flying

SAFETY

JUNE 1989

Passing the Torch

10% Stark Terror

The LOX Monster

HATR Summary 1984-88

HEAT STRESS

HEAT STRESS

CMSGT ROBERT T. HOLRITZ
Technical Editor

■ Combat capability is, to a large extent, contingent upon a unit's ability to adapt to the environment. Our aircraft and support equipment are designed to operate efficiently in almost any climate and temperature imaginable. However, unlike our equipment, the ability of our people to perform combat duties varies significantly with the environment to which they are subjected. One of the most debilitating environmental factors is the effects of heat stress.

This is because the human body can survive only at a narrow range of core temperatures, that is, the temperature which is measured deep within the body. Core temperatures that vary more than 2 or 3 degrees from the normal 98.6°F impede mental and physical performance, and variations of more than 5 or 6 degrees can be fatal. Fortunately, the human body has a system that constantly monitors and controls body temperature and, except for extreme conditions, keeps it within a safe range.

This system, called, appropriately enough, the thermoregulatory system, controls the inner temperature of the body by coordinating the body's activities to produce or dissipate heat. It is normally quite an effective mechanism. However, if overtasked, it can cause serious, even life-threatening, problems.

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DEPARTMENT OF THE AIR FORCE • THE INSPECTOR GENERAL, OSAF

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HEAT STRESS

continued

The Thermostat Mechanism

The regulation of body temperature is controlled by a thermostat in the inner part of the brain. This thermostat reacts to temperature changes in the body by stimulating responses from receptors in the skin. In cold conditions, the receptors restrict the flow of blood near the surface of the skin. In warm conditions, the receptors dilate the blood vessels near the skin surface, providing improved blood flow to increase heat loss through the skin. At the same time, sweat glands release perspiration. The evaporation of sweat on the skin cools the blood near the surface which is then circulated through the body.

Heat Disorders

There are three major disorders which result from the overtasking or failure of the thermoregulatory system.

▪ **HEAT EXHAUSTION** results from failure to replace water lost through prolonged sweating. The main symptoms are thirst, dizziness, and fatigue. Treatment and prevention are the same — drink plenty of water. It is interesting to note that each gram of water that evaporates from sweat dissipates almost 600 calories of body heat. In extremely hot weather, it may be necessary to drink up to 10 pints of water per day.

A lack of salt can also lead to a form of heat exhaustion. In addition to the symptoms mentioned above, failure to replace salt lost through sweating may also cause nausea and muscle cramps. The symptoms can, of course, be prevented by replacing salt. The typical American gets more than enough salt in normal meals, so salt depletion is not usually a problem.

▪ **HEAT STROKE** is always a life threatening condition. Characterized by a sudden onset of delirium and coma, it is brought about by the total failure of the thermoregulatory system. Heat stroke usually occurs when the body (core) temperature climbs above 105°F. At this temperature, the system simply quits. The only first aid is to cool the victim as soon as possible by placing him in the shade and spraying with water. Remember — the victim is near death, so call for medical attention immediately. The best prevention of heat stroke is to not impose strenuous duties on persons not yet acclimated to extreme heat.

▪ **HEAT SYNSCOPE** also occurs when people who are not acclimated to heat perform strenuous work. The symptoms are giddiness and fatigue. It occurs in spite of ample fluid and salt intake. The victim usually recovers rapidly when he lies flat in the shade and is reassured.

Subtle Effects

The effects of heat stress are not restricted to the more dramatic characteristics such as heat stroke. Variations within the extremes have a more subtle effect on physical and mental functions. Consider that when a maintenance technician donned in chemical warfare gear loses just 2½ percent of his body weight (about 2½ quarts of water), he loses 25 percent of his ability to function mentally and physically. And, if he is working at temperatures above 110°F, his ability to function is reduced by another 25 percent. This means that our technician's performance has been reduced by 50 percent. Now, think about the possible consequences if a pilot found himself or herself in a similar situation.

It is interesting to note that most heat stress encountered by flight crews occurs while on the ground during preflight and taxiing. This is particularly true during combat exercises and heavy flying days when fighters are lined up at the end of the runway for quick check and arming. It is not unusual for a flight crew to spend over an hour in high temperatures from the time they step to their jet until takeoff.

The Fighter Index For Thermal Stress (FITS) gives aircrew members guidance as to their *approximate limitations*. However, a wise aviator will not push himself to the limit of the FITS table. Consider the following.

▪ Six minutes into the mission, a pilot noted that the cabin temperature control had gone to full hot. When he could not adjust the temperature, he immediately turned back to the base. After 17 minutes, he contacted the tower. The controller noted that the pilot was experiencing an inability to concentrate and understand standard radio and aircraft procedures, as he kept repeating himself. Fortunately, he made an uneventful landing.

Investigation of the incident revealed the pilot was exposed to tem-

One of the best defenses against heat stress and dehydration is to drink plenty of water.

peratures exceeding 140°F for 25 to 30 minutes. If the pilot had maxed the FITS prior to flight, he probably would not have made it back.

It is important to note that the FITS table cannot be used when chemical defense or arctic flight equipment is worn because they severely limit sweat evaporation. Consequently, aircrew limitation times are less than the FITS table indicates.

Acclimatization

Fortunately, the human body has the ability to adapt to heat stress. However, the amount of time it takes for a person to acclimate varies with the severity of the environment and from person to person. Most people acclimatize within a few weeks. Some require only a few days, while others may never adapt. This depends on the individual's physical condition and, to a certain extent, physical makeup. It is interesting to note that some people have many more sweat glands than others, and people who are raised from infancy in a hot climate have more sweat glands than those raised in a cold climate.

During adjustment, the normal sweat response gradually becomes more efficient, allowing better evaporative cooling. Additionally, there are changes in circulation. For example, the amount of blood is increased, providing more heat loss through the skin without depriving the normal body functions.

Prevention

In most cases, the effects of heat stress can be prevented, or at least limited, by following these helpful guidelines.

- Plan low-altitude missions early in the day.
- Avoid flying combat turn missions with crews that are not yet acclimated.
- Drink plenty of water prior to hot weather missions. (Thirst is a poor indicator of the body's need for water.)
- Maintain good physical condition through a sensible exercise routine.
- Use the FITS table, but use it conservatively.
- Open canopies well in advance of flight. Heavies should have ground air-conditioners to cool off the flight deck at least 30 minutes prior to crew show.

It is important to remember, G-tolerance can be significantly reduced by dehydration.

Knowledge of the Problem

The effects of heat stress have greater impact on our mission now than ever before. The realistic scenarios that we now use in the "train as we fight" concept emphasize the effects of heat stress on our ability to operate in a warm environment. Therefore, knowledge of the cause, prevention, and treatment of heat stress is vital to every person in today's combat unit. ■

First aid for heat stress is to get the victim in the shade and cool him with water.

Passing the Torch

CAPTAIN R. KENT BRANNUM
CAPTAIN JEAN L. COMBS
Flight Safety Officers
71 FTW/SE
Vance AFB, Oklahoma

■ With the recent dramatic increase in the number of pilots changing career goals, some staff and supervisory positions are being filled by younger, less experienced individuals. With this high turnover rate comes a loss of corporate knowledge in many fields.

A specific example of this dramatic turnover is at one base's safety division. Within a 4-month period, the division will lose the Chief of Safety, all four flight safety officers, and the Chief of Ground Safety. With them goes a total of 53 years of Air Force flying experience and 11 years of corporate knowledge and wisdom in the business of safety in the Air Training Command. This phenomena is not restricted to a specific job or command but is occurring Air Force wide!

"Doesn't Everyone Know That?" Syndrome

One of the biggest challenges with this loss of corporate knowledge and experience is attitude or . . . the "Doesn't-everyone-know-that?" syndrome. We've all attended numerous Air Force schools UPT, RTU, PIT) establishing a certain level of knowledge. However, the "old head" gained additional knowledge through years of making mistakes, as well as acquiring experience by hands-on use of weapon systems. When it comes time to share this practical knowledge, some individuals fall into the trap (syndrome) that others have his or her own base of knowledge.

In transferring information, both individuals fail to establish a common level of knowledge for three reasons:

- The "old head" doesn't want to embarrass the new guy by asking questions reminiscent of a UPT checkride.
- The new guy doesn't want to show his ignorance by asking "basic" questions.
- The "old head" may assume the replacement has grasped the concept and covers only the main points.

Consequently, much of the practical knowledge gained by experience departs with the "old head" and is eventually lost. This requires the replacement to use valuable time and effort bringing himself up to speed, much like reinventing the wheel.

Advantages

There are, however, advantages to this loss of corporate knowledge. Have you ever heard the answer "We've always done it that way" when you ask the question "Why?"

New jobs are exciting times in our lives. When people join your organization, take advantage of the opportunity to reevaluate your standard operating procedures . . . welcome fresh ideas and new techniques in solving old problems.

This answer is the result of an individual being in a position so long he can't remember the reason.

We should keep in mind Charles Kettering's advice as printed in *Tongue and Quill*. "If you're doing something the same way you have been doing it for 10 years, the chances are you are doing it wrong." When these people move on, we have the opportunity to reevaluate the standard operating procedures of an organization. The inflow of replacements also brings fresh ideas and new techniques from other bases which may enhance your operation. Many things aren't standardized Air Force wide. Sometimes the answer to an old problem is a new look.

Lastly, after doing the same job for a number of months or years, we all have a tendency to suffer from burnout. Whether this burnout is due to repetition or monotony, the addition of new blood can generate a renewed enthusiasm for the tasks at hand. Even though the above advantages have merit, it is apparent that allowing your organization's corporate knowledge to vacate with your people before a thorough dialogue is not good planning.

Preservation Techniques

There are some disadvantages to personnel turnover. However, there are ways to preserve part of this corporate knowledge. First, on the flying side, good techniques have to keep flowing down through the squadrons. This can be accomplished by a renewed emphasis on flying experienced and inexperienced crewmembers together.

For example, it is more enjoyable and less threatening to the ego to fly with a member of your peer group. Yet, this does not facilitate the trickle down of techniques and experience. More compatible mixes would be an inexperienced aircraft commander with an experienced copilot, a young WSO with an old pilot, or an experienced wingman with an inexperienced flight lead. Not only does the information flow better in these crews, but it also provides a safer flying environment in peacetime.

Amazingly enough, one of the best places to learn new techniques is a social environment. Try buying the squadron commander or ops officer a coke and ask them about flying in "the good old days." Seriously, hangar flying, taught with a deemphasis on mandatory fun, is an excellent way to pass on experience to the younger force.

In the office, continuity folders or program management books provide a basis for information transfer. If properly updated, they provide the "old head" with a briefing guide and the new guy with a list of emphasis items to use during the transition period. Also, sending the replacement to required schools early enough so he or she will be educated prior to the transition period will allow them to be able to ask "smart" questions. This, combined with an adequate transition period and ample hands-on training, will keep the corporate knowledge where it should be — in the office.

Pass Your Knowledge On

New careers and job titles are always an exciting time in our lives. When you move up to a position of increased responsibility, insure you are ready by educating yourself to ask the proper questions. Also, when the replacement shows up on your doorstep, take pride in the skill level you have attained in the aircraft and the accomplishments you have made on the job. Pass on your practical knowledge and experiences to the younger troops to aid in carrying on the Air Force's tradition of excellence. ■

10% Stark Terror

CAPTAIN ROBERT C. COPENHAFER, JR.

■ You've heard flying described as 90-percent boredom followed by 10-percent stark terror. To me, it was more like a 99 to 1 ratio, with my 1 missing. You see, in my 7 years of flying, I had not had anything really dangerous happen like what I am about to tell you. Everybody else had a good, old, heart-pounding war story to tell except me. I had even felt cheated — but no more.

I was on a cross-country flight in my Duck (O-2A) going from northern California to a base in southern California on a beautiful autumn afternoon. I decided to follow the California coastline while maintaining 1,500 to 2,000 feet AGL. The weather was as beautiful as the scenery. And, if I thought the scenery was beautiful, only God knows how many others thought the same, so the eyeballs were alert and searching the skies. Finally, I reached the Los Angeles TCA. Having studied the approach plates and maps for the area, I noticed that VFR flight was restricted to 12,500 feet and above while over the TCA.

Complying with regulation, I climbed above 12,500 feet as I headed east over the city. I happened to see the LA Coliseum while tuning the ADF to the football game being played inside. Having never seen it from the air before, I decided to fly overhead for a few minutes while constantly searching the skies for *the blimp*. As the crowd filtered out, I decided it was time for me to continue on to my destination. Up to this time, I was strictly VFR, with no problems encountered and eyeballs tirelessly scanning the crowded California skies.

Contacting approach, I requested an ILS to a nearby airport for a low approach followed by radar vectors to my final destination. Approach cleared me to 3,500 feet, gave me a heading to intercept the ILS final approach course, and told me the weather was VFR with 5 miles.

Five miles visibility in the Los Angeles Basin at 1600 local? Right! That dark, milky haze must have been measured with a mileage marker uncalibrated on the high side! However, this alerted me all the more to constantly clear and, believe me, I did clear as I had never seen so many different aircraft in one area in my life.

On the vector to the ILS final, my ILS receiver did the expected by going inoperative. I notified approach control who instructed me to maintain VFR at 3,500 feet, proceed direct to a nearby VOR, and fly a 100-degree heading after the VOR. I said to myself, "They really can't be serious, thinking this visibility is actually VFR, but by the strict definition of VFR, they're right." It certainly wasn't the VFR I was used to in Arizona.

Pressing on to the VOR and clearing like a bandit, I had the eerie feeling something was amiss, but I couldn't put my finger on it. I do know I was never more vigilant of others than then. After roughly 3 to 5 minutes and some communications problems with approach, I arrived at the VOR and began turning to my assigned heading when I heard another aircraft calling his position at that VOR. I looked left and then glanced right to see a green-and-yellow tandem seater joining on my right, then doing an "alley-oop" over the top and in front.

By now, I was getting just a bit concerned. For 3 hours, I had flown, clearing for myself with no help from radar, and now with their help, I was getting into an uneasy situation. Winding the clock after my encounter at the VOR, I continued on the 100-degree heading for another 5 minutes or so when approach called out parachute activity 12 o'clock at 2 miles, and simultaneously gave me a vector to 110 degrees.

Looking through the darkening haze, I made contact on four jumpers at my 11 o'clock low descending over a small airport. I slipped the aircraft to search for other jumpers in that direction WHEN . . .

What happened next is the most frightening experience I've ever had in my life. Rolling wings level, I had a parachutist at my 12 o'clock actually climbing his risers with his knees above his chin desperately trying to get out of the way of my mixmaster which was about ready to mix him!

How close? Well, let's say he had a yellow helmet on, a reddish-brown mustache drooping around the corners of his mouth, which was wide open, displaying the horror of the situation, and two of the widest eyes I've ever seen on a human being.

Immediately, I dumped the nose and banked left, only to see a horde of jumpers with their rears to me, climbing their risers as well. I could not believe what had almost happened as I notified the PAR final controller.

Walking into Base Ops, I was amazed how such an enjoyable flight could turn into such a horror show in a matter of minutes. Had I done anything wrong to deserve such fate? I had seen the notice of parachute activity near my final destination in the IFR Supplement.

But, tell me, who really pays close attention to the IFR Supplement after confirming the field is not PPR or that it has the proper gas and oxygen and sufficient runway? Complacency? Not a chance! Like I said before, I was prone to the clear position. Controller at fault, maybe? Well, parachutists don't give radar returns, as far as I know. Parachutists' fault? Check your right-of-way rules.

It dawned on me I nearly killed someone, with me being at fault even though I did things by the book. Or did I? Maybe I should have asked approach if there was any parachute activity in the area mentioned in the IFR Supplement. But, on the other side of the coin, why wasn't I told sooner or, for that matter, what are people doing parachuting in an approach corridor to a major airport?

I've rehashed this nightmare over and over again, looking for ways to avoid such an occurrence again. I can tell you that from now on, this pilot is going to continue to clear like my life depended on it (I know it does), pay close attention to all the remarks in the IFR Supplement, and if any doubt exists as to unusual activity en route or at my destination, I will initiate the inquiry and not wait to be called.

Those few minutes of a 3-hour-and-30-minute flight are all I can really remember. Stark terror makes a lasting impression while yielding unwanted war stories. Hopefully, you won't be able to use the same story. ■

THE LOX MONSTER

For the aviator, LOX is a life-giving fluid. For the maintenance specialist, it can be a real killer!

CMSGT ROBERT T. HOLRITZ
Technical Editor

■ Nearly everyone who works on the flight line has the opportunity to work with or around liquid oxygen. For flight crews, LOX is a life-sustaining fluid. For the maintainer, it can be an explosive killer.

The Characteristics

In its gaseous form, oxygen comprises about 21 percent of the atmosphere at sea level. Only nitrogen (at 79 percent) has a higher concentration in the air we breathe. When oxygen is distilled into a liquid, its volume is reduced 860 times. In the liquid state, it is a nontoxic, pale blue, water-like fluid, with a boiling point of −297 degrees Fahrenheit. It is interesting to note that LOX is attracted to an electromagnet much the same as ferrous metal.

The Hazard

While oxygen does not burn, it actively supports combustion. In its natural concentration of 21 percent, most combustible substances will burn. However, below a concentration of 16 percent, oxygen is no longer capable of supporting combustion. Conversely, in a pure oxygen environment, many substances that will not burn in air will easily burst into flames. As a rule, the higher the concentration of oxygen, the less energy that is required to

Don't become a victim of the LOX monster! Follow procedures and use the required safety equipment when working with LOX to prevent a disaster.

A fatigue cap must be worn when LOX servicing connectors are above eye level.

initiate combustion. And the higher the concentration, the more violent the reaction.

Now consider that, in its liquid state, oxygen's concentration is 4,100 times that of the atmosphere. At this level, many substances that will merely burn in air become sensitive explosives. This is why it is important to keep LOX away from petroleum products, such as oil, grease, tar, and even hair tonic. For this reason, it is absolutely necessary to isolate tools and equipment used for servicing LOX. Using tools that are contaminated with grease or oil could result in a fire or explosion.

An aircraft mechanic found this out the hard way while he was working on an aircraft oxygen system. As he opened an oxygen valve, a 3-foot flame darted into the tail section of the aircraft on which he was working. Investigators blamed the incident on the use of oil-contaminated tools during a previous servicing.

OBOGS Is Coming

LOX is not only a hazardous substance, but it is also a thorn in the side of logistics folks. For one thing, it is difficult to store. For another, it requires a LOX plant to either be prepositioned at the deployed site or be mobilized at the expense of aircraft cargo space. In addition, LOX plants are extremely vulnerable to enemy attack. Without LOX, sortie generation quickly stops. Fortunately, the Air Force is working on the On Board Oxygen Generating System, or OBOGS. The main obstacle in the development of OBOGS was the weight factor. The main advantage of using a LOX system in combat aircraft is that it is light. LOX weighs only 9.5 pounds per gallon. In a single-seat aircraft, the LOX system weighs less than 50 pounds. Engineers have now developed a system that fits the bill. The system distills oxygen from bleed air from the jet engine compressors. This system will be used in the Advanced Tactical Fighter (ATF), and contractor development teams are working on systems for the B-1, F-15E, F-16, and the A-7F.

But for Now

But LOX is still with us, and it remains a hazard. TO 00-25-172 explains the safety precautions to be taken when working with LOX. The proper use of safety gear and following the procedures in the TO will ensure that you will not become a victim of the "LOX Monster." ■

The LOX servicing unit should be located the maximum distance from the aircraft, and the hose should be free of kinks and sharp bends.

Too Mission Oriented!!

■ Finally it was checkride day in the old B-52G at Castle AFB. Our crew's previous flight had been nearly flawless and hopes were high for a repeat performance.

Our crew was fairly young with the exception of the radar navigator and myself . . . I was going through aircraft commander requal training.

The briefings, preflight, and engine start went smoothly. As we taxied out and received our clearance for takeoff, the radar broke, and we had to get it fixed — a delayed takeoff, and we started to alter our flight plan. Finally, we got it fixed and took off about 10 minutes late. Not to worry. We cut our departure short and could still make our rendezvous with the tanker on time.

Working with a compressed flight plan, we rushed through each checklist in order to catch up. All this rushing had raised my body temperature a little, so I told my young copilot to turn down the temperature on the air-conditioner. As we approached the tanker, I was getting even warmer, so I hounded the copilot to keep turning the temperature down. It didn't seem to be working, so I told him to hold the switch in the manual cold position until we noticed a change in the temperature.

The air refueling track was cut short due to tanker malfunctions, so we continued on toward the low level route. Again we tried to reduce the cabin temperature, but to no avail. I now suspected the air-conditioner had gone to "full hot," so we reviewed the Dash -1 procedures while proceeding with our flight in order to complete the checkride.

The closer to low level we got, the warmer the cockpit became. I wanted to complete the check ride so we decided to complete as much of the low level as we could with the air-conditioning system in Ram to try and help cool our equipment and ourselves. During low level, the radar set shut down several times due to overheating, but we continued.

As we exited low level, the air-conditioner remained in Ram to keep as much cool air as possible flowing through the aircraft. Consequently, due to our altitude, we had to put our oxygen masks on to complete the hour-and-a-half flight back to Castle AFB. Once there, we still had 90 more minutes in the traffic pattern to complete the check.

I remember stepping out of the aircraft after the final landing and remarked how "cool" it felt. The temperature was 110 degrees!

We were all glad to be finished with our checkrides, but our performance had suffered from fatigue caused by dehydration and heat exhaustion. For a peacetime mission, I had pushed too hard and had been **too mission oriented** to turn back. We all passed our checkrides, but I learned a valuable lesson that day *because* I had made *a bad decision* in air discipline.

Lesson: Consider the performance of your crewmembers and flight members when operating under adverse conditions, and don't be too mission oriented and put your crew and yourself in jeopardy. Common sense and good airmanship are always in vogue. ■

HAZARDOUS AIR TRAFFIC REPORT (HATR) Summary 1984-1988

MSGT WILLIAM L. FINCK
Directorate of Aerospace Safety

■ In this summary, we will be comparing the USAF worldwide HATR data from the last 5 years. Don't expect to find a magic solution in this summary that will eliminate all near midair collisions (NMAC) or hazardous air traffic conditions. IT JUST ISN'T THAT SIMPLE. Instead, read the statistics, stay aware of problem areas, and discuss your opinions with your fellow fliers. By doing this, you will help our Air Force achieve the HATR program's goal — MISHAP PREVENTION.

This article will provide you with total HATR yearly comparisons, general HATR classifications, non-near midair collisions (N-NMAC), NMAC, and, finally, comments. As you review the NMAC and N-NMAC data, keep the following in mind: A NMAC is an unplanned event in which the aircrew took abrupt evasive action to avoid a midair collision, or would have taken such action if circumstances had allowed. All other HATRs that do not fall under the above definition are referred to as N-NMACs.

The numbers in chart 1 indicate the total HATRs that HQ AFISC received. As you compare the other data in this summary, you will find that the totals for 1987 and 1988 do not equal the total in chart 1. This is because 8 HATRs are still under investigation for 1987 and 23 for 1988.

Chart 1
Yearly Comparison — Total HATRs

Year	1984	1985	1986	1987	1988
Number	448	359	282	353	320

General HATR Classifications

Some of the general classifications are self-explanatory, but some of them need to be defined to ensure the same meaning.

Controller Error Operational error that results in less-than-the-appropriate separation minimum specified for aircraft receiving the ATC service.

Controller Deviation Operational error of significance but does not result in less-than-the-appropriate separation minimum.

Pilot Complaint Misunderstanding of the proper ATC procedures.

System Deficiency Procedures not established or inadequate.

Sighting Used only by USAFE air-miss reports when other classifications are not appropriate.

Traffic Control and Landing Systems (TRACALS) Deficiency

Chart 2
General HATR Classification

Classification	1984	1985	1986	1987	1988
Controller Error	74	70	47	58	54
Controller Error/Pilot Deviation	16	7	3	11	2
Controller Deviation	37	23	24	10	11
Controller/Pilot Deviation	7	4	3	6	6
System Deficiency	13	11	5	6	8
Pilot Deviation — USAF	26	19	12	19	10
Pilot Deviation — Non-USAF	58	38	45	32	36
Pilot Complaint	0	1	2	1	2
Failure to See-and-Avoid	99	90	64	104	77
Flight Procedures Deficiency	1	0	0	1	0
Sightings	11	1	3	2	16
TRACALS Deficiency	4	7	2	7	4
FLIP Deficiency	0	1	3	4	2
Avionics Deficiency	3	0	1	2	0
Runway Intrusion	21	32	15	24	30
No Hazard	23	15	16	18	18
Undetermined	14	10	9	1	1
Potential Hazard	41	30	28	39	20
TOTAL	448	359	282	345	297

HAZARDOUS AIR TRAFFIC REPORT (HATR) Summary 1984-1988 continued

Deficiency of ground facilities and equipment with associated avionics, personnel, and procedures to provide air traffic movement.

Non-Near Midair Collisions

The N-NMAC data is provided for you to compare the figures. Here are some brief summaries of N-NMAC incidents:

■ Civilian contract maintenance people were working on the runway distance remaining markers and had been cleared back from the runway edge to make way for a minimum interval takeoff (MITO) of two B-52 aircraft. The MITO was cleared for takeoff when the tower observed a contractor vehicle crossing the runway. Takeoff clearance was canceled prior to the lead aircraft crossing the runway hold line.

■ A flight of two was cleared on to hold and, at the time, an aircraft was on short final. The flight refused the clearance because they saw the aircraft on final.

■ A crew using an outdated en route low altitude chart for navigation, failed to check NOTAMs, and entered a restricted area. The crew was advised of their restricted area penetration by the center controller and was vectored out of the area.

Near Midair Collision Classification

For the NMAC, we will be looking at the classifications, NMACs with other aircraft (chart 5), at what altitudes they were reported (chart 6), and airspace where they occurred (chart 7).

Here are some examples of NMACs:

■ A C-130 was on a special operations, low-level route. The weather was hazy, with 3 to 5 miles vis and the sun at 12 o'clock. As the copilot looked up from reading a map, he saw a small, single-engine, high-wing yellow aircraft pass in front of and below the C-130. The civil aircraft appeared to be in a dive. The copilot estimated the miss distance to be 100 feet.

■ A T-37 was level at 15,000 feet on a published departure when the crew saw a Cessna 182 approximately 50 to 100 feet away. The Cessna made a climbing left turn and, at the same time, the T-37 started a descent. Both aircraft were operating in accordance with current directives. Only the ability of both pilots to see and avoid prevented a midair collision.

■ A B-52 was proceeding along an IR route at 700 feet AGL when the copilot saw another aircraft at their 11 o'clock position, slightly above

Chart 3
Non-NMAC Classification

Classification	1984	1985	1986	1987	1988
ATC Error:					
USAF	59	53	37	28	32
FAA	12	3	9	7	6
Host Nation	5	5	4	4	4
Other DOD	3	1	2	3	1
SUBTOTAL	79	62	52	42	43
Pilot Deviation:					
USAF	21	15	5	6	6
Non-USAF	30	15	16	16	18
SUBTOTAL	51	30	21	22	24
System Deficiency	11	11	4	2	3
Controller/Pilot Deviation	7	4	3	3	5
Failure to See-and-Avoid	0	0	1	4	6
Controller Error/Pilot Deviation	11	5	2	3	0
Avionics Deficiency	3	0	1	1	0
FLIP Deficiency	0	1	3	3	2
Flight Procedures Deficiency	0	0	0	1	0
Sightings	11	1	4	1	13
Pilot Complaint/No Hazard	23	16	18	19	20
Runway Intrusion	21	32	15	24	30
TRACALS Deficiency	4	7	2	7	3
Potential Hazard	41	30	28	36	15
Undetermined	8	9	9	1	1
TOTAL	270	208	163	169	165

Chart 4
NMAC Classification

Classification	1984	1985	1986	1987	1988
ATC Error:					
USAF	21	19	13	14	9
FAA	7	8	2	7	8
Host Nation	2	4	2	5	2
Other DOD	2	0	1	0	1
SUBTOTAL	32	31	18	26	20
Pilot Deviation:					
USAF	5	4	7	13	4
Non-USAF	28	23	29	16	18
SUBTOTAL	33	27	36	29	22
Controller Error	2	0	1	4	5
Controller Error/Pilot Deviation	0	0	0	3	1
Failure to See-and-Avoid	99	90	63	100	76
System Error/Pilot Deviation	5	2	1	8	2
Avionics Deficiency	0	0	0	1	0
FLIP Deficiency	0	0	0	1	0
Flight Procedures Deficiency	1	0	0	0	0
Sightings	0	0	0	1	5
Pilot Complaint/No Hazard	0	0	0	0	0
Runway Intrusion	0	0	0	0	0
TRACALS Deficiency	0	0	0	0	1
Potential Hazard	0	0	0	0	0
Undetermined	6	1	0	3	0
TOTAL	178	151	119	176	132

Chart 5
NMACs With Other Aircraft

Type	1984	1985	1986	1987	1988
General Aviation	127	103	87	127	99
Other USAF Aircraft	25	26	19	22	13
Foreign Military	9	2	3	10	8
Air Carrier	4	9	5	4	3
Other DOD	4	4	3	9	4
Unknown	8	7	2	4	3
No USAF Aircraft Involved	1	0	0	0	0
Others	0	0	0	0	2
TOTAL	178	151	119	176	132

Chart 6
Altitudes in NMACs

Altitudes	1984	1985	1986	1987	1988
Below 1,500 AGL	45	38	30	51	23
1,500 - 2,999 AGL	59	53	27	50	41
3,000 - 7,499 ft	44	32	37	42	49
7,500 - 12,449 ft	18	17	16	7	8
12,500 - 17,999 ft	6	4	3	10	2
FL 180 and above	6	7	6	16	9
TOTAL	178	151	119	176	132

Chart 7
Airspace Where NMACs Occurred

Type	1984	1985	1986	1987	1988
Airport Traffic Area (ATA)	41	27	31	42	29
Terminal Radar Service Area (TRSA)	35	26	7	6	7
Terminal Control Area (TCA)	2	0	1	0	1
Controlled Airspace Terminal	52	45	46	48	38
Uncontrolled Airspace Terminal	0	4	0	2	2
Military Training Route (MTR)	9	14	11	19	12
Military Operating Area (MOA)	12	8	2	9	5
Restricted Airspace	4	4	1	2	0
Positive Controlled Airspace (PCA)	2	3	2	0	2
Controlled Airspace - En Route	7	9	10	11	6
Uncontrolled Airspace - En Route	14	10	4	25	16
On Airport	0	0	0	1	1
Airport Radar Service Area	0	0	4	11	11
Unknown	0	0	0	0	0
Not Reported	0	1	0	0	2
TOTAL	178	151	119	176	132

the bomber. When the pilot saw the approaching aircraft, he was unable to maneuver his aircraft to increase the separation because he was close to the ground, and there was insufficient time to react. The civil aircraft passed the bomber with an estimated 300 feet vertical separation and less than 500 feet lateral on the left of the bomber.

▪ A controller lost situational awareness and allowed a T-37 to pass directly overhead and in front of another T-37. Miss distance was 100 to 200 feet (vertical) and 250 to 300 feet (in front).

Other Comments

A question was asked at a recent Chief of Safety course referencing disciplinary action taken towards individuals who report a HATR. This answer was taken directly from AFR 127-3, paragraph 1.a.(1)-(4), Hazardous Air Traffic Report (HATR) Program. Individuals who submit HATRs on incidents are granted immunity from disciplinary action provided:

(1) The violation was inadvertent; that is, not deliberate.

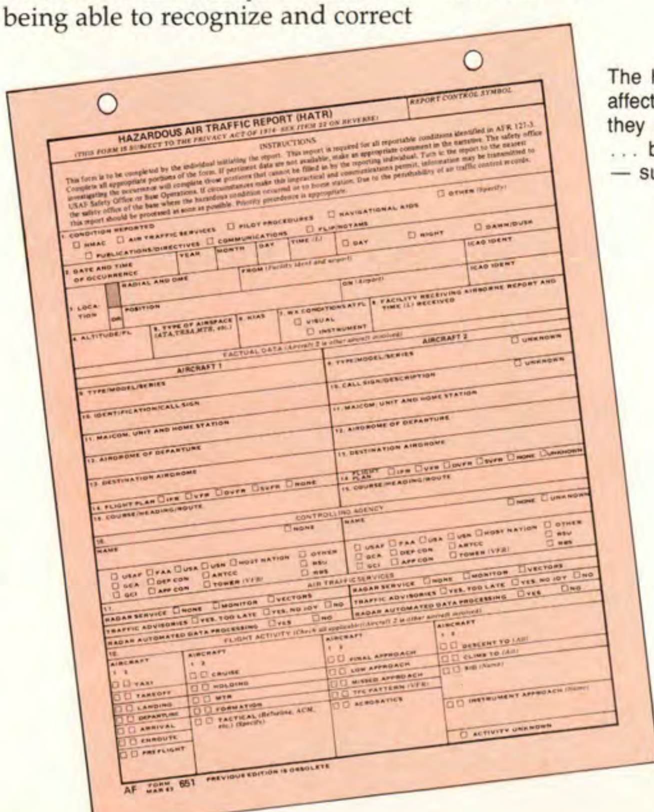
(2) No mishap occurred.

(3) No criminal offense was intended or committed.

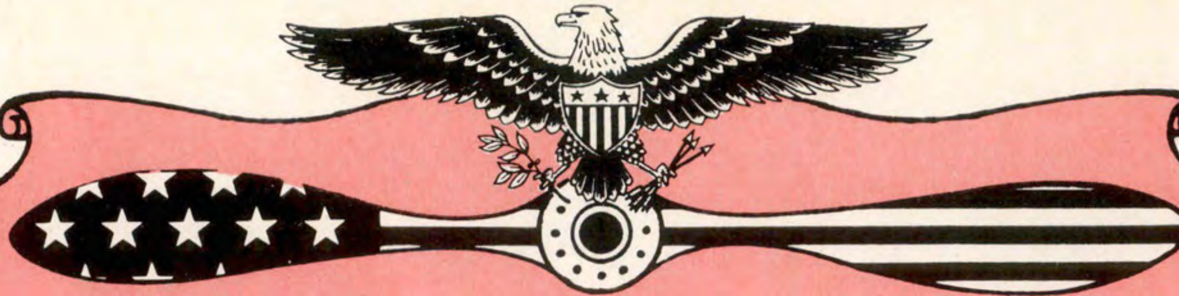
(4) The individual reported the incident as outlined in AFR 127-3, paragraph 7.

Before we finish this article, I would like to remind everyone that the HATR program requires a lot of hard work. It takes time to properly investigate a report. It takes time to prepare and send out messages. It takes time to effect changes in procedures or to educate people. But, no matter how you look at it, being able to recognize and correct deficiencies before they result in a mishap is well worth the effort.

To enhance the effectiveness of the HATR program, your ideas, comments, and suggestions are welcome. You can send them to HQ AFISC/SEFA, Norton AFB CA 92409-7001 or call AUTOVON 876-3416. ■



The HATR Program can affect deficiencies *before* they result in a mishap . . . but it all takes YOU — submit the HATR!



AVIATION HERITAGE

Pride in the Past . . . Trust in the Future

JUNE

America has a rich heritage of aviation firsts thanks to the foresight, perseverance, and sacrifice of countless dedicated men and women.

In June, we are proud to celebrate the anniversaries of these bold pioneers:

1st	1912	Lt "Hap" Arnold established a new Army aircraft altitude record of 6,450 feet.
6th	1942	Tinker AFB, Oklahoma, named for Maj Gen Clarence Tinker, Commander of Seventh Air Force and a leader in the Pacific Theater.
10th	1965	Maj Ed White became the first American to walk in space during the Gemini 4 mission.
18th	1861	Union balloonist Thaddeus Lowe, aboard the "Enterprise," sent the first air-to-ground telegraphic message to President Lincoln in the White House.
20th	1930	The American Army Air Corps opened its showcase — Randolph Field, Texas . . . soon to be known as the "Westpoint of the Air."
24th	1924	"The Race With the Sun" began at 2:59 a.m. as Lt Russell Maughan flew from Long Island to San Francisco in a PW-3 . . . landing at 9:47 p.m. (18.3 hours air time, 3.3 hours ground time).
30th	1968	Lockheed's C-5 "Galaxy" made its maiden flight.

These courageous aviation leaders set hallmarks that have made our skies SAFER and FREER for millions of people.

USAF SAFETY AWARDS

THE SECRETARY OF THE AIR FORCE

SAFETY AWARD

AIR TRAINING COMMAND

The Air Training Command's Class A aircraft mishap rate in the last 2 years was the lowest rate for a large flying command in the Air Force's history. This accomplishment is even more significant in view of the disparity between the age of their aircraft and their youthful fliers working in a training environment. During this time, they flew 1,247,923 hours and 890,000 sorties while performing a demanding mission of undergraduate flying training.

Accomplishments in ground safety were equally impressive. The command's record resulted in all-time record lows for total mishaps, government motor vehicle mishaps, motorcycle mishaps, military and civilian injuries, and fatalities in both 1987 and 1988.

These impressive achievements reflect strong command support, supervisory involvement, and a commitment to safety by all members of the command.

ALASKAN AIR COMMAND

The Alaskan Air Command's safety program reflected strong command support, supervisory involvement, and adherence to safe operational procedures and standards. The command flew over 22,000 hours in 1988 without a Class A flight mishap. This accomplishment is significant given their inhospitable flying environment.

Accomplishments in other safety disciplines were equally impressive. In weapons safety, the command has not had a Class A or B explosive or missile mishap for 9 consecutive years, a Class C explosive mishap for the past 2 years, or an air-launched missile mishap for 3 consecutive years. In ground safety, their on-duty Class A mishaps, government motor vehicle mishaps, and on-duty military injuries were substantially reduced.

These accomplishments attest to effective supervision and safety involvement at all levels of command.

In the mist of the rolling seas, Doolittle's Raiders launch off the *USS Hornet* in a flight that changed military tactics and aviation history.

B-25s OVER TOKYO

MSGT DAVE SYLVA

■ On December 7, 1941, carrier-borne planes of the Imperial Japanese Navy broke the back of the US Pacific Fleet. In every corner of the world, the Axis powers were smashing their way through Allied defenses. Distance and censors kept the awful truth from the American people, but no matter how they tried to soften the blow, there was no escaping reality. Guam had fallen, the Japanese had sunk *H.M.S. Prince of Wales* and *Repulse* and were driving the British down the Malay Peninsula. On December 22, the tiny garrison on Wake would be overwhelmed. On Christmas Day, Hong Kong would surrender. The American Army in the Philippines, stripped of air power, was retreating into Bataan on Luzon. The situation was desperate.

Damage control parties were still fighting to free trapped sailors and to save what was left of the Pacific Fleet as the meeting got underway. President Roosevelt told his staff he wanted "a bombing raid on Japan as soon as humanly possible." The raid would be for psychological effect only. It would boost the morale of the American people and our Allies. It would give the Japanese an emotional setback. It did that and more. It altered the course of World War II.

A plan was drawn up to bomb Japan from Chinese bases. Twelve B-24s, under Colonel Harry Halverson, flew east across the Atlantic to Africa. Before they could fly to New Delhi and on to China, they were diverted to Egypt to fly the first Ploesti oil field mission.

The next best hope was a carrier strike. Unfortunately, the short range of the Navy planes would put the strike force and the too valuable carriers within the attack radius of Japanese land-based bombers.

Having been an orphan son of the Army for so many years, the Air Force had learned to improvise. Both Army and Navy fliers had spent their lives and given their lives overcoming "fundamentalist" thinking. Nothing was impossible. Some problems just took a little longer to solve. This problem would also be solved.

Lt Col Jimmy Doolittle enjoys a light moment aboard the *USS Hornet* with crewmembers and support personnel, before the famous flight that changed the outcome of the Pacific Theater campaign and World War II.

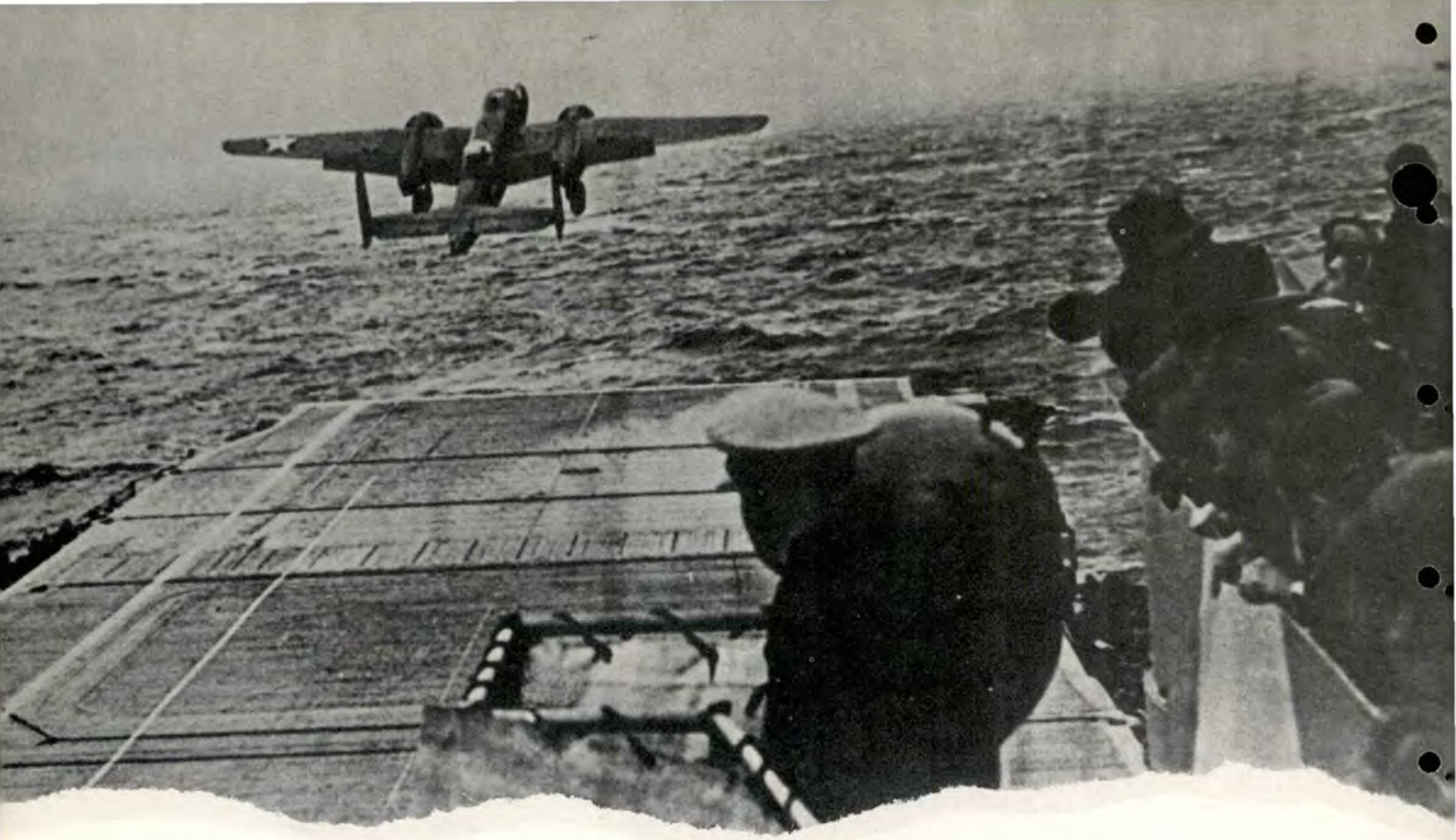
On January 4, 1942, at another meeting, the Chief of Naval Operations, Admiral Ernest J. King, was discussing plans for the invasion of North Africa. He offered a suggestion that Army bombers be transported on one of the three carriers to be used. The seed was planted. General "Hap" Arnold, Chief of the Army Air Force, taking notes, wrote: "We will have to try bomber takeoffs from carriers. It has never been done before, but we must try it out and check on how long it takes."

A Navy officer, Captain Francis S. Low, offered a suggestion to Admiral King that Army medium bombers be launched from a carrier for a strike against Japan. He had watched Navy pilots at Norfolk, Virginia, practicing short takeoffs from a simulated carrier deck painted on the runway there. Later, he had seen Army twin-engined bombers making simulated bombing runs over the same runway. The two perceptions meshed into the germ of an "impossible" idea.

The idea was examined by Admiral King's staff, and the plan began to take shape. The brandnew carrier, *Hornet*, could take 16 North American B-25 *Billy Mitchell* medium bombers on her flight deck. Steaming at better than 25 knots and escorted by a screening force, the *Hornet* would take the bombers to within 500 miles of Japan. After launching the bombers, the *Hornet* would do a 180 and head for home. The bombers would strike their targets and fly on to Chinese fields. It would work if, and it was a big *if*, Army pilots could get a bomber off a carrier deck. There was only one way to find out.

Arnold called an old and trusted friend, Lt Colonel James H. Doolittle, to oversee the project. Doolittle had just finished working the jinx off Martin's B-26 *Marauder*. Now he was told to see what it would take to get a medium bomber off the ground in 500 feet, carrying a 2,000-pound bombload and enough gas to fly 2,000 miles. The answer was typical of Doolittle: "I'll need a little time on that one. Give me a day or two." He had the answer the next day. The B-25 could do it if the crews were properly trained and if the plane was given extra tanks. Doolittle got that job, too.

continued



B-25s Over Tokyo

continued

Twenty-four *Mitchells* were modified to include the required extra fuel tanks. Twenty-four crews were assembled out of the 17th Bomb Group and the associated 89th Recce Squadron. The men were volunteers who had been told only that they were needed for an extremely hazardous mission that would require the greatest skill. Of this "First Special Aviation Project," only Doolittle and his deputy, Major John A. Hilger, knew it involved a carrier takeoff.

The selected crews reported to Eglin Field, Florida, at the end of February. A flight instructor from Pensacola Naval Air Station, Lieutenant Henry L. Miller, was given the job of training the Army crews in very short field takeoffs. He found the crews were sharp, and they learned quickly.

While training progressed, the armaments officer, Captain Ross Greening, dummied 50 caliber broomsticks to give the B-25s the illusion of protection in the tail. He also fashioned a 20-cent bombsight that was more accurate at low altitude than the highly secret Norden bombsight.

On March 21, a message was sent to Eglin: "TELL JIMMY TO GET ON HIS HORSE!" The mission was on. Doolittle assembled his 22 remaining crews and told them they were leaving. They took off from Eglin and flew to McClellan Field near Sacramento, California.

From McClellan, the planes flew to Alameda Naval Air Station, where 16 of them were hoisted aboard the *USS Hornet*. The larger planes took every inch of available deck space. The crews were mixed in with the Navy people wherever berths were to be found.

April 2, 1942, the *Hornet* weighed anchor and headed west. Her escort included the carrier *Enterprise* out of Pearl and 14 other warships.

While the convoy zigzagged its westerly course, the war went on. April 9, the exhausted garrison on Bataan had surrendered. The sick and wounded defenders set out on a death march to prison camps.

As the days dragged by, the crews performed maintenance on their planes and had their pockets picked by Navy cardplayers. The Navy crew had been told the destination of the *Hornet* the same day they left San Francisco Bay. Morale was high, and both Army and Navy men, friendly enemies, forgot all previous rivalry. Harmony was the order of the day.

The raid was to be launched after the *Hornet* had put the planes within 400 miles of Japan. From this distance, Doolittle hoped to be over Tokyo at sunset on April 19.

At 0300 on the 18th, patrols from the *Enterprise* spotted Japanese surface vessels. An alarm was sounded, but the task force turned to a new heading and avoided detection. At 0600, another Japanese ship was sighted, this time from the *Hornet* herself. At almost the same time, *Hornet's* radioman intercepted Japanese radio traffic from somewhere close to the carrier. The element of surprise was gone. The task force had been seen, and the patrol vessel, before she went under to the *Nashville's* guns, had flashed a warning message to Japan.

Only one choice could be made. At 0800, the *Hornet's* loudspeakers blared, "ARMY PILOTS, MAN YOUR PLANES!" The task force was 630 miles east of Japan. An early launch would put Doolittle's Raiders over the targets in broad daylight. There was nothing else to do. Each moment the takeoffs were delayed put the task force in danger of attack by Japanese land-based bombers.

At 0820, April 18, 1942, Doolittle's plane released brakes and lumbered down the flight deck into the teeth of the squall that lashed the task force. Five minutes later, the second aircraft lifted from the *Hornet's* deck. Exactly 1 hour after Doolittle's takeoff, the sixteenth plane flown by Lieutenant Bill Farrow was airborne.

The Navy's job done, the task force turned 180 degrees and retired at flank speed. The Raiders pressed on to the heart of the Japanese empire. They had no idea of what waited ahead for them. The enemy had been warned. The targets, Tokyo, Yokohama, Nagoya, Osaka, and Kobe, would be swarming with fighters — if the bombers got that far. The added distance and weather would alter their plan to land at friendly fields in China. There was no way alternate plans could be worked out now.

The *Mitchells*, each loaded with two 500-pound bombs and 1,000 pounds of incendiaries, raced for their assigned targets. Some of the Raiders would encounter enemy fighters, some would catch flak. Some would, much to their surprise, find that the Japanese mistook them for their own and waved to them as they flashed over their heads.

All of the planes unloaded their bombs. They did what they had set out to do. Even if only in token measure, Pearl Harbor was avenged. The agony that had tormented the American people as we suffered defeat after defeat was somehow less stinging.

None of Doolittle's planes would be saved, though. They would crash land in China or ditch in the Yellow Sea. Crews would bail out and hope they landed among friends. One plane landed in Siberia. It was confiscated. The crew was interned and put to work by the Russians. They escaped and made their way home more than a year later.

Lt Robert Hite blindfolded and being led away by captors. He was one of the lucky fliers. After spending 40 months in a Japanese prison camp, he was released and returned home when Japan surrendered.

President Roosevelt presents Jimmy Doolittle with Congressional Medal of Honor as General Henry (Hap) Arnold and Mrs. Doolittle look on with pride.

Most of the Raiders made it home, but not all. Three of them, SSgt William J. Dieter, Corporal Leland Faktor, and Sgt Donald Fitzmaurice died in the crashes of their planes. Eight Raiders fell into Japanese hands and suffered the hell of torture and captivity for 3 years. First Lieutenant Bob Meder was allowed to die in prison of beriberi. Three prisoners of war, First Lieutenants Bill Farrow, Dean Hallmark, and Sgt Harry Spatz were executed by their captors in October 1942. They gave all they had to give.

Yes, they did what they set out to do, and in doing it, the 80 Raiders of Doolittle's "Special Project" changed the course of the war more than they realized.

Admiral Isoroku Yamamoto, the man who had planned the Pearl Harbor raid, was responsible for the defense of the Emperor and the home islands. The success of the Doolittle strike proved the Americans still had teeth. Yamamoto suspected the raid had come from an aircraft carrier. The carriers had escaped destruction at Pearl Harbor and were still ranging in the Pacific. He devised a plan to bring the enemy to battle on his terms. The fight he picked cost him his carrier force instead and ended Japanese offensive plans in the Pacific. It was called the Battle of Midway.

One year to the day after the Doolittle raid, on April 18, 1943, US Army Air Force fighters intercepted and ambushed Admiral Yamamoto's plane over Bougainville. The man who started the chain of events on December 7, 1941 — the man whose embarrassment and frustration had brought about the destruction of his fleet at Midway, died in the flaming wreckage of his plane. ■

IFC APPROACH

By the USAF Instrument Flight Center, Randolph AFB TX 78150-5001

My Instrument Question is:

MAJOR BILL STANFORD
USAF IFC/FO
Randolph AFB, Texas

■ Many pilots recently took a 24-question instrument flying knowledge test as part of a study effort to determine the need for an advanced instrument course. Since the USAF Instrument Flight Center was tasked with creating this examination, we thought it appropriate to disseminate the questions and answers to everyone. Here we present eight of the questions for your information and review. Further questions will follow in subsequent issues of *Flying Safety*.

1. Reference the figure. Prior to flying this approach, it is important to check the NOTAMs to determine if the IAP is effective. The best method of determining if Wurtsmith AFB is fully covered by the USAF NOTAM system is to check the NOTAM coverage code found in:

a. The IFR En Route Supplement.

b. FLIP General Planning.

c. The Standard NOTAM Board.

d. The Base Operations NOTAM Guide.

2. Reference the figure. The depicted visual descent point (VDP) is located at 1.9 DME. This VDP is based on:

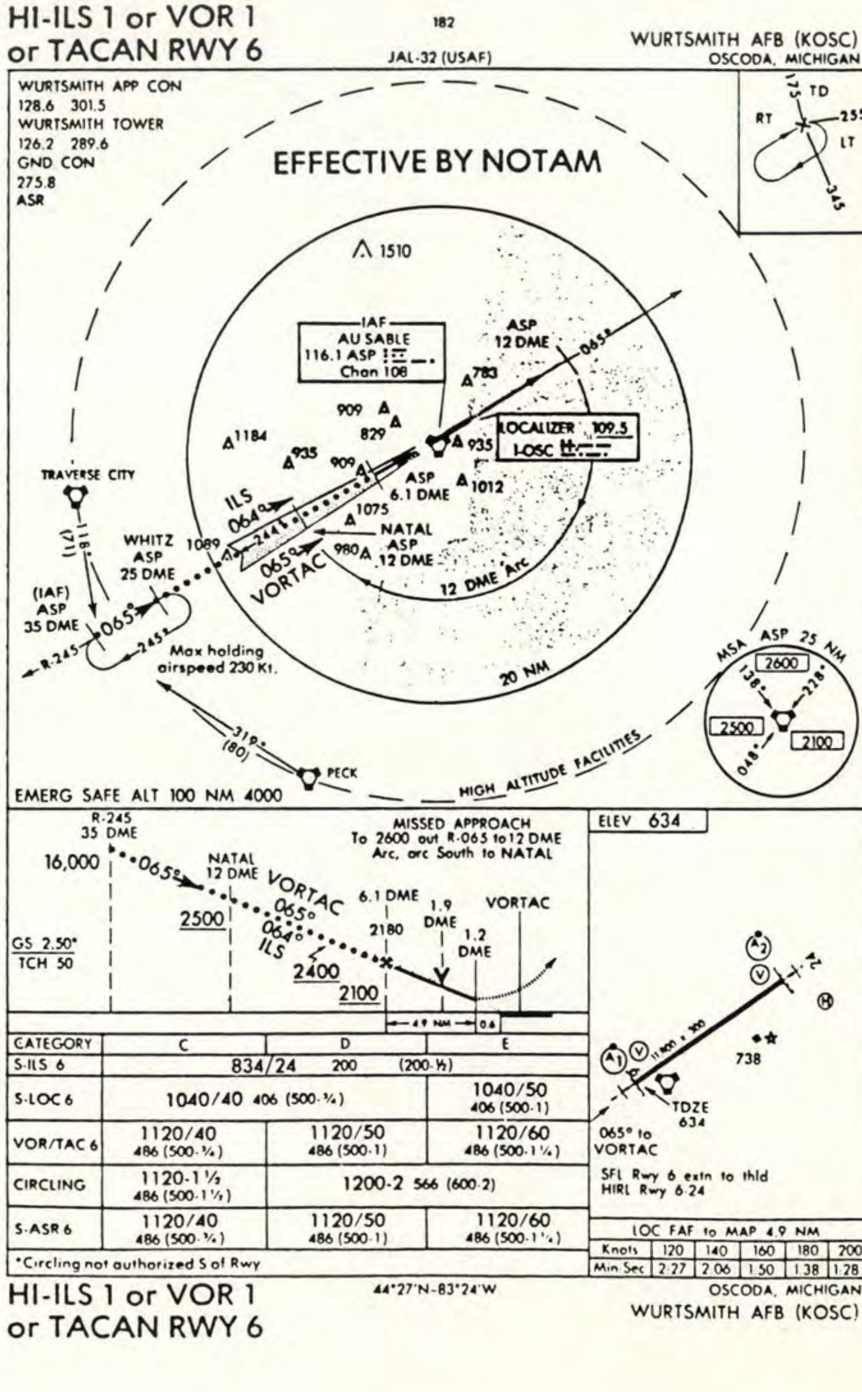
a. VOR or TACAN approach minimums.

b. Localizer approach minimums.

c. A 3-degree descent from the MDA.

d. An aircraft normally assigned to Wurtsmith AFB.

3. Reference the figure. The name of this approach tells the pilot:



CATEGORY	C	D	E
S-ILS 6	834/24 200 (200-½)		
S-LOC 6	1040/40 406 (500-¾)		1040/50 406 (500-1)
VOR/TAC 6	1120/40 486 (500-¾)	1120/50 486 (500-1)	1120/60 486 (500-1¼)
CIRCLING	1120-1½ 486 (500-1½)	1200-2 566 (600-2)	
S-ASR 6	1120/40 486 (500-¾)	1120/50 486 (500-1)	1120/60 486 (500-1¼)

*Circling not authorized S of Rwy

LOC FAF to MAP 4.9 NM					
Knots	120	140	160	180	200
Min:Sec	2:27	2:06	1:50	1:38	1:28

44°27'N-83°24'W

a. It is a straight-in approach to runway 06.

b. There may exist another ILS procedure to runway 06.

c. In order to fly the final approach portion of the IAP, my aircraft must be equipped with an operational ILS or VOR or TACAN.

d. The equipment used to fly the entire approach may not appear in the name of the approach.

e. All of the above.

4. Reference the figure. You are flying the localizer only portion of the depicted approach in an aircraft whose final approach ground speed is 150 knots. The time to fly from the final approach fix to the MAP would be:

a. 1:50.

b. 2:06.

c. 1:58.

d. None of the above.

5. Reference the figure. For the ILS approach to runway 06, the highest elevation within the first 3,000 feet of the landing surface, the threshold crossing height, and the field elevation, respectively, are:

a. 634, 40, 634.

b. 738, 50, 634.

c. 634, 50, 634.

d. 834, 65, 486.

e. None of the above.

6. Reference the figure. You are flying the TACAN approach as depicted and have just crossed NATAL at 2,500 feet. The next mandatory altitude restriction for the published nonprecision approach requires you to:

a. Cross the final approach fix at above 2,100 feet MSL.

b. Maintain at or above 2,400 feet MSL until intercepting the glidepath, then descend to 2,100 feet MSL.

c. Descend to the appropriate MDA since all other altitude restrictions apply only to the precision approach.

d. Cross the final approach fix at 2,180 feet MSL.

e. None of the above.

7. Reference the figure. You are approaching the published holding fix on a heading of 250 degrees and have decided you are aligned for a teardrop entry into the holding pattern. The maximum allowable teardrop heading would be:

a. 200 degrees.

b. 215 degrees.

c. 275 degrees.

d. 290 degrees.

8. Reference the figure. You have been cleared for the TACAN RWY 06 approach and have been directed to circle to runway 24 for landing. You are flying a category D aircraft. Which of the following is/are true?

a. You should descend no lower than 1,200 feet MSL until you are in a position to place your aircraft on glidepath to runway 24.

b. You may not circle south of runway 06.

c. You should use the circling MDA depicted for runway 06.

d. All of the above are true.

e. None of the above are true.

ANSWERS

Question 1. Answer a. Reference IFR En Route Supplement, A-4 (5). NOTAM service is shown by the symbol ◊ meaning the facility is covered by the FAA/DOD Integrated NOTAM System.

Question 2. Answer b and c. Reference AFM 51-37, para 7-6 b(6). The VDP is normally identified by DME and is computed for the nonprecision approach with the lowest MDA on the IAP, in this case the S-LOC 6. Where VASI is installed, the VDP is the point on the final approach course of a nonprecision straight-in approach procedure where the VASI intersects the lowest MDA. Where VASI is not installed, it is the point where a normal descent (approximately 3°) from the lowest MDA to the runway threshold commences.

Question 3. Answer e. Reference AFM 51-37, para 7-6 a(3) (a). Straight-in approaches are identified by the types of navigation aids which provide final approach guidance and the runway to which the final approach course is aligned. Additional equipment may be required to execute the other portions of the procedure, and it is the pilot's responsibility to determine what equipment is required. If there is more than one approach using the same NAVAIDS to a runway, the procedure will be suffixed with a number, beginning with 1.

Question 4. Answer c. Reference the figure. The timing box in the lower right-hand corner indicates timing from the LOC FAF to the missed approach point based on different ground speeds. For a speed of 160 knots, the time is 1 minute and 50 seconds. Therefore, for 150 knots, the time would be 1 minute and 58 seconds.

Question 5. Answer c. Reference FLIP GP, IAP Legend. TDZE in the airdrome depiction means "touch down zone elevation," which is defined in FLIP GP as the highest elevation in the first 3,000 feet of the landing surface. TCH 50 in the plan view under the glideslope (GS 2.5°) is the "threshold crossing height." The field elevation is located in the small box in the upper left-hand corner of the airdrome depiction. Field elevation is based on the highest point of the usable landing area, rounded off to the nearest foot MSL.

Question 6. Answer a. Reference IAP Legend and the figure. ⚡ is the glideslope/glidepath intercept altitude and final approach fix for precision approaches. Unless otherwise indicated, the nonprecision final approach altitude is to be maintained until the next fix.

Question 7. Answer a. Reference AFM 51-37, para 9-5 a(3). To perform a teardrop entry when you reach the holding fix, turn on the holding side and proceed on an outbound *track* not to exceed 45° from the outbound course. The teardrop course may be less than 45° offset.

Question 8. Answer d. Reference AFM 51-37, para 14-6 (c), and the figure. Do not descend below circling MDA until in a position to place the aircraft on a normal glidepath to the landing runway. The note at the bottom of the profile view says, "circling not authorized S of Rwy." The circling MDA and the weather minima to be used are those for the runway to which the instrument approach is flown (this is not always the landing runway). ■

The Vortex Ring State

CAPTAIN R. E. "BUCK" JOSLIN

Captain R. E. "Buck" Joslin is a Marine helicopter pilot currently serving as the helicopter aerodynamics instructor for the Aviation Safety School located at the Naval Postgraduate School in Monterey, California.

■ A helicopter, even with excess engine power, may encounter an uncontrolled rate of descent by inadvertently descending into its own rotor downwash.

Let's determine how this uncontrolled rate of descent could be encountered by looking at the source of lift of a helicopter. Anyone who has been around rotary wing aircraft is aware of the tremendous air velocities generated below the aircraft by the "pumping" action of the rotor blades as they provide the necessary lift for flight. This air velocity generated by the rotors is normally called induced velocity (Vi).

But what happens if that air is somehow blown back onto the rotor blades? If this occurs, the pressure differential across the rotor blades is disrupted, lift will be lost, and the aircraft will rapidly descend into a condition commonly called the vortex ring state. But how can we possibly get into this situation?

If a helicopter is descending at a velocity that approximates the velocity of the air it is pumping down, it experiences this vortex ring state. This will be manifested in the cockpit as an uncontrolled, increasing rate of descent, aggravated by the addition of power (collective). This condition may also be encountered when descending into the blade tip vortices or wake turbulence of another aircraft. But we will confine our discussion to the self-induced vortex ring state, triggered by excessive rates of descent at low horizontal velocities.

The next questions we may ask ourselves are where and when does this occur? Most operator manuals are inadequate in their discussion of the flight conditions leading to this phenomenon. They generally specify that the "the vortex ring state may be encountered during rates of descent greater than 800 feet per minute at forward velocities less than 40 knots."

These guidelines, however, are extremely conservative and do not reflect the true parameters or account for the actual mechanism leading to the vortex ring state. A computational study, validated by flight tests, was conducted by the United States Army Aviation Laboratory in

VORTEX RING STATE FOR DESCENT RATES BETWEEN 70% and 125% OF INDUCED VELOCITY IN A HOVER.

$$V_{i\,\mathrm{HOVER}} = \sqrt{\frac{DL}{2\rho}} \times 60$$

IN FPM

R = MAIN ROTOR RADIUS

$$DL = \text{DISK LOADING} = \frac{\text{WEIGHT (lbs)}}{\text{DISK AREA } (\text{ft}^2)}$$

$$\rho = \text{AIR DENSITY} \left(\frac{\text{SLUGS}}{\text{ft}^3}\right)$$

$$\text{DISK AREA} = \pi R^2 \quad (\text{CH-46} = 3612\ \text{ft}^2)$$

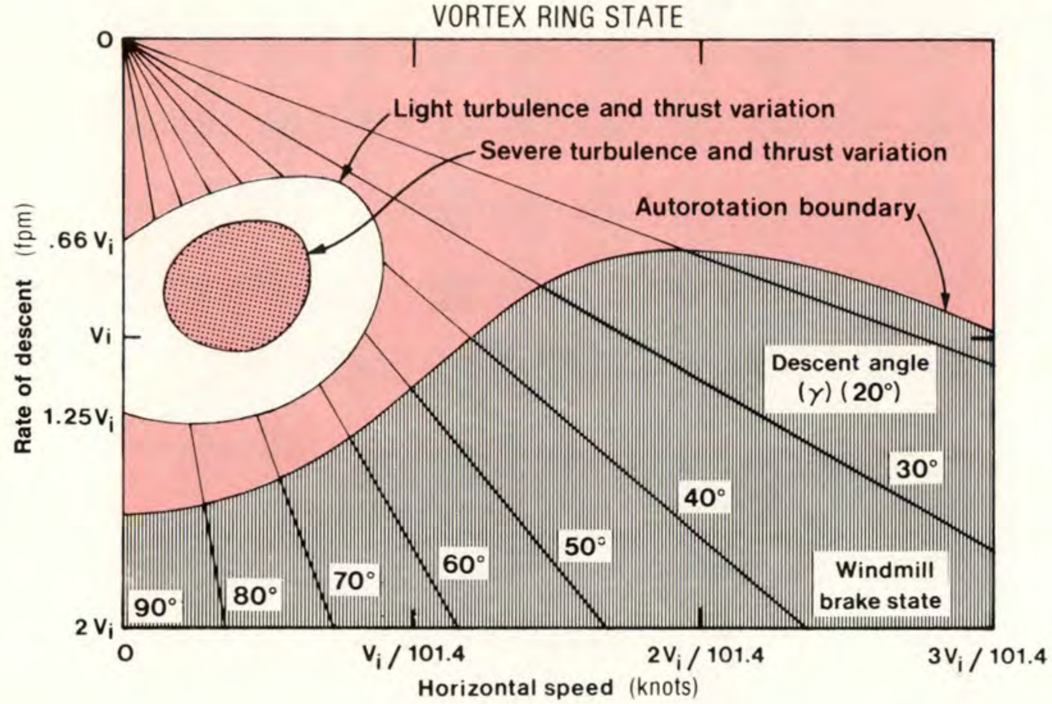


Figure 1.

1971, which outlined an operating envelope for this so-called "vortex ring state" as a function of the aircraft's induced velocity in a hover.

A generic diagram is depicted in figure 1, and the numerical boundaries for the severe and light turbulence regions of the vortex ring state are portrayed as multiples of the induced velocity in a hover. The appropriate constants for unit conversions have already been included on the diagram in order to present the rate of descent and velocity data in units of feet per minute (fpm) and knots, respectively.

By plugging in the appropriate gross weight (W), main rotor disk area (A), and air density (p) values, we can easily create a valid vortex ring diagram for any helicopter operating in the flight regime of choice.

Figure 2: Air Density in the Standard Atmosphere

Altitude (Feet)	Density (Slugs/Ft³)
Sea Level	0.002377
2000	0.002241
4000	0.002111
6000	0.001987
8000	0.001868
10000	0.001755

Figure 2 lists air density values at selected altitudes in the standard atmosphere. The variation is fairly small over the normal operating altitudes of rotary wing aircraft, and although these values change somewhat under nonstandard conditions, the deviations are insignificant in the context of the overall accuracy of this computation.

Once we compute our induced velocity in a hover, using the indicated formula of $Vi = \sqrt{W/2pA} \times 60$, with weight (W) in pounds, main rotor disk area (A) in square feet and density (p) in slugs per cubic foot, the entire diagram falls into place. Density is mass per volume, and slugs are the unit for mass. The multiplication by 60 merely puts the induced velocity in units of feet per minute to correspond with what would be read on the cockpit vertical speed indicator.

Remember that as altitude increases, air density decreases, and vice versa. The division by 101.4 on the horizontal axis converts the induced velocity factor from feet per minute to knots to correspond with what would be read on an airspeed indicator.

A sample diagram for a CH-53E

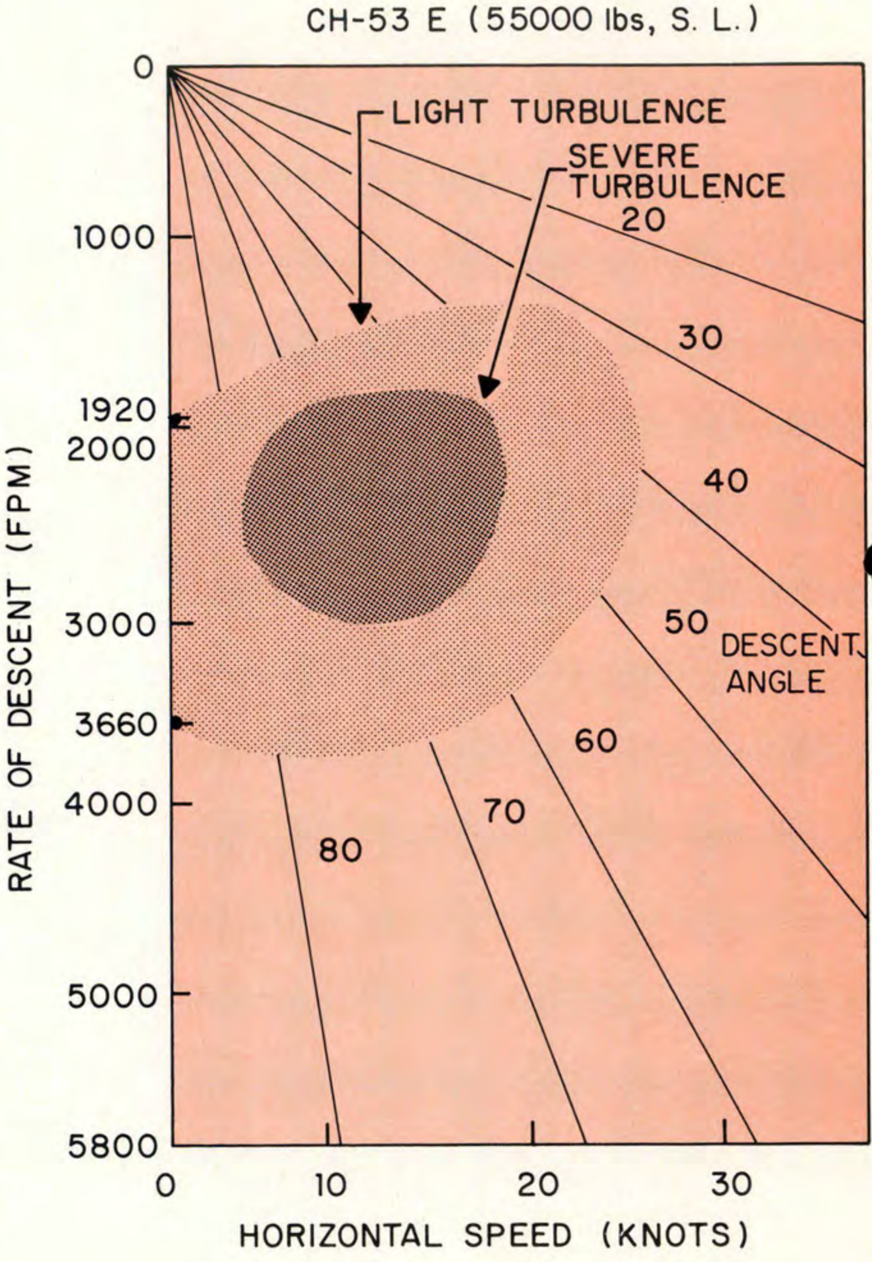
continued

at a gross weight of 55,000 pounds operating at sea level (density = .002377 slugs/cubic foot), is presented as an example in figure 3. We can see that we first encounter the vortex ring state at a descent rate of approximately 1,920 fpm at velocities less than 30 knots and have bypassed this region at around 3,660 fpm.

The most adverse descent is when we traverse through the center of the severe turbulence region and corresponds to a descent angle of around 70 degrees, with 90 degrees being a perfectly vertical descent. In addition, we can see from an analysis of the induced velocity equation, that the vortex ring state will be encountered at the lowest descent rates when we are at low gross weights and at low altitude (high density).

The recommended corrective action is to break out of this disturbed air through some sort of nonvertical motion or by entering an autorotation. The latter course of action is impractical at low altitudes. Nevertheless, the best corrective action is to avoid the vortex ring state altogether, and we can do this only if we know our helicopter's aerodynamic operating envelope! ■

Figure 3.



FSO's CORNER

BIRD STRIKE REPORTS

CAPTAIN DALE T. PIERCE
919th Special Operations Group
Duke Field, Florida

■ Bird strike reports are a necessity of life in the flight safety business. The specifications for the reports are provided in the bird strike regulation, AFR 127-15, The Bird Strike Hazard Reduction Program. What is not specified in the bird strike regulation, with a few exceptions, is the manner in which the required data are to be collected. As a result, the various organizations within the Air Force have created tools to suit their individual needs.

A few weeks ago, while I was walking through the 55th Special Operations Squadron (SOS) operations area, Eglin AFB, Florida, I stopped to look at their flight safety bulletin board. As I looked over the usual complement of flight safety-related material, I noticed the HR and HATR forms attached to the base of the board. Then I noticed a third form, one I didn't recognize, attached to the base of the board. It was a locally produced bird strike report form.

As I looked over the bird strike form, I noticed the writer had made the form simple to read and understand. He also made it easy to complete. At the top were some blanks for the usual stuff, like pilot name, date, and time of occurrence. Below that were a series of "circle the right answer" multiple choice questions. For these, the FSO had taken the time to consider the possible alternatives to a number of questions and following each, provided a list of appropriate responses. This not only makes the form easier to complete, but also ensures the answers are understandable when received.

Some areas covered by these multiple choice questions are lighting conditions, aircraft landing light condition, strobe light condition, phase of flight, flightpath in relation to clouds, whether a warning of bird activity was received, whether evasive actions were taken, and whether bird remains were found on the aircraft. In addition, blanks are provided to enable the writer to amplify the multiple choice questions, when necessary. Some blanks were used to collect information such as airspeed, altitude (AGL and MSL), coordinates of incident, and impact point on the aircraft.

The bottom line is that the form was made easy to use so that the pilots will be able to provide COMPLETE INFORMATION WITH A MINIMUM OF TIME. What more could you ask?

The FSO at the 39th Special Operations Wing, Eglin AFB, Florida, thought the idea was a good one. He made aircraft-specific changes to the form and distributed it to the FSOs at their subordinate CONUS and overseas units.

Captain John Shields provided this month's FSO's Corner idea. He created the form when he was the FSO for the 55 SOS at Eglin AFB, Florida. He's now assigned to Kirtland AFB, New Mexico.

The FSO's Corner needs your ideas. What are you doing in your program that could help other FSOs and other aircrews if they knew about it? Call me (Dale Pierce) at AUTOVON 872-2012 (SMOTEC). ■

BIRD STRIKE REPORT

AIRCRAFT COMMANDER: ____________
AIRCRAFT: MH-60 C-130 TAIL NUMBER ________
DATE OF BIRDSTRIKE ________ LOCAL TIME ______

THIS REPORT IS TO BE FILLED IN BY THE AIRCRAFT COMMANDER AFTER AN ACTUAL BIRDSTRIKE, WHETHER THERE WAS DAMAGE OR NOT. IT IS USED TO HELP REDUCE THE BIRD HAZARD IN OUR FLYING AREA. IF EXACT DATA IS UNKNOWN, USE APPROXIMATIONS (STATING IT IS A GUESS). FILL IN ALL THE BLOCKS.

TURN INTO THE SAFETY OFFICE WITHIN ONE WORKDAY!

LIGHT CONDITIONS (CIRCLE): DAWN BRIGHT HAZY DULL DUSK NIGHT RSOLL/NVG
LANDING LIGHT: ON OFF STROBE LIGHTS: UPPER ON LOWER ON BOTH ON BOTH OFF
PHASE OF FLIGHT: TAKEOFF CLIMB LOW LEVEL CRUISE DESCENT FINAL LANDING
AIRCRAFT SPEED ______ KIAS ALTITUDE ________ MSL ________ AGL
FLIGHT PATH IN RELATION TO CLOUDS: IN-CLOUDS ABOVE BELOW NONE
LATITUDE/LONGITUDE (to nearest minute): ____________
LOW-LEVEL ROUTE NUMBER (if applicable): ________
SPECIES AND NUMBER OF BIRDS (if known): ____________
IMPACT POINT(S) ON AIRCRAFT ____________
DAMAGE TO AIRCRAFT: ____________
WAS AIRCREW WARNED OF BIRD ACTIVITY PRIOR TO BIRDSTRIKE? YES NO
IF YES, HOW? ____________
EVASIVE ACTIONS TAKEN BY AIRCREW? YES NO
IF YES, WHAT? ____________
WERE THERE ANY BIRD REMAINS LEFT ON AIRCRAFT? YES NO
IF YES, ENSURE MAINTENANCE TURNS THEM IN TO 655 CAMS/QA
REMARKS (anything you feel may be valuable to the BASH program) ________

IF DAMAGE OCCURRED, ENSURE ODO CONTACTS THE COMMANDER OR OPS OFFICER ASAP!!

ODO INITIALS ______ DATE/TIME ________

DO NOT WRITE BELOW THIS LINE

CC/DO NOTIFIED BY ________ DATE ______ TIME ______ (L)
COGNIZANT SAFETY OFFICER ________ DATE NOTIFIED ______

OPS TOPICS

An In-LIGHTNING Experience

■ A C-130 was cruising at FL 190 in IMC and heavy precipitation. The heavy precipitation rendered the weather radar ineffective with a 1 to 2 NM usable range. The crew asked the center if there were any thunderstorms nearby. The center stated there was one storm at the aircraft's 2 o'clock position at 10 miles, and their current heading seemed safe enough.

Just as the crew was requesting a lower altitude, they saw two flashes of lightning and felt a heavy thud as a third bolt they didn't see hit the aircraft. No avionics were lost, and the crew continued on to their destination. Upon arrival, they inspected the Hercules and determined no significant damage had occurred, so they continued their mission to home base.

At home base, maintenance discovered the lightning had struck and damaged both the nose and SKE radomes. Inspection revealed numerous white burn spots on the aircraft: 20 on the inside of the cargo door, 6 inside the aircraft aft of the cargo door, 6 on the inside of the ramp, 4 on the right wing, and 1 on the right aileron.

Traffic Congestion

Two Eagles taxied out for a DACT sortie. When they reached the arming area, they found it crowded. There were two more F-15s in the area awaiting red ball maintenance, plus a fire truck and an F-4 under tow from a previous emergency. This left only one arming slot open, which lead took. No. 2 remained on the taxiway for the before-takeoff checks. When cleared for takeoff, lead pulled out of the area and onto the runway without difficulty.

No. 2 quickly cleared right, then began to taxi, concentrating on the two Eagles on his left. As he passed behind them, the pilot allowed his aircraft to drift right of the taxi line. He did not check the right side again or correct back since he believed the right side to be clear — that is, until he heard a crunch and felt the aircraft swerve right.

He looked and saw the aircraft's right wing embedded about 1 foot into the roof of a step van. The impact moved the van about 12 feet. There is conflicting evidence as to whether the van had been there all along or had moved to the position of the mishap after the pilot began to taxi.

Contributing to the congestion and the mishap were other factors, like the absence of procedures or markings for vehicle parking in the area, and the deviation of the taxi lines from the actual centerline of the taxiway.

Blocked Escape Slide

An EC-135 was delivered for Class II modifications. Inspection of life support equipment disclosed a trash can secured to the emergency escape slide container near the aft escape hatch. The trash can was held in place by a tiedown strap wrapped around the can and the escape slide container. With the strap in place, the container couldn't be opened, and the strap would have to be removed before the slide could be deployed.

This could be a real hazard during an emergency, especially for crewmembers who seldom work with tiedown straps. The time lost in removing the strap could well be the difference between a successful emergency evacuation of the aircraft and an unsuccessful one. ■

MAINTENANCE MATTERS

Job Consciousness — The Long and Short of It

■ A routine F-15 basic postflight (BPO) inspection revealed impact damage to seven first-stage fan blades on the right engine. A borescope inspection uncovered further damage to the engine core module.

After the preliminary investigation indicated FOD by a threaded object, inspection of the Eagle revealed one screw was missing from panel 4R. That panel, along with four others surrounding the aircraft's windscreen, had been removed and reinstalled during a recent windscreen change.

A screw that is too long is obvious because the screwhead is not flush with the panel. However, a screw that is too short may seat and be properly torqued, but it will not have a sufficient grip due to the reduced threading. An incorrect depth will allow screws to loosen due to airframe vibration. Seldom does the person who removed a panel install the same panel. It's usually someone working another shift.

When you remove aircraft panels, are screw bags available to contain the screws for each panel? Are screws that require machinist removal or those that became unserviceable during removal either documented or immediately replaced with serviceable ones? Are the screw bags at the site labeled with panel number and number of screws? It sure helps if you're the person installing the panels!

Sometimes, when installing panels, we fail to consider the consequences of incorrect screw lengths. Job consciousness (self-discipline) is a necessary ingredient to good workmanship and safety. Think about it the next time you remove or install access panels.

Loose Dust Caps and Streamers

Two jet engine technicians were operating the right engine on a T-38 at the sound suppressor with the canopy open. At a power setting of 85 percent RPM, they suddenly heard a loud pop and immediately shut down the engine. With the intake screen removed, a visual intake inspection revealed foreign object damage. Inspection also found a dust cap and streamer were missing from the rear ejection seat catapult hose.

Egress system technicians had previously installed the dust caps and streamers when they dearmed the seat to allow maintenance people to work a throttle problem. When the engine folks inspected the engine, they found the dust cap and streamer in the compressor section.

During the engine run, the catapult hose dust cap was most likely unscrewed by the streamer blowing in the wind. The cap and streamer apparently then migrated through the sound suppressor seal and were ingested by the engine.

This unit's egress shop people reviewed their policy on installing dust caps on the seat catapult hose to ensure: (1) The dust cap is properly tightened to prevent it from becoming unscrewed, and (2) the hose is securely stowed after a seat is dearmed.

In addition, engine run people were briefed on the critical nature of operating engines with the canopy open, increasing FOD potential. They were also reminded to ensure all ejection seat dust caps and streamers are secure prior to operating engines.

Perhaps other units may want to consider similar safety measures.

Initiation

Two egress specialists were dispatched to install an escape handle initiator in the cockpit of a B-1 bomber. Two maintenance people were also called to loosen the throttle quadrants to provide the egress technicians access to install the initiator.

When the maintenance people arrived, one of the egress folks laid the initiator on the copilot's seat and left the cockpit to allow the maintenance folks room to work. One of the maintenance people saw the initiator on the seat and, not knowing it was an explosive device, pulled the safety pin and — BANG! It functioned as designed. Fortunately, no one was injured, but a replacement initiator cost the Air Force $2,600.

This mishap would have been avoided had the egress technicians complied with the requirements of AFR 127-100, Explosive Safety Standards, which demands all explosive items used for egress maintenance, such as detonators, squibs, and initiators, to be carried in protective containers and be marked clearly to identify the contents. Hopefully, the curious maintenance troop learned a cardinal rule in the aircraft maintenance business. That is: "If it is in or on an aircraft and you don't know what it is, don't touch it." ■

UNITED STATES AIR FORCE

Well Done Award

Presented for

outstanding airmanship

and professional

performance during

a hazardous situation

and for a

significant contribution

to the

United States Air Force

Mishap Prevention

Program.

SECOND LIEUTENANT

John M. Sepanski

56th Tactical Training Wing
MacDill AFB, Florida

■ On 6 May 1988, Second Lieutenant John M. Sepanski, F-16 student pilot, was on a syllabus surface attack tactics sortie. During recovery, after successfully completing one low approach, he attempted to lower the landing gear for a full stop landing. Lt Sepanski lowered the gear handle but observed gear-up indications in the cockpit. With less than 1,200 pounds of fuel remaining, he initiated a go-around and declared an inflight emergency.

While on the go-around, Lt Sepanski quickly analyzed his aircraft malfunction, arranged for a chase aircraft, and established contact with the SOF. The chase aircraft confirmed the cockpit indications, observing all gear up and gear doors closed. After an unsuccessful attempt to recycle the landing gear handle, Lt Sepanski slowed the aircraft and pulled the alternate gear release handle. All three gear doors opened immediately, followed by the two main landing gear lowering to the down and locked position. The nose landing gear, however, remained in the up position.

With the SOF reading the applicable checklist items, Lt Sepanski made several unsuccessful attempts to lower the nose landing gear. With only 500 pounds of fuel remaining, he decided to land from a visual straight-in. After touchdown, Lt Sepanski held the nose up in a 2-point aerobrake while moving the throttle to the cutoff position. He then skillfully eased the nose down until the centerline fuel tank and the nose gear door contacted the runway surface. As he skidded to a stop, the centerline fuel tank erupted in flames. Lt Sepanski ground egressed uninjured, and the fire department quickly extinguished the ensuing fire.

Lt Sepanski's outstanding airmanship and time-critical decisions resulted in the recovery of a valuable combat resource. WELL DONE! ■

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UNITED STATES AIR FORCE

Well Done Award

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

SECOND LIEUTENANT
William L. Mourafetis

56th Tactical Training Wing
MacDill AFB, Florida

■ On 22 April 1988, Second Lieutenant William L. Mourafetis, a student pilot with less than 60 hours in the F-16, was flying on a syllabus surface attack mission. At 1,000 feet AGL on the downwind leg of the pop-up pattern, his aircraft entered an abrupt uncommanded right roll. While countering the rolling moment, Lt Mourafetis called "knock it off," slowly rolled the aircraft back to wings level, and began a shallow climb.

With no caution lights displayed in the cockpit, Lt Mourafetis checked the exterior of the aircraft and observed the right leading edge flap had failed to the full up position. He continued to climb to a safer altitude and proceeded toward home base. Despite controlling the failed leading edge flap, constant stick pressure was required to maintain level flight making pilot fatigue a significant complicating factor.

To reduce his aircraft's gross weight prior to landing, Lt Mourafetis attempted to jettison his external wing tanks. When the emergency jettison button was depressed, only the right wing tank departed the aircraft. Fortunately, the tank remaining on the left wing reduced the stick pressure required to maintain level flight.

Lt Mourafetis performed a controllability check and determined that an approach speed of 210 KIAS was required to maintain sufficient roll control for the approach. He then flew a 6-8 degree AOA approach and touched down at slightly less than 200 KIAS. After touchdown, the right rolling tendency became almost uncontrollable, and Lt Mourafetis had to force the nose of the aircraft to the runway to maintain directional control. He was able to keep the aircraft on the prepared surface and engage the departure end cable.

Lt Mourafetis' careful analysis of this critical in-flight emergency and superb flying skills averted possible loss of life and saved a valuable combat resource. WELL DONE! ■

Write A Dumb Caption Contest Thing

Road & Rec

The Air Force Journal of Driving and Recreational Safety

Our newest ground safety publication is out! The third issue will feature Water Safety and other great articles. Watch for it soon!

Okay, gang, here's the latest dumb caption for all of us humor aficionados (nuts). We can't believe how great you are at beating our dumb captions each month.

And, of course, if you are the one that our panel of dumb humor experts selects as the best, we will ballyhoo the caption, and your name, in the magazine and send you the coveted cheap little prize for you to cherish and lord over all your friends and associates forever.

Be sure to get your entry into the mail before 21 August 1989 so it may be judged.

Please NOTE — We are *not* announcing the winner for the April's contest in this issue. We are postponing it one month to allow time for everyone in the farthest distribution points to be able to enter the contest, too. We'll resume announcing the winners in July and continue each month, thereafter. Thanks for your patience.

Write your captions on a slip of paper and tape it to a photocopy of this page. DO NOT SEND US THE MAGAZINE PAGE. Use "balloon" captions for each person in the photo or use a caption under the entire page. You may also submit your captions on a plain piece of paper. Remember, the minimum bribe is $100,000, and all decisions are relatively final.

Send your entires to: **"Dumb Caption Contest Thing" • *Flying Safety* Magazine • HQ AFISC/SEPP • Norton AFB CA 92409-7001**