three reversed too soon, etc., etc. They were the sincere admonitions of those who knew better and cared. Years later, during combat tours, I would be grateful.

Today, we are still hammering away at making things better. We want, we need, we can have fewer aircraft crashes.

For you new guys, take it on faith that it was a struggle to get where we are today, and it takes our best to hold the line with the low accident rates we now enjoy.

Can we do better? Yes! It's like hanging on the wing at night in the weather — you do everything you can and whatever it takes. Nothing is written in the stars. We can do anything if we really go for it.

I leave as I came, firmly convinced of these things:

- Our country is the greatest.
- Our Air Force is the best.
- The successful mission is a safe mission, the by-product of a good, disciplined operation.
- Your discipline and your integrity are two of your most important assets.
- The stakes are high and getting higher.
- You have a front row seat in a fiercely demanding, vitally important mission.
- Winning is not an easy way, but the only way, and besides it cuts down on the paperwork. ■

Keep pressing and thanks
"Barracuda"

LELAND K. LUKENS
Brigadier General, USAF
Director of Aerospace Safety

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SPECIAL FEATURES

REGULAR FEATURES

DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, USAF

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HOW IT WENT

CAPTAIN MIKE MALONE
Directorate of Aerospace Safety

■ Last year we achieved the second best flight safety record in Air Force history, and the lowest fighter/attack rate ever. These accomplishments were achieved under some of the most realistic and demanding training challenges ever, and these challenges were met well in 1981. Numbers and rates were zeroed out 1 January 1982, but most certainly the challenges remained. This article will take a look at how well we have met the old and new challenges so far.

	1982 Thru June	1981 Thru June	1981 Total
Total Class As	45	48	80
No. Destroyed	44	45	74
Pilot Fatals	27	25	43
Total Fatals	89	82	122
Class A Rate*	2.7	3.0	2.44
Flying Hours	1,680,684	1,615,437	3,234,180

*Rate per 100,000 flying hours

During the first 6 months of 1982, we experienced 45 Class A mishaps while flying almost 1.7 million hours.

Overall, we did slightly better the first 6 months of this year as compared to last year while flying about 65,000 more hours. However, simple subtraction or a look at Figure 1 will show that we have a long way to go to beat the last 6 months of 1981 when we had only 32 Class A mishaps and a 6-month rate of 1.9. Actually, as the figure shows, the low number of Class As the last quarter of CY 1981 (10), is what really brought us down to the 1981 rate of 2.44. Other than that quarter we were — and still are — hovering between 21-24 Class As a quarter.

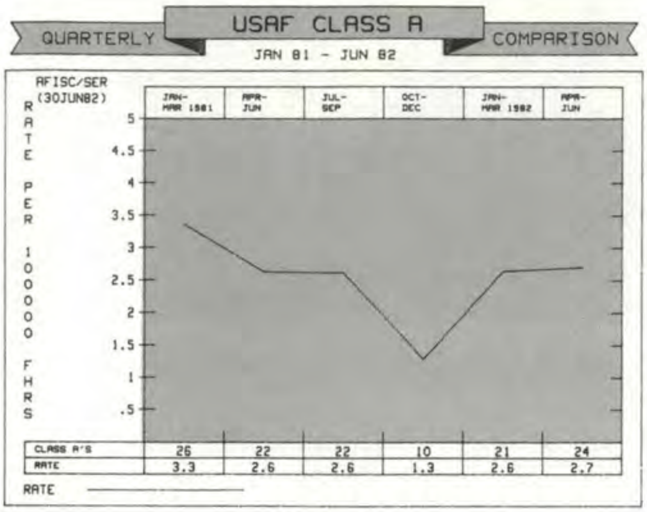


Figure 1

For a further breakdown of our Class As by number and rate here's how we are doing by type aircraft. Only the helicopter rate is above last year's 6-month experience.

	1982 Thru June	1981 Thru June	1981 Total
Fighter/Attack	33/5.92	32/6.22	52/4.95
Bomber	0/0.0	1/1.26	2/1.29
Cargo	5/0.87	6/1.06	8/0.71
Trainer	3/0.79	7/1.97	12/1.66
Observation	1/2.70	2/4.61	4/4.92
Helicopter	3/6.77	0/0.0	2/2.32

The major difference between this and last year's experience is seen in the operations and logistics-related mishap breakout as compared to the 1982 forecast.

1982 Forecast vs Actual

Type Mishap	1982 Actual	6-Month Forecast	Total Forecast
Operations	17	24	48
Logistics	27	16	32
Misc/Undet	1	1	2
Total	45	41	82
Rate	2.7	2.4	2.4

Operations-related mishaps historically constitute 55-60 percent of our total Class As, and logistics-related mishaps about 40 percent. However, during the first 6 months of this year we have seen a definite reversal with operations-related mishaps accounting for 38 percent of the total and logistics-related mishaps accounting for 60 percent.

In the operations area the most significant decrease this year has been in loss of control mishaps with 2 through June 1982 vs 7 through June 1981. Unfortunately, this has been offset by an increase in collision with the ground mishaps (both on- and off-range) from 7 the first 6 months of 1981 to 9 in 1982.

In the logistics area, the most significant increase this year has occurred in the number of engine-related mishaps. Engines have accounted for 11 of the 27 logistics-related mishaps this year as compared to a total of 6 for *all* of 1981. Fuel system-related mishaps have also been on the increase with 5 this year versus 3 all of last year. In addition, the number of flight control system mishaps presently show no improvement with 4 this year versus 8 all of last year.

So, from merely looking at the numbers, the first 6 months of 1982 was not all that bad, but to reach our goal of "2.2 in 1982" is not going to be easy the next 6 months.

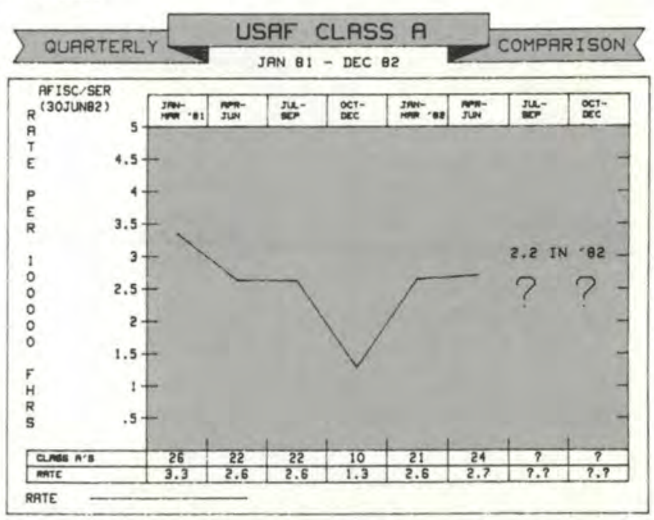


Figure 2

The challenge was met in 1981. An all-out effort to reverse the present logistics trend and further reduce operations-related mishaps can meet the 2.2 challenge in 1982. ■

Single VS Twin Engine Fighter/Attack

LT COL JOHN R. ALBERTS
Directorate of Aerospace Safety

■ One of the more frequent questions we get every week (or every day, it seems) is how does the F-16— or the F-15 — or "whatever" aircraft compare to other fighter/attack aircraft of the present or a past era?

It's easy to forget just how many aircraft we used to lose when compared to today's 1980 and 1981 total loss rates of 74 aircraft. For example, the lowest yearly loss rate of F-51 aircraft destroyed in any year was 66 per 100,000 hours in 1953 when *only* 121 were destroyed.

The figures below compare seven single-engine and seven twin-engine fighter/attack aircraft of a more modern vintage from the first military flight to the present. Due to changes in reporting criteria throughout the years, only destroyed aircraft loss rates are used for consistency, and cumulative rates are shown to eliminate yearly fluctuations. Each aircraft is compared at similar milestone flying hours, which are shown along the bottom axis. Note that the intervals between milestones vary above 140,000 hours and those shown generally correspond to the lifetime flying hours of one or more of the aircraft. Data is current as of 30 June 1982.

Several major points can be made from these figures.

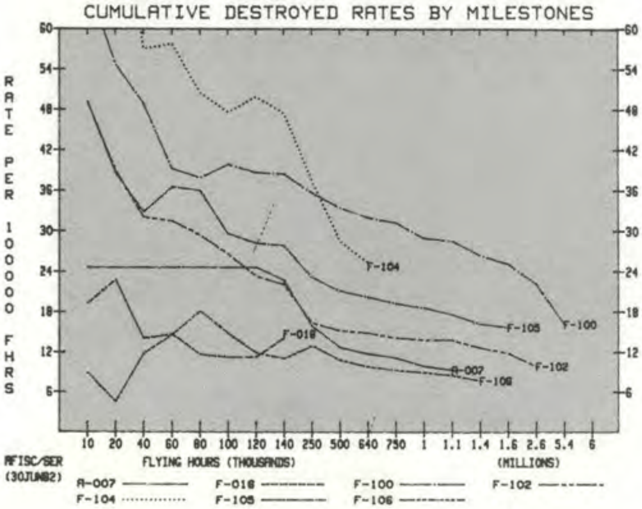
■ Every aircraft demonstrates a gradual decrease in destroyed rate over time. (As the aircraft "matures," system improvements are made, operator knowledge increases, and operational procedures are "fine tuned.")

■ On balance, twin-engine fighter/attack aircraft experience a lower rate than single-engine fighter/attack aircraft.

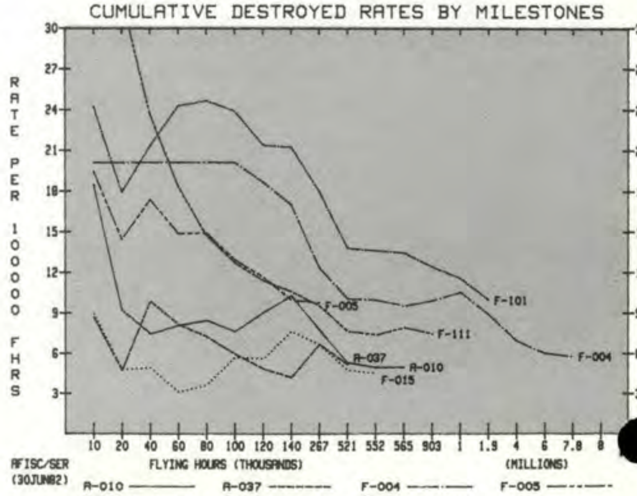
■ Overall, newer technology aircraft such as the F-16, F-15 and A-10 have peaked lower in their early flying years and are presently experiencing lower rates than earlier technology aircraft.

Many of us "ol' bold ones" often reflect back very fondly on the days when we were flying the "Sabre" and "Super Sabre," but as the figures show, our odds of having to step overboard were considerably higher also — not so fond a memory! ■

SINGLE-ENGINE FIGHTER/ATTACK
CUMULATIVE DESTROYED RATES BY MILESTONES



TWIN-ENGINE FIGHTER/ATTACK
CUMULATIVE DESTROYED RATES BY MILESTONES



DECISIONS . . . DECISIONS . . . DECISIONS

IF IT CAN HAPPEN, IT WILL

■ Who would ever imagine a normal service mission could end in an impossible emergency. Whatever the probability, the alert aviator must always function on the premise that "if it can happen, it will."

A C-12 crew was taking off from their home base when one of the generators failed. They elected to continue the IFR mission with one generator inoperative. The crew knew each generator was capable of handling the electrical load. About 30 minutes into the flight, the unexpected occurred — the second generator failed. No problem; there was still another source of electrical power — the battery. No doubt you can visualize what happened next in this calamity of errors. Yes, the battery failed. A total electrical failure — what do you do now? This situation could have been avoided if the crew had taken immediate action to resolve the initial deficiency.

Let's make a quick analysis of this situation that couldn't happen. Would you as the pilot have made the decision to continue the mission? The operators manual states: "Either generator is capable of carrying the full load of normal aircraft electrical equipment." This is a positive point to continue the mission. However, the operators manual also states: "Two operative generators are required equipment for IFR flight." Does this revoke the positive factor of the generator capabilities? The reply should be yes. Although the operators manual states the aircraft can be flown VFR with one generator inoperative, the primary mission of the C-12 is to carry passengers/cargo under instrument flight rule conditions day or night into high density air traffic control zones and into known icing weather conditions.

With this additional data available to assist you in making your decision, would you as the pilot have made the decision to continue the flight? If your reply is in the affirmative, let's examine an additional factor of this mishap. The initial emergency occurred during takeoff roll at the unit's home base of operation. Should this have been a factor in the decision process? Every available bit of information should be incorporated into the decision process to formulate the best conclusion.

It would appear from all the factors analyzed that the mission should have been aborted. From a safety standpoint, it is inconceivable that any individual would elect to initiate such a mission with an existing malfunction. ■

— Adapted from *Flightfax*.

So now we gotta BAIL OUT?

CAPTAIN PATRICK F. NOLAN
560th Flying Training Squadron
Randolph AFB, TX

■ I guess all aircrew members know the risks of their professions. Most deal with them by rationalizing the odds against something catastrophic happening to their own aircraft. Each year for the past 10 years about 80 Air Force crewmembers were forced to eject and only 78 percent of those survived. I was unlucky in a sense to find myself in an ejection situation but, fortunately, it was a pre-planned controlled ejection. Here's how the situation developed.

On that day in December we were doing what I'm sure many other aircrew members were doing — waiting for the weather to break so we could get some training sorties accomplished. When the SOF requested a crew for a weather ship, a good friend and I volunteered. We launched our T-38 with me in the front seat and Joe in the rear seat. We flew a heavy weight approach to check the weather, followed by a departure to check the MOA (Military Operating Area), and then RTB. Our bingo fuel was fairly high because our alternate was some 200 miles away.

We determined the weather was 600 feet overcast with tops at 4,500 feet. All was well with the world until we put the gear handle down on the return approach. Joe was flying the approach from the rear cockpit when our habit patterns were broken by the ominous sound of the gear horn and the failure to have any safe gear indications. Joe and I each had more than a thousand hours in the T-38 and had complete confidence in the alternate gear release system as we had used it in practice many times. The alternate extension in the T-38 consists of a D-handle connected to cables routed to each gear uplock. By pulling the handle, the front seater manually releases the gear uplocks, and the gear fall into the windstream, locking in place. When I pulled the handle, the system did not work as advertised.

You can imagine the astonishment and the cockpit expletives as the cable broke, leaving one each alternate gear release D-handle in my left hand — cable unattached. If that wasn't bad enough, the next thing we saw was a green light for the right main gear, but still unsafe indications for the nose and left main. This was when we both knew we were in deep "Kimchee" and we might have to eject. The RSU confirmed our unsafe indications, and we climbed back up above the weather to sort things out. We called our SOF who directed a chase ship to rejoin.

With the nose and left main gear up and the right main down, the Talon could not be landed. We had 30 minutes of fuel on board to work the problem. You name it, we tried it — unstrapped from the ejection seat to try to pull the cable at the floorboard, positive, negative, and zero Gs, yaw, shut down the left engine to deplete utility hydraulic pressure, cycled the gear handle a thousand times, turned electrical power on and off, wound the clock, etc. Additionally, the SOF had phone patches with maintenance, FTD (Field Training Detachment), quality control, and Northrop. None of their suggestions worked.

After 30 minutes, we were out of ideas and out of gas, so we started toward the controlled bailout area. The plan was to eject at 10,000 feet with approximately 200 knots. Enroute, we both cinched down all of our straps as tight as we could. We stowed our loose items in the map case with the exception of our kneeboards, which we placed on the floorboard of the aircraft. At this point, running the pre-ejection checklist became extremely difficult due to the UHF radio transmissions (i.e., a new chase ship being vectored in, helicopters receiving recovery instructions, along with normal radio transmissions). If we had to do it over again, we would have shut off the UHF radio while running the ejection checklist, then turn it on prior to getting out.

When we reached the bailout point, I commanded the bailout and Joe ejected from the back seat. I brought the throttle to idle and assumed the proper position — **handgrips raise; triggers squeeze.** The system operates very quickly, and the first thing I realized, I was flailing through the air. I brought my hands to my lap to check for the lap belt and was able to get my feet and knees together prior to opening shock. Opening shock at 200 knots was a pretty good jolt, but looking up at that nice, full parachute gave me such satisfaction and relief that I hardly noticed the bruises from the leg straps. I quickly accomplished my post-ejection checklist and then relaxed for the ride down, which was spent waving at Joe and the chase ship and thinking about the different types of parachute landing falls (PLFs) I might have to make.

I was hoping for a nice, green pasture but when I broke out of the clouds at 800 feet AGL, it was obvious I would be landing in a heavily wooded area. As I approached a large tree, I slipped the parachute to the right and prepared for my PLF. Just as my feet hit the ground, the parachute hung in the tree stopping me in a squatting position — feet firmly on the ground. I stood up, disconnected from the parachute, and took account of myself. Amazingly, I had survived the ejection and landing without a scratch or a tear in my clothing. I had seen Joe land about a quarter of a mile away; so I quickly started in that direction. I was no more than 100 yards from the parachute when the helicopters spotted me and hovered above me.

The helicopter crew signaled for me to follow to a suitable landing spot a quarter of a mile away. As I walked up to the helicopter, I could see Joe sitting in the jump seat grinning from ear-to-ear. I stopped to shake his hand prior to getting in on the other side. A short ride later, we landed right next to the squadron, and everyone piled out to welcome us back. It was a great feeling.

The flight surgeons nabbed us, and off we went to the hospital for a couple of days of check-ups and paperwork. Joe and I take our hats off to the Life Support and Egress shops across the Air Force for their outstanding work and professionalism. They sure made our day! ■

ACES II Ejection Seat

H. ENGEL, JR.
R.C. BRASHEARS
Aeronautical Systems Division
Wright-Patterson AFB, OH

■ What has happened with ACES II? Has it performed up to expectation? Did we ask for too much?

Since ACES II was first discussed in *Aerospace Safety* (September, 1978), over 2,200 seats have been installed in F-16, A-10, F-15, and B-1 aircraft, and nearly 2,500 have been built. But what of the record since the first ACES II ejection in August 1978?

There have been 34 ejections in the USAF; 30 have been survived with three major and six minor injuries. Of the four fatalities, three were out of the ejection envelope, and one drowned after a successful ejection.

The statistics are noted in Tables I, II, and III. Even though this is a good record, there is always room for advancement; and the Life Support SPO has five and ten year plans to improve the ACES II seat. ■

Table I
ACES II Ejection injuries in USAF

Year	No.	Fatal	Major	Minor	Minimal/ None
1978	2	0	0	0	2
1979	5	1	1	0	3
1980	9	1	0	1	7
1981	7	2	0	2	3
1982	11	0	2	6	3

(2 Jun 82)

Table II
ACES II Ejections By Aircraft

	A-10	F-15	F-16
USAF	10	3	21

Table III
ACES II Fatalities

A/C	Ejection Conditions
F-15	210K, 80 Ft, 32° Rt Bank, 12° Nose Down
A-10	220K, 4,000 Ft, Out of Control, Drowned During Rescue
A-10	300K, 250 Ft, 30° Rt Bank, 30° Nose Down, Hi Sink
F-16	200K, 250 Ft, 110° Nose Down

The ACES II ejection seat has achieved a very good record of performance during its four years of service. No injuries or fatalities have been attributed to seat malfunctions in any of the 34 ACES II ejections.

WANTED ALIVE

CAPTAIN TERRY MAYER
HQ USAF

■ Funding requirements are primary considerations in a majority of Air Force operations. One distinct exception, where cost is absolutely no constraint, is a search and rescue (SAR) effort. When lives are at stake, costs and resources will not be spared in the search and recovery of Air Force Crew members. Of course, money is not the only element in a successful rescue.

Certainly one important ingredient is the quality and scope of the rescue forces. The Air Force rescue team is composed of highly-trained, experienced professionals who are devoted to saving lives. In addition to the rescue-dedicated ARRS forces, there is a wide spectrum of assets available to assist during a SAR. Military, federal, state and local agency resources may contribute anything from sophisticated reconnaissance aircraft to scent-tracking dogs. The resources are available and will be used when needed, but they must have a starting point. That is where the final, and probably most important, ingredient enters the successful rescue formula.

■ **The survivor is the key to a successful rescue.** All aircrew members, despite their confidence and optimism, are potential survivors. If you, as a crew member, find yourself in a predicament that may lead to a survival situation, keep these simple pointers in mind to help the rescue forces help you.

If you are down and on your own you can be sure you are the center of all out efforts to get you back safely.

■ **Start Talking — Pronto.** At the first hint of trouble, advise someone (anyone) that you have a problem and give your location. Sometimes this is not a viable option. In the event you are in a comm-out situation, the next pointer is critical.

■ **Do the Expected.** The rescue forces will try to visualize logical scenarios to use as starting points in a search effort. If you attempt an innovative technique or alter normal patterns under these circumstances, you may delay your rescue while the search proceeds using a logical sequence of events.

■ **Keep The Faith.** Practice good survival techniques until rescue is imminent. If you aren't found immediately, an extensive search will begin and continue as long as there is a whisper of hope.

The ARRS motto reflects the attitude, enthusiasm, and dedication of the rescue forces — "That others may live." If you find yourself in a survival situation and have performed the boldface pointers, rest assured that the search effort will leave no stone unturned; the Air Force WANTS YOU ALIVE! ■

Looking at night air refueling

■ The date — today, the place — any anchor air refueling area, the time — 2200, local. There is no moon tonight, and there was a write-up on the AFTO 781 that said, "boom nozzle light is very dim." It was left open, no action taken. You, the boom operator, are expecting three sets of fighters, four planes to a set. They are all F-16s. According to our T.O. Dash 3, Air Refueling Manual, we can refuel the receivers because the nozzle light does work. You and I know how difficult air refueling at night can be. When you complicate it with fighters, no moon, and a dim, but working, nozzle light, it can become downright dangerous. Cheer up, booms, help is on the way.

From September 1981 to January 1982, we of the 904th Air Refueling Squadron at Mather AFB, California, were involved with testing a new concept in night air refueling. One of our KC-135As was modified with a tail-mounted floodlight. The light is mounted on the top of the vertical stabilizer and shines down over the air refueling envelope. It is controlled by a rheostat located in the boom pod on the boom operator's panel. The rheostat has an "off" position along with 10 different intensity settings. The telescope at disconnect switch was relocated to make room for the floodlight rheostat.

The light itself contains two light bulbs. These bulbs are the same as the cargo compartment lights of a C-141. There are what looks like four scratched areas on the clear cover below each bulb. These areas are actually light diffusers. At full intensity, the light produces approximately twice as much light as a full moon.

Since the light has been installed on our aircraft, we have flown tests using F-15s (A and B models), B-52s (G and H models), A-10s, C-141s, F-111s, and F-106s (A and B models). Questionnaires were completed by the boom operators after each flight. Questionnaires were also sent to the receiver pilots for completion and returned to us. Both the pilot and boom operator questionnaires were then sent to the 4200 TES, Edwards AFB, CA.

On all night refuelings, we attempted to have one of our squadron instructor boom operators as well as two line boom operators aboard the aircraft. This served two purposes. The first was to let as many of our booms as

under a different LIGHT

TSGT EDWARD F. MAZZINI
904th Air Refueling Squadron
Mather AFB, CA

The new tailmounted floodlight on the KC-135 illuminates an area as large as an entire F-16. This greatly improves a boom operator's ability to see canopies, antennas, and control surface movements — all of which makes night air refueling safer.

possible "see the light" and second, to get as many opinions and evaluations on the light as possible.

The evaluations of the light by the boom operators were all extremely favorable. Two problem areas were discovered, and these will be covered later. Some of the favorable areas noted were: an increased visible area of the receiver, his rate of movement, the location of the canopy, any antennas, and the location of the receptacle and any raised surfaces. With the intensity of the light set within the recommended settings, the various receivers became rounded. Instead of looking at a flat surface, similar to looking at a photograph, the receiver became three dimensional. This greatly improves one of the weakest areas of night refueling — depth perception.

As we all know, depth perception is what allows us to judge the distance between the tip of the boom and the surface of the receiver. Without it, we, as boom operators, cannot keep the boom from striking the receiver prior to contact and after disconnect. Unfortunately, striking the receiver does not just scratch some paint off. It can lead to the breaking off of antennas and the cracking, and sometimes loss, of a window or canopy.

Next to depth perception, the second area that is important and necessary for a safe refueling is the area visibility. With the F-16 receiver, the light illuminates an area that covers from wing tip to wing tip, from the nose of the receiver to the tail. With this large an area visible to us, we can see where antennas are located and where a canopy begins and ends. We can also see the movement of flight control surfaces. The movement of these surfaces keys us to anticipate any movement of the receiver. This enables us to follow the movement quicker and reduces the chance of nozzle cocking. All of the above items make night air refueling safer from our end.

Under the canopy is another factor that contributes to a safe air refueling — the receiver pilots. How does the light affect them? Are there any glare spots? Does the light shine in their eyes? Do they like or dislike the light? We will look at these questions and attempt to answer them with information given to us by the receiver pilots' questionnaires and information given over the radio. I will not attempt to answer the questions in the order they were asked.

After briefing some of the F-16 pilots at Hill AFB, Utah, about the floodlight, we conducted the air refueling. One of the pilots came in to get his fuel. At approximately five feet from contact, he stopped his forward movement and asked, "Where is the light you told us about?" We told him that it was on the top edge of the tail. He then backed out, looked up and said, "Oh, yeah, now I see it." He then came back in and got his briefed offload with no problems. The more

Looking at night air refueling under a different light continued

aircraft that we refueled, the more apparent it became that the floodlight was not adversely affecting the receivers.

This was confirmed when the questionnaires started to come back to our squadron. All of the receiver pilots stated that they came under the light at approximately 30 feet from the contact position. When asked if the light bothered them they replied that it did only when they looked directly at it. There were a few instances when we were asked to turn the light down. There are three to four recommended settings for each receiver. When the light was turned down to the lowest recommended setting, the pilots had no problems.

Another area of concern was glare or hotspots. None of the pilots complained of hot spots. One of the F-106 pilots and both of the F-111 pilots mentioned a glare on their instruments. Even with the glare they were able to complete the offload with no major difficulties. If a checklist or any paper (like a map) was placed on or near the windscreen there would be a reflection from the light.

When asked if there were any adverse affects caused by the light in flying their airplanes, one F-106 pilot said that when he entered the area covered by the light he did get slightly disoriented. None of the other pilots who responded complained of this problem.

Of all the receivers questioned, the F-16 and A-10 pilots commented most favorably about the floodlight. The A-10 pilots commented about how the light gave them a much better reference when approaching the contact position. The consensus of all the receiver pilots was that they liked the light and felt that it enhanced the safety of night air refueling. Anything that makes air refueling safer is something the pilots like and want to see become adopted throughout the Air Force.

During the testing period, our boom operators noted two problem areas with the modification. Both problems were inside the boom pod. The first problem was with the telescope at disconnect switch. The switch was relocated to a position just below the signal coil test switch. There was no illumination onto the switch. This created a problem when going from manual to auto retract and back again. The dome light intensity must be turned up in order to find the switch and then place it in the proper position. The other problem area was also minor. The underbody/underwing and boom nozzle rheostats were repositioned. If the rheostats are not seen during preflight, the nozzle light can be turned on by mistake. Both problems can be solved with a little care and the addition of a light for the telescope at the disconnect switch.

As stated earlier in this article, help is on the way. The boom floodlight has been approved for installation on all KC-135A aircraft. The light improves visibility, helps depth perception, causes no major problems with the receivers, and makes night air refueling much safer. ■

"SAFETY TROPHIES"

for distinguished contributions during 1981

CHIEF OF STAFF INDIVIDUAL SAFETY AWARD

Presented to Air Force personnel who made significant contributions to safety during the previous calendar year.

LIEUTENANT COLONEL EDWARD L. HUBBARD
Air Force Systems Command

As Director of Base Safety for Armament Division, Eglin AFB, Florida, Lt Col Hubbard provided safety leadership for 30 tenant units and 20,000 people and contributed to accident-free flying operations and a significant reduction in ground mishap injuries.

CAPTAIN ROBERT J. TOMCZAK
Tactical Air Command

As Chief of Flight Safety, 474th Tactical Fighter Wing, Nellis AFB, Nevada, Captain Tomczak was a key element in the wing's mishap-free conversion to the F-16 aircraft, and his investigations of mishaps and aircraft incidents contributed greatly to the future flight safety of the F-16 aircraft.

FIRST LIEUTENANT ROY L. GRESHAM
Strategic Air Command

As Missile Safety Officer, 351st Stragetic Missile Wing, Whiteman AFB, Missouri, Lieutenant Gresham identified missile high accident areas before mishaps occurred, and contributed significantly to the Strategic Air Command's readiness posture.

CHIEF MASTER SERGEANT RONALD C. CHRISTIANSEN
Tactical Air Command

As Chief, Ground Safety Division, Headquarters Tactical Air Command, Chief Christiansen's safety leadership contributed to a reduction in ground mishaps, and he developed concepts that have improved the ground safety career field for the entire Air Force.

THE COLOMBIAN TROPHY

Symbolic of excellence in military aviation safety for tactical flying operations, the Colombian Trophy for 1981 was awarded to the 354th Tactical Fighter Wing. The wing flew more than 18,000 sorties and 30,500 hours with no accidents. This achievement was attained while the wing conducted a combat training mission in a high performance tactical fighter aircraft.

354th Tactical Fighter Wing
Myrtle Beach AFB
South Carolina

THE KOREN KOLLIGIAN, JR. TROPHY

Awarded to the Air Force person who most successfully coped with an inflight emergency. Captain Faber was flying a U-2 aircraft on an operational mission when he experienced an aircraft electrical system failure and loss of attitude reference indications in instrument flying conditions. Through exceptional airmanship, he managed to descend to visual flying conditions and, despite gear lowering, fuel dumping, and elevator trim problems, successfully recovered the aircraft.

Captain Larry E. Faber
9th Strategic Reconnaissance Wing (SAC)
Beale AFB, California

THE DIRECTOR OF AEROSPACE SAFETY SPECIAL ACHIEVEMENT AWARD 1981

Major Command — Flying Safety

Air Force Reserve

AFRES achieved the lowest number of aircraft mishaps and mishap rate in the past 8 years while flying nearly 134,000 hours in a variety of weapons systems and performing a demanding worldwide operational mission. They were involved in numerous aircraft conversions and participated in 49 major command and USAF operational exercises.

Major Command — Ground Safety

Electronic Security Command

ESC had the best ground safety record in command history. They did not experience a single military or civilian fatality, and had only 8 military injuries while performing a worldwide security mission.

Wing — Flying Safety

55th Strategic Reconnaissance Wing
Offutt AFB, Nebraska

The 55 SRW flew 20,000 hours during 1981 without a Class A or B mishap, and reached the 20-year and 200,000 hour milestones of continuous airborne command post "Looking Glass" operations; one of the outstanding safety and operational accomplishments in the history of aviation.

THE DIRECTOR OF AEROSPACE SAFETY INDIVIDUAL SPECIAL ACHIEVEMENT AWARD

Major Daniel P. Kallenbach

366th Tactical Fighter Wing
Mountain Home AFB, Idaho

Major Kallenbach experienced an extremely complex multiple emergency in an F-111 fighter aircraft, including a fire and complete failure of the primary hydraulic system, but through his outstanding airmanship, the aircraft and perhaps the lives of the crew were saved.

Major Bobby R. Quisenberry

Chief, Missile and Nuclear Safety Division
Headquarters Strategic Air Command

Major Quisenberry significantly influenced the safe operation and future deployment of both ground and air launched stratetic missile systems within SAC and the U.S. Air Force.

OPS topics

Hard Landing

An Aero Club pilot was practicing landing around dusk. The pilot had some difficulty with the rapidly changing light conditions, landed hot and bounced.

When he tried to "fly" the aircraft back to the runway, he touched down nose wheel first hard enough to activate the ELT (5-7 Gs). The nose gear strut failed on impact, and the aircraft slid to a stop on the main gear and broken nose strut.

Wire Strike

■ Two UH-1's were redeploying from Red Flag. After a refueling stop at an enroute base, the two aircraft took off in formation.

While enroute, Number 2 practiced crossovers, trail, and fingertip procedures. The procedures used were not in accordance with command directives, and changes in position were not coordinated by radio.

After about an hour of flight, Number 2 was in fingertip at lead's 7:30 position. Number 2 executed a left 360° constant airspeed turn in an attempt to enter extended trail.

As he rolled out of the turn, the pilot of Number 2 realized that he was below lead and still descending. He immediately added power but, as he started to climb, the aircraft struck some power lines at about 150' AGL. The pilot was able to make a safe emergency landing in a nearby field.

Thunderstorm Problem

A C-130 was over southwest Colorado enroute to a western base when the aircraft encountered an unexpected solid line of thunderstorms which had built up after takeoff. The aircraft radar was weak, and so the aircraft commander requested vectors from Center in an attempt to penetrate the line.

After about 3 or 4 minutes on the vector heading, the aircraft encountered moderate to severe icing and then about 45 seconds of hail. After landing, the crew found numerous cracks in the nose radome.

Unlocked Gear

An F-15 took off on a DACT mission without incident. During the first intercept, the pilot began a near vertical low to high conversion in min AB, 500 knots, and 4-4½ Gs. The pilot then heard a loud bang and muffled thump. He called "knock it off" and upon investigating, found the gear handle down and the red light in the handle on.

Lead rejoined and confirmed the gear down de-

Some recent happenings in the arena of flight — some good, some bad, some simply amazing.

spite an unsafe indication for the right main. The pilot returned to base and made a successful straight-in landing. But after aerobraking, the pilot could get no braking with either the normal or emergency systems. He then lowered the hook and successfully engaged the BAK-12 cable.

Investigators found that the landing gear handle could be placed up but would not slide into the uplock detent unless deliberately placed there. From this intermediate position, less than two pounds of force were required to cause the handle to come down. So, under the G forces of the stern conversion, the handle came down and so did the gear damaging the gear door linkage, brake lines, and separating the right aft main gear door from the aircraft.

Split Flaps

A CT-39 was at 3,000 feet MSL on a night VMC approach. As the pilot lowered the flaps to initiate an intermediate descent, the aircraft started a left roll. The pilot stopped the flap movement and determined that the flaps had split with the left up and right partially down. He was able to work the right flap up and then set up for a no-flap approach. The crew was almost 12 hours into a 14-hour crew duty day at this point. At about five miles the pilot initiated turn to final and lowered the gear.

Then habit patterns interfered and the pilot automatically and unintentionally lowered the flaps. This time the crew did not detect the rolling moment as quickly because the aircraft was in right turn and the gear was in transit. The right flap came full down while the left stayed up. All attempts to bring the right flap up failed.

By now the aircraft was on a three mile final and luckily was fully controllable, so the crew elected to continue the approach to landing which was successful.

Transient Alert Boarding Ladders

Just after brake release, and prior to engaging the afterburner, a hard thump was felt in an *F-106B* aircraft. The takeoff was aborted, and the Tower informed the aircrew that both external tanks had jettisoned. It turns out the aircraft had just returned from a cross-country during which an *F-102* boarding ladder had been used by a transient alert crew for entrance to the rear cockpit.

The F-102 ladder hangs farther over the canopy rail than the F-106 ladder and had broken the guard on the rear cockpit external tanks jettison button. The guard, but not the button, had been replaced the night before the incident flight. However, the jettison button switch was broken internally and shorted during the ill-fated takeoff roll causing the tanks to jettison.

The moral of the story is that when you're cross-country and see TA coming at you with the latest model of home-made or modified boarding ladders, make sure nothing in the cockpit can be activated/damaged by the part that hangs over the canopy rail. ■

— Maj Gordon N. Golden, Directorate of Aerospace Safety.

TIE-DOWN SENSE

IRA J. RIMSON

■ Large numbers of aircraft parked outdoors are damaged each year by high winds associated with storms or frontal passages. Summer brings convective storm activity to much of the world, and they can develop over a very short span of time. Planning for secure tie-down, as for most hazardous situations, means expecting the unexpected.

Where To Begin

The pilot's handbook or owner's manual for each aircraft has a section that generally covers the recommended method for tying down the aircraft. The service manual will provide greater detail, including tables covering aircraft weight, wind velocities and direction and proper angles for setting tie-down ropes or chains. It is advisable to obtain a copy of the detailed tie-down diagram from the service manual, and assemble a tie-down kit that can be carried on cross-country flights away from home base.

The kit should contain sufficient equipment to perform an adequate tie-down job in a 50-Kt. wind. It should include rope, cable or chain — with the appropriate attaching and tightening fittings — auger bolts for sod parking ramps, control locks, chocks and covers for all external openings.

Parking Considerations

Ideally, an aircraft will be parked in an area which provides at least four-point tie-downs. If information is available on an approaching storm, the aircraft should be parked with its nose to the wind.

Concrete parking ramps with embedded tie-down rings generally offer limited flexibility. It can be improved by attaching tie-down cables to the rings to form a cable "grid" to which the aircraft tie-downs can be attached. Sod parking areas provide the greatest flexibility, but the tie-down methods vary widely in effectiveness.

Auger bolts are the most effective anchors and have an additional advantage in that they can be "screwed" into the ground without using a sledgehammer. (It helps to have a length of pipe that will fit through the eye of the auger bolt to help turn it into hard or rocky ground.)

Star anchors, the base of which are like an inverted ship's anchor, are next best, but they must be driven into the ground with a sledge and can be difficult to remove from rocky ground.

Wooden stakes are least effective. They tend to loosen easily when the ground becomes wet from rain, and, because they are only effective in one direction, they can be pulled out if the wind shifts markedly.

The two primary types of tie-down rope used for aircraft are manila (hemp) and synthetic (nylon). Because of its many inadequacies, manila is less suitable, although substantially cheaper. Manila also is subject to rot after exposure to the elements and is particularly susceptible to deterioration from gasoline, oil and grease spills. It shrinks when wet, which can put undesirable strain on tie-down fittings. Nylon, on the other hand, is relatively unaffected by either petroleum products or water. It does have a tendency to stretch, and this should be taken into consideration when tying down.

Whatever material is used, the rope should have a breaking strength greater than 3,000 pounds (1,350KG). It is advisable to splice a hook and thimble into one end of a tie-down line and to attach the other to the tie-down with a hook and sheave to prevent excessive abrasion that could cut through the line.

Tying Down The Aircraft

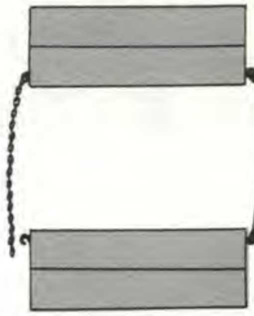
Use the aircraft tie-down rings — *not* struts, landing gear legs, or other protuberances. No exceptions. Believe it or not, I once saw an aircraft tied down by the brake hydraulic lines.

Nylon ropes should be tied without slack but also without any strain on the aircraft. Dry manila should have one-to-two inches of lateral slack to permit shrinking in rain. This is where art comes into play — too much slack will permit the aircraft to jerk against the ropes, damaging it, snapping the lines and/or both. Too much strain can put inverted loads on the wing structure.

Tie-down ropes should lead at 45° angles, both outward and downward from the tie-down fittings. The ideal eight-point tie-down would have two lines at each wing, one each led outward, forward and aft at a 45° angle and two each at the nose and the tail, each tending outward at 45° to the centerline. The exception is the previously mentioned "grid" of tie-down cables, in which the ropes are tied vertically to the cables.

All flight controls should be secured to prevent movement, either by the aircraft's integral gust lock or by battens placed externally. Be sure the battens have highly visible flags as a reminder to remove them before flight. Ailerons and rudders should be secured in the neutral position. Elevators on tricycle-gear aircraft also should be neutral. If "taildraggers" are parked heading into the wind, the elevator should be secured in the nose-up position. If the tail is into the wind, the elevator should be nose-down. Flaps should be up.

Chocks should be securely positioned fore and aft of each wheel, including the nose wheel, and held in place to prevent them from being dislodged by wind. Figure below shows a cheap and simple method of securing chocks that can be modified to fit any aircraft from a Cub to a B-747 by



Bungee cord — permanently attached at both ends with eye bolts (approx. one-half to two-thirds wheel diameter in length, long enough to put slight stretch in bungee cord). Chain — permanently attached at one end with eye-bolt, other end loose. Screw hook in opposite chock to keep chain taut against tires and bungee tension.

altering the size of the bungee and chain.

If located or traveling to an area where heavy winds are common, it is wise to acquire a spoiler that can be placed along the wings to break the lift generated by the winds. The simplest method is to use a narrow sandbag long enough to extend the full width of the wing and about three inches (75mm) in diameter. One can easily be made from old fire hose filled with sand and with the ends sewn shut. A bungee-type arrangement can be fitted to hold the spoiler at the 25% chord position on the wing, at which point it is extremely effective in negating any lift generated by the clean wing.

In addition, close and lock doors and windows, cover or plug pitot tubes and static ports, exhaust and intake openings and any other holes where water or dust intrusion could pose a problem. — Courtesy *Flight Safety Digest*, March, 1982. ■

■ In the past few months we've received countless calls asking about the Pilot's Annual Instrument Exam, so, as promised in our May article, here's the status. The current Instrument Exam has been in the field since 1977. To say it's getting old is to grossly understate the issue. Complaints have ranged from "this test is so old, that it is no longer valid" to "this test is so old, I can hardly read my pony!" Well, rest easy, a change is in the mill, and for the last few months we have been hard at work writing new questions. The result of our labor is in final coordination and should be distributed by late summer.

The new test is a departure from prior editions in that MAJCOMs and individual flying units will be more involved in structuring the test administered to their pilots. This new test will contain a minimum of 100 questions (sound familiar?); however, the option exists for 25 percent of the questions to be developed at the MAJCOM or unit level. Other than this optional area, the test questions will be drawn from a "bank" of approximately 250 questions dealing with AFR 60-16, AFM 51-37, FLIP, AFM 51-12, and, of course, a few of the traditional hand held computer problems.

This question bank concept should solve the problem of invalid questions due to changing regulations, differences in equipment, and individual command policies. As questions become outdated or invalid, they can be replaced on a one-for-one basis. Using this same substitution concept, a new test can be generated as required to avoid having to take the same test over-and-over. AFP 60-19, Vol III, will outline the specifics of administering and updating the test.

Now that final selection of the questions is being made, we feel that it's only fair to highlight certain areas, ideas, and specific questions that didn't quite make it to the final evaluation stage. So, with tongue parked firmly in cheek, we call it:

Clips From The Cutting Room Floor

Question No. 6 — Write a 500 word essay dealing with the pertinent factors involved in field stripping the rate switching gyro (neatness counts).

Question No. 46 — The reported altimeter setting is 29.87 in. Hg. You have not reset your cruise altimeter setting of 1023 mm Hg. Upon letdown and arrival, while at your minimum descent altitude (MDA), you will be:

a. higher than you wish you were.
b. lower than you think you've been.
c. right where you're not.
d. some of the above.

Question No. 106 — Which statement concerning Indicated Altitude is correct, if the station altimeter setting is set in the Kollsman window?

a. Indicated altitude is the height of the static ports above mean sea level.

b. Indicated altitude is the height of the altimeter case above mean sea level.

c. Indicated altitude is merely an indication of height and should not be used for instrument approaches.

d. Indicated altitude is next to cleanliness.

Question No. 137 — Consider the following quote:

"Instrument flying is inherently dangerous and should not be taught to our pilots." Explain in your own words, the relationship between that concept and the phrase "Cleared as filed."

As a special treat for those who feel they need a little edge, here are four answers sure to appear on the new exam: a, b, c, and d. Hope this helps!

Remember, you drive the content of this column. Let us hear from you with suggested topics or specific questions. Call Lt Col Jim Curran or Maj Bill Gibbons at AUTOVON 487-5834. Keep it "On Course." ■

LOOK OUT, BIRD, I'M COMING THROUGH

2Lt Steven Sayre • UPT Student Pilot, Randolph AFB, TX

■ Ever been on inside downwind and hear that familiar RSU call, "Use caution in the pattern, there are birds in the vicinity of downwind?" Yeah, right! With runway spacing, configuration, airspeeds and other aircraft to worry about, I've got no time to fool with birds. "Look out bird, wherever you are, 'cause I'm coming through!"

Then one day I came across a bird who felt the same way I did: "I've got no time to fool with airplanes; look out jet, I'm coming through!" And that's exactly what he did — just below the canopy bow slightly left of center. He left a 7" x 4" hole in the windscreen and blood and meat and feathers everywhere else. What was it like? Well, it's not something you'd want added to the Special Syllabus Requirements List.

I had pulled my first low closed (to 600 AGL), was adjusting spacing from the runway and had slowed to below configuration airspeed when three large birds appeared at 12 o'clock. Collision appeared imminent, but I had a split second to consider my options. Duck forward quickly and risk inadvertently pushing over (at 600 AGL, it wouldn't take much to ruin your whole day), or climb quickly. I fought the instinct to duck over yet didn't pull too hard for fear of stalling out. The sound was just like somebody hit the windscreen with a ball bat as hard as they could. I was thrown back into the seat and felt my head go back firmly, but not severely enough to keep me from controlling the aircraft. The need to maintain aircraft control was my first consideration as visibility was a real problem with blood and bird debris covering my visors.

Noise level and windblast were not difficult to cope with. The IP quickly analyzed the situation and flew the aircraft to a safer altitude while telling the RSU we would be landing on the center runway and why. I turned up the intercom and had uninterrupted communications with the rear cockpit. In short order I told the IP what had happened, that I was all right, and that "Roger, he had the aircraft." I raised my hands so he could see them and then wiped off my visors to check for damage and have a look at the engine instruments. My left gear light gave an unsafe indication, but the rear cockpit checked good so we confirmed the safe indication with mirrors and proceeded to an uneventful landing and rollout (except for the stench and wiping off the meat, feathers, blood and glass).

Three Common Sense Lessons (learned the hard way)

- First, use both visors — lighting conditions permitting — prior to the climb check and after the descent check . . . *brother, I believe!*

- Second, with birds level at your 12 o'clock, begin a climb. If they do hit, at least you'll be in a position to bail out. You must fight your initial reaction to duck over, especially at low altitude or if it means sacrificing aircraft control.

- Third, listen up when the RSU calls out a bird warning. Sure, I know, it only happens to the other guy and besides, you got too many other more pressing things to worry about, right? That's what I said, but if that bird had hit another six inches to the right, it would have been my last gradebook write-up. ■

TAIL ROTOR TRICKERY

MAJ J.P. CRESS, USMC

■ Turn to the *Emergencies* section in the operator's manual of any conventionally driven, single-rotor helicopter and you'll probably find a reasonably good discussion of what to expect and what to do if you lose control of tail rotor blade pitch, if you lose tail rotor drive, or if the whole tail rotor and gear box(es) fall off! Depending on the problem, the book will advise a broad range of expectations and corrections varying from "controlled power landing techniques . . . will enable . . . a safe landing on a good surface" to . . . "it is recommended that the helicopter be abandoned in lieu of landing, if parachutes are available."

You'll no doubt agree that these kinds of problems, mechanical in nature, are those that come to mind when you talk tail rotor troubles. But is this the whole story? Does something have to break in order to cause you trouble with your tail rotor? You'll agree that there are lots of ways to get yourself into difficulties with the main rotor, short of breaking something off it. Since the tail rotor is a lift or thrust producer somewhat similar to the main rotor, it's not unreasonable to assume that it can create aerodynamic headaches similar to the blade stall and power settling problems we associate with the main rotor. What are some of these problems? When do you run into them? How do you avoid them or correct for them?

If you think back on what you know about main rotor aerodynamics, you'll agree that one of the scarier problems that comes to mind is power settling, a term you'll find various authors using to refer to flight in the vortex ring state. It becomes troublesome when descending at low forward speed with the rate of descent within about 70-150 percent of the average induced velocity of the rotor. The phenomenon is often described as a case of settling into your own downwash. The result is a large thrust variation, vibration, and reduced control effectiveness, as well as rapid loss of altitude.

How do you put a tail rotor in such an environment? It should be clear that left sideward flight can cause the tail rotor (for a conventional American design) to operate in a condition much like the main rotor during power settling. Though it doesn't settle *per se*, left sideward velocities (10-35 knots, depending on loading) due to wind or control deflection can cause the tail rotor to work in its own downwash, provided the fore/aft wind components are light. As might be expected, the results will be large variations of tail rotor thrust and difficulty in maintaining directional control, with the nose oscillating while the pilot attempts to counteract with rapid left/right pedal inputs.

The problem was of sufficient proportions in two fairly recent, high technology helicopters to limit one of them to 15 knots of left sideward flight and to force redesign of the tail rotor of the other. This would preclude a problem where, at high gross weight and density altitude with light port winds, the pilot would find the aircraft yawing right after left pedal input due to operation of the tail rotor in the vortex ring state.

What about starboard winds or aircraft motion to the right? This affects the tail rotor in the same manner that a downward gust would affect the main rotor. The reason, of course, is because the inflow, or downwash, reduces angle-of-attack (a) as shown in Figure 1.

Again, a tail rotor in right sideward flight or with wind from

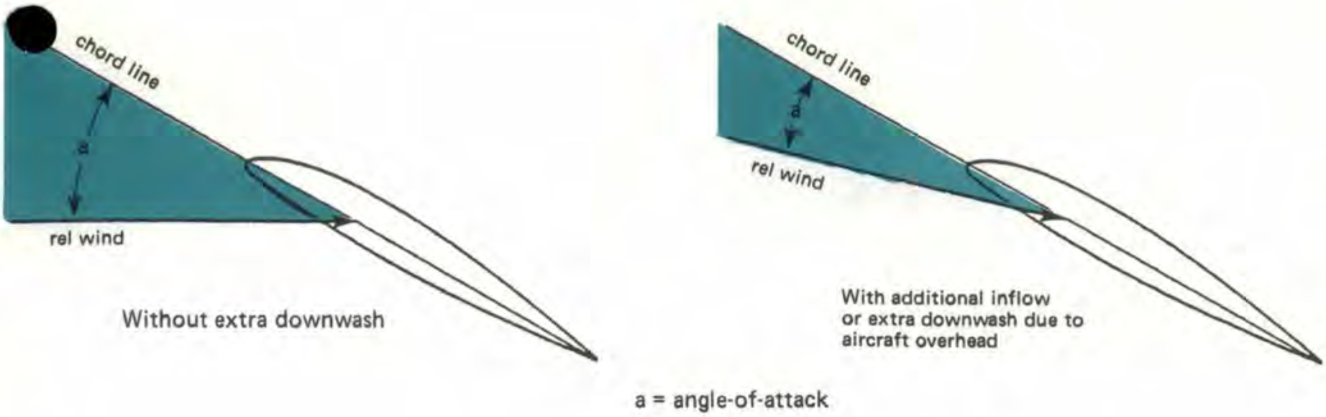


Fig. 1

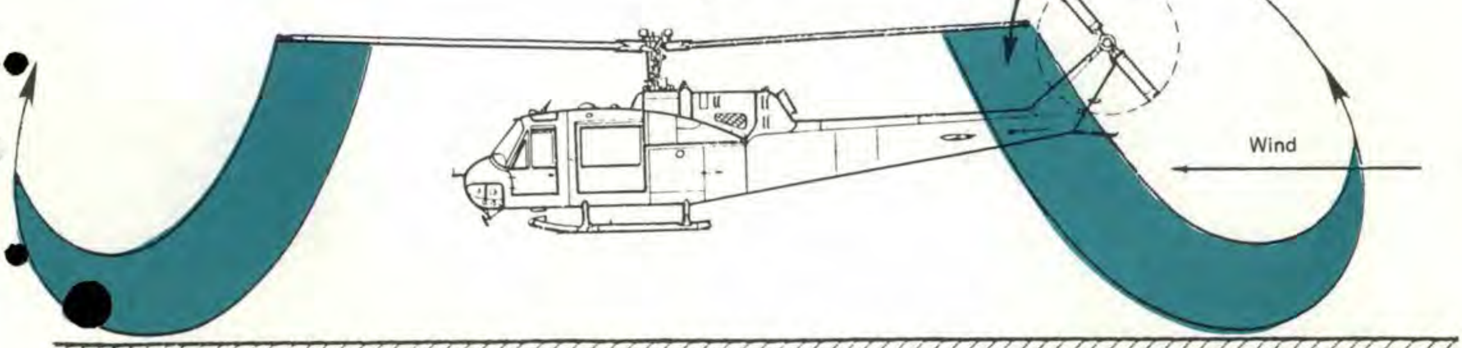
the right experiences a similar reduction in angle-of-attack and loss of tail rotor thrust. Unless the pilot counters with left pedal (greater tail rotor pitch), the aircraft will tend to weathercock into the wind. As the aircraft is flown at higher gross weight, density altitude, higher right sideward velocity, or in stronger starboard winds, full left pedal may be commanded by the pilot. Initially, this can result in excessive tail rotor power demand, possibly causing settling and an uncontrolled nose-right rotation. If the tail rotor controls lack stiffness and a given set of rotor blade structural criteria are met, the tail rotor may enter a complicated condition sometimes called *buzz*, in which tail rotor blade spars are coned and twisted to the point where blade pockets are stripped from the spars. Tail rotor *buzz* resulted in the loss of several helos of one particular model prior to tail rotor modifications to correct the problem.

Did you ever notice that your single-rotor helicopter becomes a bit squirrelly in yaw when in rearward flight or with wind on the tail while near the ground? NASA and various contractors have spent considerable effort in looking at pilot complaints of such problems in several different helicopters. These studies have uncovered an interesting phenomenon which has become known as the ground vortex. As the name implies, the problem only becomes a factor when the aircraft is operated at low-wheel (or skid) heights, where the main rotor tip vortex can act with wind to produce an area of extreme rotational turbulence near the tail rotor (or main rotor, with headwind) as shown in Figure 2.

As the figure implies, winds tend to contain the region of vorticity created by the shed vortex from the main rotor and may actually blow this region onto the tail rotor (or, of course, the pilot may back into it). When this occurs, the aircraft may become very skittish in yaw, necessitating large and rapid pedal inputs from the pilot in order to maintain heading. While the problem seems to occur in a narrow tailwind speed range of 10-20 knots, protracted flight under these

continued on next page

Fig. 2



conditions can be fatiguing and clearly hazardous.

It is interesting to note that the ground vortex located near the tail rotates counterclockwise when viewed from the left, as shown in Figure 2. As you might expect, if the tail rotor turns in the same direction, a relative reduction in velocity over the tail rotor will occur when it operates in the vortex, further compounding problems with directional control. As a result, one manufacturer in particular has changed the direction of rotation of the tail rotor on newer helicopters to reduce problems with the ground vortex. If your helicopter's tail rotor turns counterclockwise (as viewed from the left), you may want to keep a closer eye on this problem of tail rotor/ground vortex interaction with tailwinds or during rearward flight.

More tail rotor trouble, again related to the direction of the wind, results when the tip vortices, shed from the advancing side of the rotor disc, impinge directly on the tail rotor. While many variables influence this effect, the things to remember are: with winds 040-090 degrees relative, you can expect that this problem will first make itself known at wind speeds of about 20 knots; the loss of tail rotor thrust and increase in tail rotor power required which result from this tail rotor-main rotor vortex interaction was found, in recent contractor research, to have a greater effect on tail rotor performance than any of the other aerodynamic factors mentioned here; and, it was found that winds at 040-090 degrees relative are the most critical angles in limiting tail rotor performance.

In addition to comments and/or charts concerning launch/recovery winds in your manual, you'll often find at least one other comment dealing with tail rotor aerodynamics, though perhaps you hadn't thought of it as such. Ever see a statement like "directional control becomes marginal if rotor rpm decays to ____ percent "N_r/N_f," or ". . . tail rotor thrust may be insufficient at low rotor speeds?" As every nugget knows, lift or thrust varies directly as the square of velocity. In a rotary winged machine, velocity means rotor rpm. Now, what does this all mean?

Well, let's suppose you're hovering at maximum gross weight. It's a hot day and the density altitude is high. You latch on to an external load at the upper limit of the aircraft's capability for these conditions. As you lift, you note a loss of rpm to 100 percent; indicated torque is as predicted from your pocket checklist. Due to relatively high engine power output and thinner air, you find the left pedal just about on the stop. You add a bit more collective and, though pedal position remains unchanged, you note an rpm loss to 95 percent as the load breaks ground and a slow, uncontrolled nose-right rotation begins. Clearly, tail rotor thrust (though the tail rotor blades were at or near maximum pitch) was insufficient to counter main rotor torque as a result of a number of factors. What are they?

First of all, if maximum engine torque output had not already been reached, increased collective resulted in greater rotor torque and, therefore, a demand for greater antitorque from the tail rotor. Secondly, since the left pedal was near the stop, the need for greater tail rotor thrust could not be met with increased tail rotor pitch. Even if it could, however, the result would have been increased power demand by the tail rotor on an aircraft already lacking sufficient power as evidenced by drooping rotor speed. Thirdly, since a reduction in main rotor speed of 5 percent necessarily means a 5 percent reduction in the speed of everything tied to it, the tail rotor also droops 5 percent. Since the tail rotor thrust varies directly as the square of the rpm, a drop to 95 percent means nearly a 10 percent reduction in tail rotor thrust, assuming pedal position is constant. The result can be a helicopter spinning like a top. This has happened at least twice over the past two years in Navy/Marine Corps aviation at a cost of two airframes and numerous fatalities. Let's hope we can wait at least a few

TAIL ROTOR TRICKERY continued

more years before we once again prove this already well established law of helicopter aerodynamics.

Let's review briefly what's been said over the past few pages:

▪ Tail rotors can be placed in a vortex ring state during left sideward flight, or with a port crosswind, just as a main rotor can be subject to power settling. While the conditions will vary somewhat from aircraft to aircraft, velocities from the port to the left rear quarter at 10-35 knots can lead to this problem.

▪ Winds from the starboard, or right sideward flight, cause a reduction in tail rotor blades' angles-of-attack, necessitating increased left pedal input (American design). Pedal stops may be reached with loss of yaw control.

▪ Winds on the tail or rearward flight at low speed (10-20 knots) may cause the tail rotor to operate in the ground vortex with a resultant loss of tail rotor thrust and increase in tail rotor power required. (This is a particular concern with *pusher* tail rotors rotating counterclockwise when viewed from the left.)

▪ With wind speeds on the order of 20 knots (or higher) in the range of 040-090 degrees relative, blade tip vortices may impinge upon the tail rotor, causing loss of tail rotor thrust and increased power consumption.

▪ Drooping rotor rpm, with the left pedal near the stop, can cause loss of directional control primarily due to the rapid loss of tail rotor thrust (varies as the square of rpm) as rpm decays. Resulting nose-right/tail-left motion will tend to increase tail rotor blade section angles-of-attack, possibly leading to stall. This would, of course, mean a greater thrust loss and power required increase.

Newscaster Harry Reasoner once said: "A helicopter does not want to fly. It is maintained in the air by a variety of forces and controls working in opposition to each other, and if there is any disturbance in this delicate balance, the helicopter stops flying, immediately and disastrously." The tail rotor produces one of those "forces . . . in opposition" which provides for the "delicate balance." Knowing what to expect, both *of* the tail rotor and *from* it, could certainly have saved us some thought-I-coulds in the past and can surely underwrite some can do in missions yet to come our way. ■

(Author's note: Much of the technical material included in this article was derived from materials published by the American Helicopter Society. Those relied upon more heavily were: "Tail Rotor Performance in the Presence of Main Rotor, Ground, and Winds," by Wiesner and Kohler, which appeared in the July 1974 issue of the *Journal of American Helicopter Society*, and "Tail Rotor Design, Part 1: Aerodynamics," by Lynn, Robinson, Batra, and Duhon which appeared in the October 1970 issue of the same journal.)

In reviewing this article for Approach, *Mr. Herm Kolwey, an aerodynamics expert in the Naval Air Test Center's Rotary Wing Division, had the following comments:*

For shipboard helicopter operations, flight envelopes are developed for degraded modes, i.e., AFCS Off, Boost Off, etc. For shore-based operations (Air Force pilots note), the pilot should possibly consider a reduced envelope when experiencing a combination of conditions with respect to the tail rotor. For example, if you are (a) heavy, (b) AFCS Off, or (c) have a high drift angle, don't accept adverse winds or downwind approaches. Also, in the same conditions, don't combine functions such as lifting off and simultaneously turning right. – Adapted from *Approach.* ■

NEWS FOR CREWS

Career information and tips from the folks at Air Force Manpower and Personnel Center, Randolph AFB, TX.

DYNAMICS OF THE AIRLIFT NAVIGATOR FORCE

CAPTAIN JOHN PARK

■ Airlift navigators make up approximately 22 percent of the total active duty navigator force. Most people probably didn't know that, and it may not be the most pertinent bit of information regarding the airlift navigator force. But there's a lot of information regarding the dynamics of that nav force you might consider interesting and maybe even beneficial to you from a career planning perspective. Here is some information you can use to answer questions like "What happened to the C-141 nav drawdown?", "How much longer are C-5 navs going to be around?", "What caused C-130 nav manning to turn to . . . so fast?" and "When are airlift navs going to get a chance for career broadening again?" I'll cover the primary strategic airlift weapon systems, specifically the C-141 and the C-5, and then I'll hit on the dynamics of the C-130 nav force.

The C-141 navigator force has experienced more changes than any other airlift population over the past several years. The C-141 navigator requirement began a drawdown from 468 in the mid-1970s to a projected 76 line-assigned squadron navs by the end of FY83. During that drawdown, many C-141 navigators found their way into the rated supplement, non-flying rated staff, ATC, and a few other places doing some pretty rewarding jobs. That drawdown was halted at 137 line-assigned navs when operations identified the need to support a brigade-size airdrop requirement related to the Rapid Deployment Joint Task Force. Without any Undergraduate Navigator Training (UNT) inputs (they were virtually shut-off when the drawdown started) the only source of navigators to meet this new requirement was prior C-141 navs completing non-flying tours of duty. In some instances, a return to flying duties was viewed as being detrimental from a career standpoint, but the overriding consideration at the time was to meet Air Force requirements and protect mission capabilities.

Things have changed again! The Military Airlift Command (MAC) and the Air Force Reserve (AFRES) got together and decided to share the requirement for the C-141 airdrop crews. AFRES will support a portion of the total commitment which, in turn, will reduce the active duty requirement. It all boils down to a further reduction of MAC's C-141 line-assigned navigator requirement to 102 (no change in the staff requirement is expected). There are also more inputs available to fill C-141 flying positions than in the past: 10 navigators from FY81 UNT production, 25 navigators from FY82 production, and a higher number of prior C-141 navigators completing non-flying tours of duty who need to fly to complete flying gates and renew weapon system viability. When we combine the decreasing requirement with increased inputs, we create a rotation of navigators through the C-141 units that has been lacking for quite awhile. This rotation should prove to be very healthy, both for the flying units and for individual careers.

The C-5 navigator force has also

been anticipating a reduction in authorizations. The C-5 navigator requirement was originally scheduled to be zero by the end of FY81 but has been extended twice. The first extension delayed the reduction by three years while awaiting procurement and installation of a pilot-operable radar. Contract problems have now delayed the reduction by another year so that the drawdown will not start until FY84 with the requirement going to zero navigators by the end of FY85. This final reduction is pending yet another milestone — MAC wants to revalidate the four-man crew concept (without a navigator) after the new radar is installed before it drops the C-5 navigator requirement completely. Should this test come out against the four-man crew, it could lead to the C-5 navigator requirement being retained at its current level.

There will continue to be inputs to the C-5, at least in the near future, from prior qualified C-5 resources, some utilization of prior qualified (non-airdrop) C-141 navs, and 15 UNTs from the FY82 production.

The FY80 and FY81 UNT distributions had a major impact on the tactical airlift navigator manning situation. The distribution was revised during those years due to the fighter weapon system officer (WSO) manning problems: lack of CONUS stability, and the Air Force's most severe navigator shortage. In addressing these problems, almost 50 UNTs during that two-year period were diverted from C-130s to the fighter WSO pipeline. This reduction of UNT inputs somewhat hampered normal management of the C-130 nav force due to its impact on crew force manning levels.

It required the return of previously qualified C-130 navs to flying duties in order to protect

mission capabilities. As with the strategic airlift nav force, moves of this sort did not always optimize senior officer utilization. Consequently, it affected overall retention which further affected the manning shortage. However, with UNT production rates again growing to 1,000 per year by FY83, it is unlikely any shift in future UNT distribution will so drastically affect any one weapon system.

The outlook for C-130 navs is much brighter now than it has been over the past 12-24 months. FY82 UNT production has 129 navigators headed toward C-130s of all sorts, and the FY83 production has 178 UNTs designated for C-130s. This substantial UNT input over the next two years will fill line navigator shortages from the bottom (the way it should be) and provide the flexibility for career development and broadening in the rated supplement (including AFIT), rated staff, and ATC. I know that's a shock to most of you, but it's rapidly becoming a reality.

Well, I think you can probably answer the questions I posed at the outset of this article. The current and foreseeable dynamics of the airlift navigator force will create a much improved manning and career development situation over that which has existed for almost two years. There will be some new players in the Airlift Career Management Section at HQ AFMPC over the next few months, but I want to encourage you to call if you have further questions about career opportunities or anything related to airlift and personnel. We don't have all the answers, but we can usually find them or point you in the right direction. Please call AUTOVON 487-6831 for strategic airlift or AUTOVON 487-6818 for tactical airlift. ■

MAIL CALL

EDITOR:
FLYING SAFETY MAGAZINE
AFISC (SEDF)
NORTON AFB, CA. 92409

It Takes Two

■ I read with great interest the article, "F-4 Single Engine Recoveries With Utility Hydraulic Failure" in the May 1982 issue of *Flying Safety*. The story brought back the memory of what I thought was a similar incident that happened to me. However, it wasn't long before I realized that the incident in your article and my memory were one and the same. The event was hairy indeed, and but for the grace of God we were able to put the aircraft back on the ground. One thing bothered me, though. To read the article is to think the aircraft was a single seater, ". . . the pilot wisely . . . the man who made the recovery . . . the pilot was expecting. . . ."

It takes two men to make the Phantom an effective fighting machine and two men (and some folks on the ground) to recover one from an inflight emergency like the one you described. The crew made it happen that day and does every other day. It's important we don't forget that.

Major Thomas N. Trotta
Military Airlift Command
Scott AFB, IL

A Note To Rex Riley

We have a good safety program at our base and are proud of our maintenance personnel. Unfortunately, in the past few months some aircrews transiting our base have not been quite as safety conscious.

We have worked hard to establish good safety attitudes in our maintenance people and are concerned when flight crews fail to set a similar good example. Some of the more recent problems include:

- Removing static producing clothing (flight jackets) during refueling operations.
- Removing ground wires in the wrong sequence.
- Smoking around the aircraft.

Please help us pass the word to aircrews about these safety concerns.

Major Gregory A. Konrad
1605th Military Airlift Support Wing

Flight line safety is everybody's business — no matter what base or unit. As aircrews, we should always set the example of using proper procedures in and around aircraft. ■

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LT COL
Richard G. Hellier

SrA
Michael D. Crews

27th Tactical Fighter Wing
Cannon Air Force Base, New Mexico

■ On 14 August 1981, Lt Col Hellier was flying SrA Crews on an F-111D crew chief incentive flight when he noticed the wheel well hot caution light illuminate. Starting an immediate climbing turn back to base, he lowered the landing gear to avoid possible tire fire/explosion. Lt Col Hellier's wingman rejoined and did not see any fire or smoke. Because the engine bleed air source was turned off, the equipment bay pressure low and forward equipment hot caution lights illuminated, so SrA Crews began shutting down nonessential electrical equipment. About two minutes later, the wingman reported light smoke or vapor coming from the wheel well. Lt Col Hellier noticed that the left engine oil pressure gauge was stuck in the upper limit. Then all televised flight instrument displays flashed twice and went blank. Simultaneously, the flight controls gave an abrupt pulse as the left generator failed. While trying to analyze erratic engine instrument indications, the left engine fire warning light flashed. The left engine was shut down and fire extinguishing agent discharged. Both engine fire detect circuits and then the fuselage fire circuit failed their integrity check. When Lt Col Hellier lowered the slats and flaps for a single engine approach, the aircraft abruptly yawed left, and the yaw damper caution light illuminated. He turned off the yaw damper and prepared for an approach end engagement. Confirming hook down indication on the caution light panel, Lt Col Hellier saw the utility hydraulic hot caution light on, indicating impending utility hydraulic system failure. Despite indications of a fuselage fire, a single engine condition, and the yaw damper off, Lt Col Hellier maintained a smooth glide path to a successful approach end cable engagement. The initial source of the fire was a catastrophic failure of the cross over hot air bleed duct. Alert and decisive action and superb flying skill by Lt Col Hellier, along with the quick and accurate assistance of SrA Crews, resulted in the recovery of the aircraft with minimal damage and prevented possible serious injury. WELL DONE! ■

CLEAR YOUR FLIGHT PATH!