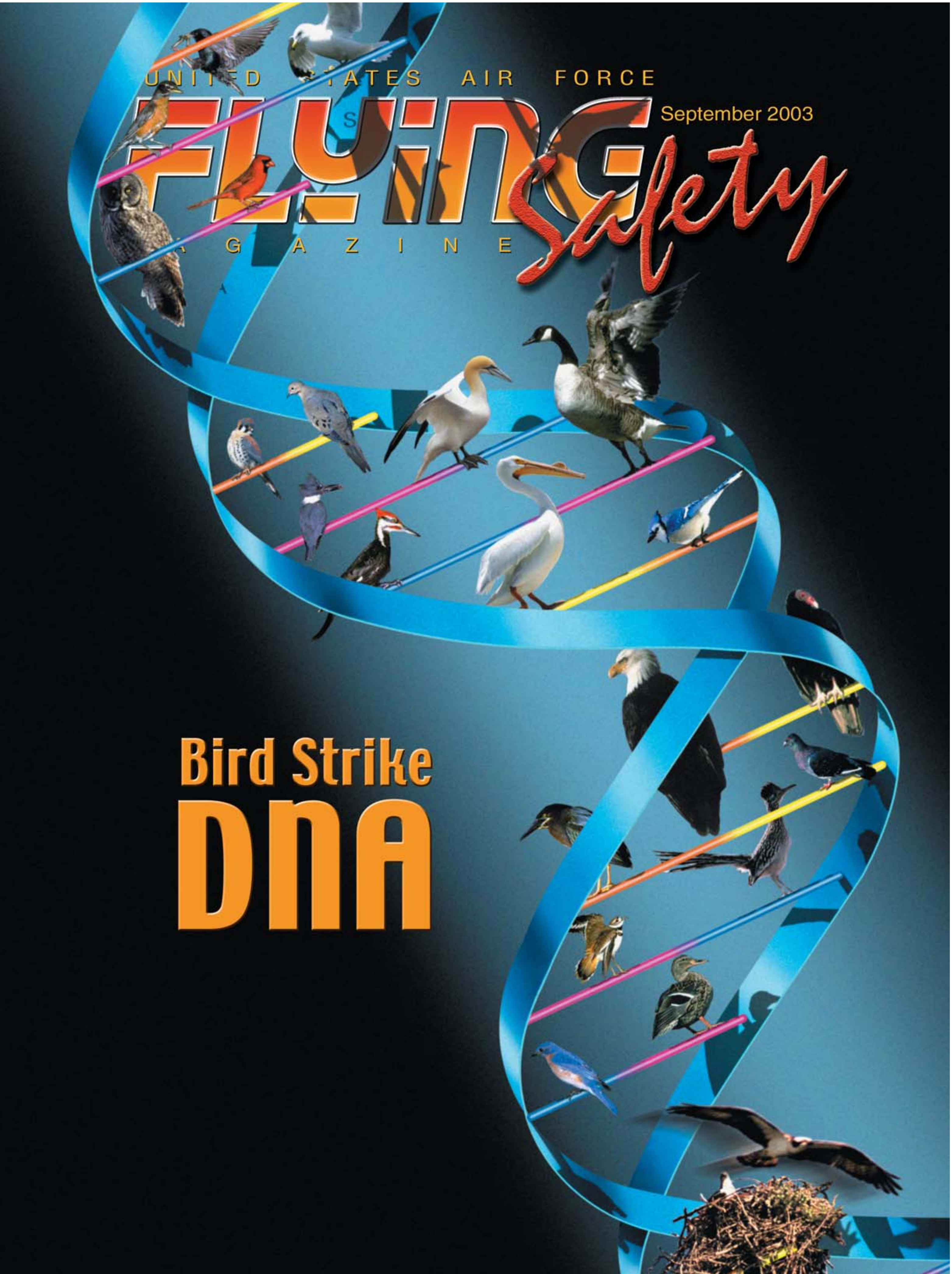
UNITED STATES AIR FORCE
FLYING Safety
MAGAZINE
September 2003
Bird Strike
DNA

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UNITED STATES AIR FORCE

FLYING Safety

MAGAZINE

This Issue:

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SAFETY sage

24TH NATIONAL AEROSPACE FOD PREVENTION CONFERENCE

Well, if you weren't lucky enough to attend this year's National FOD Conference, presented by National Aerospace FOD Prevention, Inc. (NAFPI), Snap-On and Kelly USA, you missed a great opportunity to improve your processes and reduce your FOD cost. Six hundred-plus of your fellow military members, airfield operators, aircraft manufacturers and depot counterparts were there.

Once again, NAFPI put on a professional and interesting conference from which we could learn, and provided the opportunity to network with our peers, which at times was the most informational. Twenty-six different vendors were there to show (and sell) their products. Some examples of the things that you could learn about were:

- The latest in tool control technology.
- An assortment of hardware control devices, The FOD Boss, and shop vacuums.
- The latest in computer software to track the tools you use every day.
- The newest type of fasteners that can help you eliminate lost rivet heads.
- Magnetic sweepers to pick up FOD or tools to find the missing tool/fastener.
- The strongest and most versatile vacuums available to clean your ramp.
- How technology is making the borescope you use look like Fred Flintstone's car.
- The newest and fanciest tool boxes you can think of.
- How to fix that broken concrete without calling in the Corps of Engineers.
- Even the US Forest Service was there to talk about wildlife control. Birds are FOD, too.

There was a lot to look at, great people to meet and share stories, good and bad, that can help you. As always, the FOD Conference provided a multitude of speakers to inform you about how a company or military unit is improving its processes and including FOD prevention in its daily routine.

The key theme again this year was "FOD prevention is crucial to your success." Why? Because the Air Force has spent $200 million on FOD damage from 1993 to 2002, and we continue to damage aircraft every year due to bad maintenance practices, improper tool control, and lack of cleanliness. Only we, the maintainers, can solve this issue. Let's make 2004 a better year for FOD and reduce the damage. If you didn't get the chance to attend the conference this year, there will be another one next year. You can check out the NAFPI website at NAFPI.com, as well as the Air Force, Army and Navy Safety Center websites. Also, a host of other links from the NAFPI website that can help you improve your FOD program. Hope to see you there next year!

Bird Strike DNA

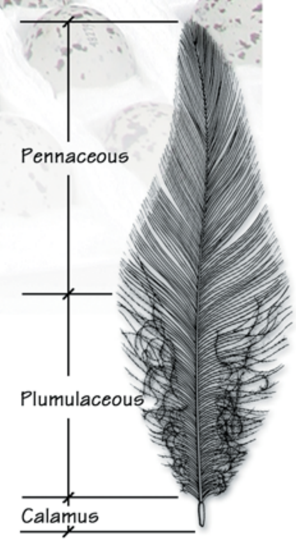
Imagery Courtesy of Smithsonian Institute, Division of Birds

CARLA DOVE, MARCY HEACKER AND LEE WEIGT
Division of Birds and Laboratories of Analytical Biology
Smithsonian Institution, Washington, DC

The Feather Identification Lab at the Smithsonian Institution has discovered DNA. Well…we're going to be using it in our BASH efforts anyway!

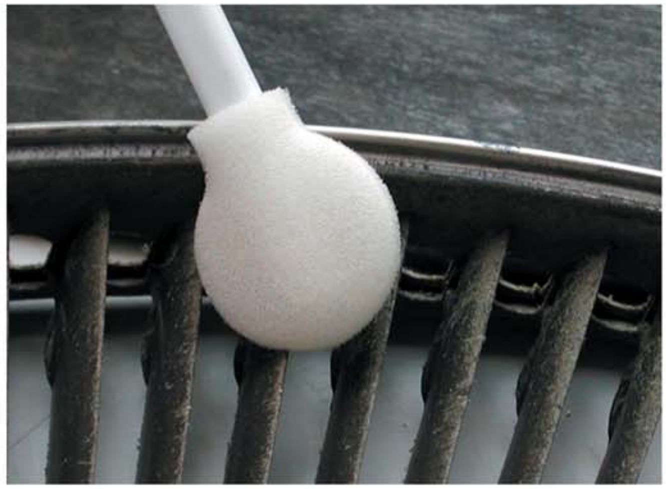
The Federal Aviation Administration (FAA) is joining the U.S. Air Force's feather identification program at the Smithsonian Institution to identify species of birds that collide with aircraft by developing a new DNA database. Beginning in July 2003, the FAA is providing funding to the Feather Lab to build a database of DNA sequences of approximately 300 species of birds commonly involved in bird/aircraft collisions. Currently, only about 60% of the birds that are involved in bird strikes have been partially sequenced and are available on GenBank (a national database of DNA sequences) for comparison, and many of those do not contain the appropriate gene(s) or gene region(s) for bird strike analysis.

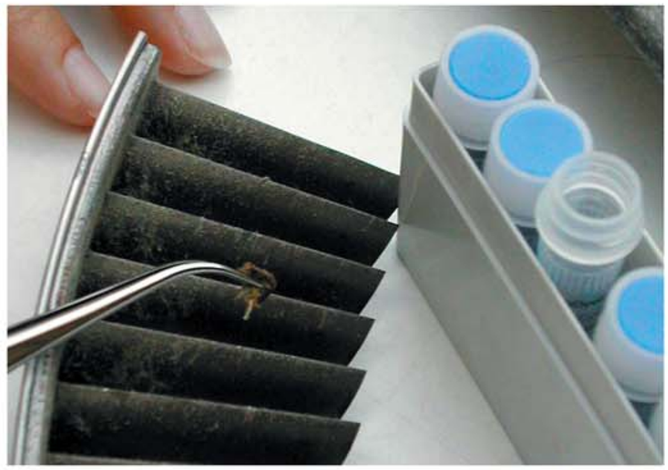
This five-year project represents an Interagency Agreement between FAA and USAF and aims to increase



the accuracy and ability of the Feather Lab to identify those "hard-to-identify" bird remains included in paper towel swipes that do not contain downy (plumulaceous) barbs for microscopic examination. By joining forces, the USAF will allow the Feather Lab to conduct identifications on civil bird strikes, and the FAA will provide funding for the research and development of a DNA identification system that can be used by both agencies in cases that lack morphological evidence for museum comparisons. The DNA identification process should be fully functional in five years, but for the time being we are going to be busy developing protocols, extracting DNA from frozen tissues stored in the museum's collection, and sequencing bird "snarge" (a Feather Lab term for the goop that is wiped from the airplane after a bird strike).

In 2002, nearly 2000 military bird strike cases were received for identification in the Feather Lab. This represents an increase from 1532 cases in 2001 and does not include the nearly 200 cases received annually from the FAA for civil bird strike identifications. The average number of bird strike cases identified per working day is approximately seven, but Spring and Fall migration are by far the busiest times of the year in the Feather Lab. The increased awareness of BASH programs and the ease of on-line reporting within the Air Force is no doubt responsible for the fact that a record 49% of the USAF bird strikes are now reported for positive identification.





Because the amount of time it takes to identify species of birds from fragmentary evidence can range from one hour to several days, we are in desperate need of some high-tech assistance. Additionally, Flight Safety personnel are becoming expert detectives when it comes to gathering bird strike evidence and are making it much more difficult to find feather barbs in the minute samples they scrape off the aircraft. These samples do, however, often contain bits and pieces of tissue or blood that may be useful in DNA testing. Fortunately, the Smithsonian has a cryogenically preserved tissue collection of birds from all over the world that will be used to establish the DNA database.

Old "Bird Dog," New Tricks

We all know that the first step in preventing a wildlife problem on an airfield is to identify the culprit, and the USAF BASH programs are now very aware of the importance of collecting even the tiniest samples for identification. Lee Weigt, manager of the Smithsonian's Laboratories of Analytical Biology (LAB) molecular program, will lead the DNA project, the major obstacles of which are overcoming the degraded state of the DNA in the samples being collected. The project will have a forensic approach and the database will initially focus on the mitochondrial DNA (mtDNA) most likely to be recovered from degraded samples ("snarge"). We will establish the database for large portions of three gene regions of the mtDNA and design primers and probes to detect these in poor-quality tissue and fluid samples. Rapid isolation of the samples in the field will be paramount, and we'll be testing several user-friendly field collection protocols from the beginning of the project to determine our highest probability of success. Identification via DNA sequencing is the "gold" standard, but we hope to develop cheaper and faster methods as a result of the database development.

"If It Ain't Broke…"

Just because we are going high-tech does not mean that we are going to abandon the "old way" of doing things! Even though the feather identification process is complex, it's still the easiest, fastest and cheapest way to determine what kind of bird was ingested into your engine or smacked up against your aircraft.

Once we get bird strike remains, there are several steps we take to make a positive final identification. First, we look over the USAF SAS (Safety Automated System) report for information such as date of strike, location, damage and remarks that can really be helpful in narrowing down the avian culprit.

Many times, the remains we get are in pretty rough shape—there is nothing quite as smelly as bird remains that have gone through an aircraft engine and then been subjected to the confines of the postal service. In these cases, washing the feathers in hot, soapy water is necessary to help restore the natural color, shape and texture. Sounds simple…but it works!

The unique expertise of our Feather Lab is that we have many years of experience peering through a microscope trying to figure out what microscopic features of the plumulaceous (downy) region of the feather sets one species apart from another. Using the feather microstructure can be an important step in the ID process if the material does not contain any obvious whole feather characters for specimen comparisons. We prepare microslices from unknown feather samples and compare the microscopic structures to "known" reference slides of feathers made from museum specimens. While these microstructures alone cannot tell us the exact species, they can tell us what "group" of birds we are dealing with (i.e., duck, shorebird, passerine).

Once we have gone through these initial steps, we usually have an idea of what type of bird we are dealing with. It's at this point that we boldly go into the museum collection of over 620,000 bird specimens to search for a match to the unknown feather sample. Having access to such a large collection allows for specific, accurate comparisons. Whether we need a Wilson's Warbler from California in September, or a Pin-tailed Sandgrouse from Iran…chances are it's in the collection. We also feel that this direct comparison to "known" specimens increases the accuracy of the IDs by not relying on memory or experience alone. The final identification call is made after considering all of the information and clues gained from this process and the information provided by you on the AF SAS report.

When you consider the condition of much of the material we receive, in addition to the variation in bird plumages, identifying feathers from bird strikes can be a daunting task. Our goal of adding the new molecular identification techniques is to continue to build our traditional old morphological ID methods and (ultimately) make this task as efficient and accurate as possible.

2002 Feather Lab Statistics

In 2002, feather samples were received from 328 different USAF airfields and a total of 255 different species were identified from bases all over the world. Many new species were added to the list last year as a result of increased flying at overseas bases. This underscores the importance of having a large research collection that is worldwide in scope for these new identifications. The top reporting USAF bases for 2002 included: Little Rock (86 cases), McConnell (66), Altus (59), Columbus (57) and Travis (57). Considering that even the smallest bird can cause damage to an aircraft, it is important to keep track of all bird strikes. (See Chart 1.)

Identifications based only on microscopic analysis reached the highest recorded number in 2002 at 487 cases. The majority of these identifications were confirmed to ordinal level only (170 Passeriformes), but many were identified to at least the family level (i.e., swallow, thrush). The DNA technology that we are developing with the FAA will hopefully assist us in refining these types of identifications. The increase in microscopic identifications is attributed to the new technique of wiping the bird strike off the aircraft with a wet paper towel (see collecting methods at http://afsafety.af.mil/AFSC/Bash/wild.html).

Reporting: Part Of The Greater Good Big Picture

Proper species identifications help provide baseline data needed to properly implement habitat management plans on airfields, warn aircrews of bird strike dangers and assist engineers in designing safer engines and windscreens. Some of the other important reasons for accurate species identifications and continued reporting include answering questions regarding strike hazards at individual airfields; the development and enhancement of the BAM (Bird Avoidance Model); permit hearings and construction of landfills; U.S. Fish and Wildlife Service concerns of species protection; and obtaining depredation permits. In order to keep "muscle" in the bird strike database and help prevent damaging strikes, we need to work together to assure the continued accuracy and consistency of the bird strike data. You are the ultimate beneficiary, so please report all bird strikes via the USAF Safety Automated System (AF SAS) at http://SAS.kirtland.af.mil. We will be supplementing all collecting methods once we have determined our protocols for the DNA-based molecular testing.

This new system will greatly enhance our identification efforts, and it will help to make the skies safer for all of us.

Average Cost of a Common Bird Strike in 2002

Species	#Strikes Identified	Total Damage	Avg. $/ Strike
Mourning Dove	132	$500,000	$ 3,787
Horned Lark	112	$ 29,000	$,259
Red-tailed Hawk	24	$634,000	$26,416
Mallard Duck	9	$626,000	$69,500
Canada Goose	3	$258,000	$86,000

Chart 1

HQ AFSC Photo by TSgt Michael Featherston

Feather Lab FAQs

1. What kind of feather material do I collect?

The more the better…if you have a whole bird, pluck feathers from the wing, tail, breast and back. DO NOT CUT FEATHERS. We need the fluffy barbules located at the base for microscopic analysis. Other helpful parts include: feet, beaks and bones.

2. What if there is no whole feather material?

We'll take what we can get. If all you see is a smudge of blood, tissue, or small feather bits ("snarge"), wet the area and wipe it with a paper towel. Send us the towel and all. This type of material will be the main focus of the molecular ID techniques.

3. Do you only identify birds?

No, we have identified everything from frogs and turtles to bats. In fact, we have a bat identification expert in the division of mammals (Suzanne Peruach, USGS) who is working on microscopic identification of hair samples.

4. What is a passerine?

A passerine is a shortened name for birds that are in the order Passeriformes. Species in this order are commonly known as perching birds or song birds and include warblers, sparrows, finches and crows. Because the microscopic structures of these birds can be similar to each other, we often stop at the "passerine" level on these identifications.

5. Can I get West Nile Virus from collecting bird remains?

So far, there have been no reported cases of cross-infection of this virus from dead birds to humans, but it is *not beyond the realm of possibility*. We urge you to use common sense and minimize contact with bloody remains. If in doubt, wear latex gloves.

6. How do I package remains?

Place remains in a clean zip-lock bag, sealed paper envelope or anything that will keep the sample contained. DO NOT USE TAPE or Post-It notes. The sticky material traps the downy feather barbs. PLEASE PUT AF SAS NUMBER ON THE SAMPLE.

7. Do you ever want whole birds?

If you find an unusual or interesting bird in good condition on your airfield, please contact us…we may like to have it for our research collection. Recently, we received a Black Kite (see photo, page 7) from Pakistan that had been prepared with a spread wing to facilitate feather identification. Remember to freeze the bird as soon as possible and note the date and location that it was found.

8. Where do I send the material?

Due to delays following the anthrax scare of 2001, the Smithsonian has set up a Post Office Box address for items that should not be irradiated (such as feathers in plastic bags). We ask that you please send non-rush cases via regular post to:

Feather Lab
Smithsonian Institution
NHB E-610, MRC 116
PO Box 37012
Washington, DC 20013-7012

For overnight, express, or priority shipping please send to:

Dr. Carla Dove
Smithsonian Institution
NHB E-610, MRC 116
10th & Constitution Ave., NW
Washington, DC 20560

You May Still Have A BASH Problem If...

"CAPT GRAZ MARLA"
HQ AFSC/SEFW

Since my article in the April 2003 issue of *Flying Safety*, I had the fantabulous opportunity to do a little traveling, and to witness some BASH programs. From the poor downtrodden sufferers of feathered wrath, to the ammo strapped Dirty Harrys hoping an animal will make their day, all have their own views of what makes a successful BASH program. If you read my last article and still aren't sure if your BASH program has problems, here's another little test for you.

You may have a BASH problem if:

—Your Bird Hazard Working Group (BHWG) reminds you of a scene from "The Godfather."

—You're constantly harassing Cajuns from trying to put duck-blinds on your airfield.

—The species of birds on your airfield resemble the Texas motto of "Everything big."

—You think the term "pyrotechnics" refers to an arsonist with a technical degree.

—While taxiing, you saw deer mating next to the runway and thought it was the funniest thing.

—You think the phrase "snap, crackle, pop" refers to your last sortie.

—Your wildlife management team reminds you of Wile E. Coyote.

—You've "slipped the surly bonds of earth" and wondered why you were surrounded by geese.

—You think there's such a thing as Canadian Geese.

—You open each BHWG meeting with "Here they come zooming to meet our thunder/At 'em boys, Give 'er the gun!"

—There's a Draft Day for joining your Wildlife Depredation Team.

—You've resorted to referring to moose as meese.

—The base populace uses the drainage ditch next to the runway as a swimming hole.

—The grass on your airfield resembles the hair-do of a certain boxing promoter.

—You think the phrase "wildlife management" refers to limiting the number of squadron parties.

—You think the terms "bangers" and "screamers" refers to your kids. (This is a family publication, folks!)

—Your harassment efforts sounds like a 4th of July celebration.

—Your base subsidizes its income by raising emus.

—You think Huey, Dewey, and Louie are evil incarnate.

—You take deranged pleasure in carving the Thanksgiving turkey.

—You think Alfred Hitchcock movies are non-fiction.

—You think "Cats" is the greatest Broadway show ever.

—You find yourself rooting for Sylvester while watching cartoons.

—You keep yelling, "BOO!" at your neighbor's parakeet.

—You know what the acronyms AHAS and BAM stand for.*

—You consider Col Harland Sanders a great American War Hero.

—The director of your wildlife management team is known as "The Punisher."

—Your base biologist lives by the motto, "Sha me? I don't know nuttin."

And lastly…

—You definitely have a BASH problem if you called the Feather Identification Lab at the Smithsonian Institution and understood the entire conversation without questions.**

The BASH warriors at the Safety Center are still working hard on our behalf, trying to ensure safer skies for all. Despite being a "high demand, low density" asset, they are there to help answer your flocking problems. Be sure to utilize them and, as always, please take care of yourselves and each other.

** For the record, they stand for "Avian Hazard Advisory System" and "Bird Avoidance Model." For a closer look, see "Avoiding Birds in the 21st Century" on page 16 in this issue.*

*** The cooperative effort between the Smithsonian and the USAF continues. See "DNA and Birdstrikes" on page 4.*

(Editor's Note: "Graz Marla" is a composite of several young wildlife ecologists who have been working on AFSC's BASH team. As they are all leaving soon, this is their "swan song.")

Illustration by Dan Harman

There I Was: "The Leans"

LT COL GREGORY E. DAVIS
AFOTEC, Det 5
Edwards AFB CA

I find writing about spatial disorientation (SD) both ironic and amusing. I recently sent an SD article to *Flying Safety* Magazine ("The Giant Hand," April 03). The ironic part of this article is I just finished a tour as the Aerospace Physiology Flight Commander at Sheppard AFB, TX.

My first real episode of SD happening in formation came when I flew the wing position on an approach in Undergraduate Pilot Training (UPT). Vance's weather that day was 600-foot ceiling with five miles visibility. The winds were out of the north at eight knots. I got to lead out and wing back. I had a great time in the area and thought I was ready to fly a regular formation approach. The tops of the clouds were right around 3000 feet on the clock. I wanted to do my best with my instructor, Maj "Stump" Stark, in the pit of my T-38. Initially, the flight was heading 080 and level at 3000 feet. In and out of the clouds we went as we started the left turn to dogleg. We also started the descent to the final approach altitude.

With one long turn ending and the rollout on the localizer, I was toast. Now solidly in the weather, we rolled out and, boom! It hit me—my first real case of the leans. There was no way on God's green earth you could convince me that I was not in 90 degrees of left bank, flying on the right wing while traveling straight ahead on a 351 heading centered on the localizer. I did my best to maintain position and fly the aircraft, even though everything in my brain told me I was in 90 degrees of bank. I have to be honest: I made one power correction larger than I should have during gear extension, and Stump took the jet from me. As soon as I looked at the ADI, the entire sensation of being in 90 degrees of bank went away. I asked Stump how he was doing, and he told me he was just as whacked out with leans as I had been.

I remember learning about SD in Aerospace Physiology back in pilot training, and I remember my ride in the Barany chair. While looking at various definitions of the leans, I found several descriptions for the illusion. The most interesting definition came from NASA's Dictionary of Technical Terms For Aerospace Use: "Leans: Illusion of a craft being tilted, with corresponding leaning of the crew in the opposite direction, caused by a false labyrinthine reaction uncorrected by visual cues." They define *labyrinthine* as "Referring to the labyrinth of the inner ear which acts as an acceleration sensor."

I'll stick with the description in AFMAN 11-217, Vol 1, Chapter 22, of what the leans are and how you get them. Here are some edited sections of that chapter (with my emphasis in italics) so if you haven't looked at it in a while, you can see what is there. The full chapter is worth rereading.

22.1.3. Susceptibility. It is important to remember that sensory illusions occur regardless of pilot experience or proficiency...

22.2.1.1. Semicircular Canals. The three semicircular canals on each side of the head are positioned at right angles to each other so that angular accelerations in any spatial plane (pitch, roll, or yaw) can be detected. The fluid within the semicircular canals moves relative to the canal walls when angular accelerations are applied to the head. This fluid movement bends sensory hair filaments in specialized portions of the canals, which sends nerve impulses to the brain resulting in the perception of rotary motion in the plane of the canal stimulated… *(Author's Note: In the School of Aerospace Physiology Standard Curriculum lesson dealing with SD, the following is taught: Subthreshold, less than two degrees/second rotation cannot be detected by the semicircular canals. Suprathreshold, two or more degrees/second can be detected. This is why the entry into an unusual attitude may be undetected (subthreshold) and the recovery (suprathreshold) from the unusual attitude generates the leans or other illusions.)* Additionally, angular accelerations experienced in flight can be quite different from those experienced on the ground. Hence, we can erroneously interpret the sensations produced by the fluid movement in the semicircular canal.

22.3.1.3. The Leans. This is the most common vestibular illusion and is caused by rolling or banking the aircraft after the pilot has a false impression of the true vertical... *The leans are most commonly felt when flying formation on the wing in the weather or at night...* These false orientation cues can quickly convince the wingman of being in an "unusual" attitude and cause a strong case of the leans. *To minimize the effects of the leans while on the wing, it is important for the wingman to occasionally cross-reference the attitude display, without making a head movement if possible.* Thus, the pilot must use focal vision to overcome the false cues and to acquire accurate spatial orientation information.

22.5.1. Personal Factors. Mental stress, fatigue, hypoxia, various medicines, G stress, temperature stresses, and emotional problems can reduce the pilot's ability to resist spatial disorientation…

22.5.6.3. Formation Flying. A demanding situation with a high potential for creating spatial disorientation is night or weather formation flying. Formation flying presents special problems to the pilot in maintaining spatial orientation. First, and most important, pilots flying on the wing cannot maintain appropriate visual dominance. They are deprived of any reliable visual information concerning aircraft attitude related to the earth's surface. They cannot see the true horizon and have little or no time to scan their own instruments. Under these conditions, it becomes difficult to suppress information provided by unreliable sources such as the vestibular system. *Illusions of various kinds are almost inevitable...* Poor in-flight communications and the lack of specific procedures *(properly briefed)* to recover a disoriented wingman will increase the potential for an aircraft mishap.

22.6.3.3.1. Division of Workload. The other crewmember can assist the pilot by… changing radio/IFF channels... The division of workload between the crewmembers should be clearly understood and covered in the *preflight briefing.*

22.6.3.3.2. Critical Phases. During departures, penetrations/en route descents, or critical phases of flight, the second crewmember should closely monitor and call out altimeter settings, altitudes, airspeeds, and other appropriate information.

22.6.3.4.2. Crew Coordination. Specific procedures concerning division of workload and crew coordination should be clearly understood and covered in the preflight briefing.

22.6.3.5. Flying Formation. All of the general principles for dealing with spatial disorientation apply to formation flights. Additional procedures are necessary since the potential for spatial disorientation is greatest for formation flights during night or weather conditions. *(Author's Note: Especially during temporary lead change and/or lost wingman procedures.)*

22.6.3.5.5. Disoriented Wingman. In the *preflight briefing*, the flight leader should cover specific procedures to manage a disoriented wingman.

22.6.3.5.6. Communication. The flight lead should encourage a wingman to verbalize a feeling of disorientation…

22.6.3.5.7. Persistent Problem. If the wingman continues to have problems, the lead should bring the flight to straight-and-level and advise the wingman. If possible, maintain straight-and-level for at least 30 seconds and up to 60 seconds. Generally, the wingman's symptoms will subside in 30 to 60 seconds. Advise ATC if an amended clearance is necessary.

22.6.3.5.8. Lead Transfer. If the above procedures are not effective, then lead should consider transferring the flight lead position to the wingman while straight-and-level.

Over the last 20 years of flying, I've had my fair share of SD episodes, you can rest assured—right up to the end. After almost four years instructing both students and instructor trainees at Sheppard, assignment time came, and I had to schedule my fini-flight. Given the chance to fly formation in the mighty T-37B Tweet, I jumped at it.

The weather for the day was 700 feet broken—overcast with the tops at 4000 feet, clear above. Sheppard has a field elevation of 1100 feet, so that meant we had about 2200 feet of weather to go through both going up and down. Getting to fly formation, I wanted to lead out and wing back for a formation approach and landing for my fini-flight. As luck would have it, the T-37s had the SOF duty that day so we pre-coordinated for an approach to the center runway with the Simultaneous Instruments status. The other pilot in my jet was Lt Kat "SOTOS" Richardson, the youngest Aerospace Physiologist on my staff.

It was so bad, I was sure we flew most of the approach inverted.

I had a great time, and the flight was uneventful until we descended back into the weather for the formation approach and landing. We got extended vectors with multiple turns to the right and the left. I was flying on lead's left wing while sitting in the left seat of the T-37. Due to the poor in-flight visibility, I didn't have any chance to glance at my ADI. SOTOS was padlocked on her ADI because she didn't want to get the leans. She also handled all the radio frequency changes for us.

It was really amazing. There I was, on the wing of an aircraft, and I had a really good set of the leans. I could see the sun peeking through the clouds above me, telling me my airplane should be right side up. No, that didn't cure the leans. I had SOTOS sitting next to me to tell me what attitude we were in at any given time. No, that didn't cure the leans. I know the somatogravic (seat-of-the-pants) sensation told me I was right side up. No, that didn't help either. Even though I was Chief of Aerospace Physiology, I got the leans. Nobody, including myself, is immune from the leans. It was so bad, I was sure we flew most of the approach inverted.

I have to say now it was amusing because I could run through all the things leading into the episode and how my body felt and dissect every detail. I could tell it was definitely my semicircular canals that gave me the sensation. Yet, I had to do what every pilot has to do in such events, just hang in position and wait to break out of the weather. Once we broke out, I was amazed the ground was actually down and not up. The gyros in my head re-caged, and I felt fine. We landed uneventfully, and I got the customary wet-down from coworkers, my wife and kids.

I want to repeat what I said on the platform to all my students at Euro-NATO Joint Jet Pilot Training: It can happen to anybody at any time. Get the proper rest, nutrition, hydration and mental preparation so you can battle it and come out ahead. Know yourself, and be honest about what is going on around you and inside you.

The Air Force continues to fight the battle of SD. We have lost $1.4 billion in airframes and, worse, 60 lives between FY 91 and FY00 due to SD—that is nine times the dollar cost and eight times lives lost to GLOC over the last 10 years.

As I mentioned at the end of "The Giant Hand," please take a trip to the ASDT (Advanced Spatial Disorientation Trainer) at Randolph AFB. While I will admit being biased toward the regular refresher training my now-former unit gives, I cannot top the training given in the ASDT. I only have one discrepancy I would like to note in the training the ASDT offers. When you get to the G-excess illusion, the console operator will ask you to return the simulator to the bank angle prior to the onset of the illusion. The way I did that was through the seat-of-the-pants feeling. You won't be able to use the seat-of-the-pants feeling to return your aircraft to straight and level or a prior bank angle. You will have to use visual information by looking outside or at the ADI to do so.

The ASDT can't stop you from getting SD, but it can help you learn to deal with it successfully. Brief 'em up and fly safe.

Departure Procedure Categories

HQ AFSC Photo by TSgt Michael Featherston

AIRPORT NAME	TAKE-OFF MINIMUMS
ALBUQUERQUE,NM ALBUQUERQUE INTL SUNPORT (KIKR/KABQ/ ABQ).	Rwy 8, RT, CAT A, B, 1700-2* Rwy 8, RT, CAT C, D, E, 2400-3** Rwy 8, LT, CAT A, B, 900-2*** Rwy 8, LT, CAT C, D, E, 3200-3†

* Or standard with minimum climb of 400/NM to 8000.
** Or standard with minimum climb of 400/NM to 9000.
*** Or standard with minimum climb of 220/NM to 7000.
† Or standard with minimum climb of 470/NM to 9000.
Comply with radar vectors, or Rwy 8, upon passing 5750 MSL turn left/right as assigned direct ABQ VORTAC. Rwy 12, 17, 21 turn right. Rwy 3, 30, 35 turn left. All aircraft climb direct ABQ VORTAC. Departures on ABQ R-147 CW R-023 climb on course. Departures on ABQ R-024 CW R-146 climb in ABQ VORTAC holding pattern (Hold W, LT, 077° inbound) to cross ABQ VORTAC at or above airway MEA/MCA.

MAJ JAMES L. TAYLOR
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12 OG/AIS
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Recently, the Air Force Advanced Instrument School (AIS) has received several questions regarding category restrictions listed as part of the IFR Departure Procedures (DPs) in the "Trouble T" section of the approach books.

For example, take a look at the IFR DP above for Albuquerque International Sunport, NM (this can be found in the "Trouble T" section of the DoD High and Low Vol-6). Notice it lists different "see and avoid" weather minimums for CATs A, B and C, D, E aircraft with associated climb gradient minimums for those categories. The general question is, "Are those categories the same as the approach category designations and, if so, what speeds are we expected to fly on the departure in each of those categories?" Good question, and as with just about everything else we talk about at AIS…"It depends."

Please keep a couple of things in mind while reading the discussion that follows.

(1) This applies to U.S. TERPS procedures only. ICAO is another story altogether.

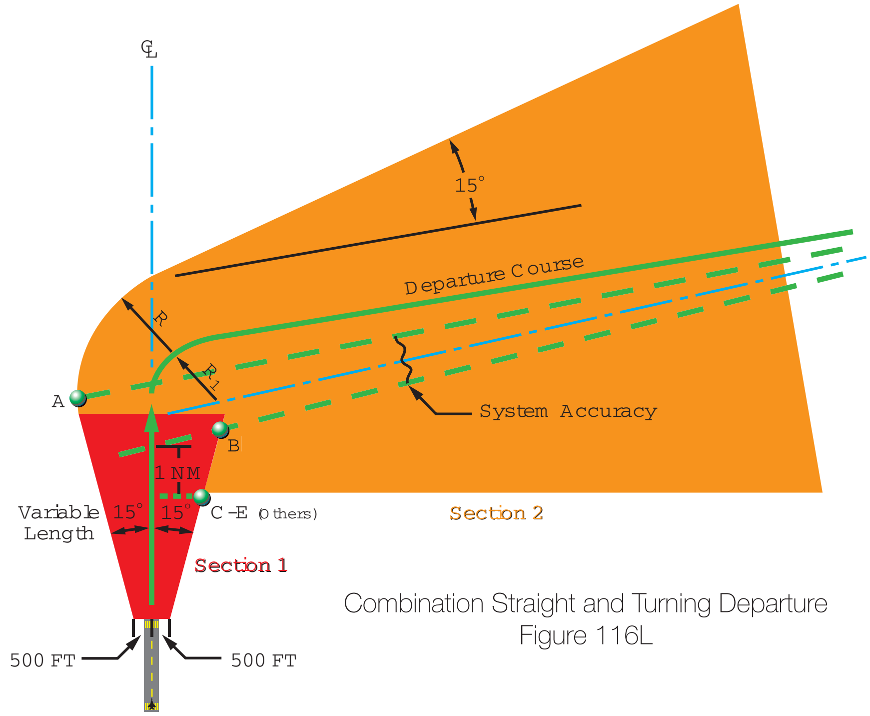
(2) Departure categories will only apply to turning departures; thus, the length of the turn radius may determine the obstructions considered and, ultimately, the climb gradient required.

(3) The discussions regarding airspeed, turn radii, flight track, etc., assume you are climbing at the minimum required climb gradient on the departure procedure. This means you will turn at the last possible moment. (Aircraft climbing at significantly higher rates than required on the DP will typically turn earlier and should stay well inside the protected airspace on the departure.)

Thus, the point of this discussion is to make pilots aware that there are, in fact, airspeed assumptions built into the DP. Hopefully, this information can help make you a safer pilot.

Figure 116L and Table 31 come from FAA Handbook 8260.3B, Change 1 (TERPS), and they are the figure and table used in the basic construction of turning departure procedures. The value "R1" in the figure and table is the turn radius of the actual flight path, whereas "R" is the outer boundary radius used in the construction of the departure area used to search for obstructions, etc.

Notice that the table divides the flight track radii into Categories A and B and then "Others" ("Others" meaning Categories C thru E). Seeing the radius on the table begs the question, "What speeds do those radii assume?" We've done some simple chart chasing on the turn performance chart in AFMAN 11-217v1, Figure 20.7,2 and here's what we've discovered.



Combination Straight and Turning Departure
Figure 116L

Departure Turn Radii				
Turn Altitude	Flight Track Radius NM (R_1)		Outer Boundary Radius NM (R)	
	Categories A and B	Others (Categories C-E)	Categories A and B	Others* (Categories C-E)
S.L. to 1000' MSL	1.0	2.5	2.0	5.5
1001' to 3500' MSL	1.2	2.7	2.4	5.9
3501' to 6000' MSL	1.3	2.9	2.6	6.3
6001' to 8500' MSL	1.4	3.1	2.8	6.7
Above 8500' MSL	1.6	3.4	3.2	7.3

*These turn radii will accomodate speeds up tp 350 KIAS with 30 degrees angle of bank. Outer boundary radius may be reduced 1/2 NM for operational advantage. Procedure must be annotated with airspeed restriction of 250 KIAS.

Table 31

Using the flight track radii in the CATS A and B column and entering the chart assuming 30 degrees of bank, we find that the true airspeed needed to make each of those turn radii work equates to an approximate indicated airspeed of 200 knots or less. That seems reasonable—Category A and B aircraft probably won't fly faster than that on departure, anyway. Looking at the "Others" flight track radii, we find that roughly 310-320 KIAS results in those radii at those altitudes. Keep in mind, however: These numbers are only rough estimates we pulled from the chart, for illustration purposes only. Interestingly, the current TERPS manual does not specify any maximum or minimum airspeeds associated with any of those radii in the table above, except for the note that applies to the "R" (outer boundary radius) value used in the area construction. What the note says, essentially, is this: Even if you fly as fast as 350 KIAS on departure, the obstacle area is big enough that you should still remain inside protected airspace. We say "should" because the note assumes you start your turn no later than the farthest point in space predicted to be your turn point. If you turn past that point…you're outta there.

OK, so how do we apply this to daily flying operations? Let's consider what we know about typical departure depictions or descriptions in an approach book.

(1) Do we typically see any maximum (or minimum) airspeeds listed on the DP? "No."

(2) If our tech order (T.O.) or MAJCOM authorizes us to fly faster than 250 KIAS below 10,000 feet, do they take into consideration TERPS? "No."

(3) Does AFMAN 11-217v1 say anything about maximum airspeeds on DPs? "No."

(4) Are you beginning to wonder why you haven't hit anything yet? "Perhaps."

When you look at a DP that lists separate climb gradients for Category A and B and then C, D and/or E, do you need to do anything radically different when you fly the departure? Well, we think the speeds calculated above tell the tale. Fly the departure at your normal T.O. airspeeds, using the published climb gradients for your aircraft category (i.e., a Category B aircraft on approach will use

Primary Area Outer Boundary Radius (R_1)				
Aircraft Speeds	**90**	**120**	**150**	**175**
Turn Radii Below 10,000' MSL	0.9	1.4	1.9	2.4
Turn Radii 10,000' MSL and Above	1.4	2.0	2.7	3.3
Aircraft Speeds	**180**	**210**	**240**	**250**
Turn Radii Below 10,000' MSL	2.5	3.2	3.9	4.2
Turn Radii 10,000' MSL and Above	3.4	4.3	5.2	5.5
Aircraft Speeds	**270**	**300**	**310**	**350**
Turn Radii Below 10,000' MSL	4.7	5.6	6.0	7.3
Turn Radii 10,000' MSL and Above	6.2	7.3	7.7	9.3

Speeds include 60-knot omni winds below 10,000' MSL; 90-knot omni winds at 10,000' and above; bank angle 23°.

Table 3-2

the Category B minimums on departure). And if you must speed, please keep the following idea in mind: Category A and B aircraft should not exceed 200 KIAS, while "Others" (C, D and E) should not exceed 300 KIAS (250 KIAS below 10,000 feet unless authorized higher by T.O., MAJCOM, FAA, etc.) when category limits are posted. If the DP doesn't break down the climb gradients by category, it's safe to assume the designer used the "Others" column in the table. Thus, in this case, speeds up to 300 KIAS will work fine for all categories. Generally, once you get above 10,000 feet, obstacles aren't a huge concern. However, if you are in one of those areas where mountains are everywhere (e.g., Jackson Hole, WY), you might be well served to keep your speed at or below 300 KIAS (250 KIAS is even better) until you are established in the en route environment. Dumping the nose at 10,000 feet to accelerate to 400 KIAS (standard in the T-38) is not a wise move in these instances.

Having said all this, the newest version of TERPs (FAA Handbook 8260.3B, Change 19) has some slight differences regarding DP construction that are worth noting. Essentially, Change 19 clarifies the speeds and turn radii used for departure construction and gives the TERPS designer (a.k.a., TERPster) additional guidance for publishing maximum airspeeds or non-standard departure airspeeds. Take a look at Table 3-2 from Change 19 above. Here we see that they've eliminated all those different altitudes shown in Table 31 (Change 1) and only differentiate between turn radii below 10,000 feet MSL and at and above 10,000 feet MSL. Also, notice the wind and bank angle assumptions factored into these turn radii. Change 19 makes it simple for the TERPster (from paragraph 3.5.1.):

"For turns below 10,000 feet mean sea level (MSL), use 250 KIAS unless a speed restriction other than 250 KIAS is noted on the procedure for that turn. For turns at 10,000 feet and above, use 310 KIAS unless a speed restriction not less than 250 KIAS above 10,000 through 15,000 feet is noted on the procedure for that turn. Above 15,000 feet, speed reduction below 310 KIAS is not permitted."

Let's take another look at Table 3-2. Based on the guidance from paragraph 3.5.1, the TERPster will use a 4.2-mile outer boundary turn radius below 10,000 feet and a 7.7-mile radius at and above 10,000 feet when designing a DP using Change 19 criteria. Thus, from a pilot's perspective, if you can maintain 250 KIAS or less below 10,000 feet, and 310 KIAS or less above 10,000 feet (unless published otherwise), you'll be fine. Change 19 criteria are currently being applied to all new civil DPs and slowly but surely being applied to existing civil DPs as airfields come up for routine TERPs reviews. Albuquerque International hasn't undergone a TERPS review in a while, but chances are the departure categories will go away when it does. As far as Air Force airfields are concerned, however, Air Force Flight Standards Agency has this to say: "USAF TERPS will not implement Change 19 until all of our TERPsters are trained on our new TERPS automation software and until the software is fielded sometime next year [2004]. We expect there will be a 24-month grace period [thereafter] to ensure all CONUS departures/approaches meet the Change 19 criteria." Thus, you shouldn't see any noticeable differences on Air Force-designed DPs for a while.

You might wonder when those other airspeeds listed in Table 3-2 come into play. Well, according to paragraph 3.5.1c: "When speeds greater than 250 KIAS are authorized below 10,000 feet MSL, and speeds greater than 310 KIAS are authorized at or above 10,000 feet MSL, use the appropriate speed in Table 3-2." When this happens, there will be a note published that will say, for example, "Do not exceed 270 knots until CHUCK intersection."

Everything discussed so far addresses concerns about turning at the farthest possible point or overshooting the turn due to excess airspeed (i.e., flying a larger turn radius than designed). If you're wondering what happens if you turn early or have a very high climb gradient resulting in a short-distance turn on departure, look again at Figure 116L above. The protected airspace on the inside of the turn starts before the actual turn by over a mile…but not that much over. We wouldn't recommend going vertical off the deck and turning; you might not be in protected airspace. When flying a DP, fly at normal airspeeds, at normal bank angles, and at (or reasonably above) the recommended climb rates, and you should have no problems with obstacle/terrain clearance.

Fly safe! ■

Avoiding Birds

In The 21st Century

Photo Illustration by Dan Harman

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Approximately one-quarter of all bird strikes to USAF aircraft occur on low-level and range missions throughout the world. A largely disproportionate amount of damage and catastrophic incidents are recorded from these strikes, however. While bird strikes in the airfield environment are always a concern, they are much more easily addressed than those in the off-airfield environment.

Airfield bird control measures begin with aggressive habitat management and also require active bird dispersal techniques. Occasionally, population control measures are warranted. These techniques are widely used and accepted after many decades of applied experience by military and civilian agencies across the globe.

However, once an aircraft departs the managed airfield environment, bird control is no longer a viable option. Unfortunately, bird movements in the low-level and range environments often coincide with USAF mission profiles. Avoiding these bird concentrations in time and space becomes the only alternative to minimize the risk of bird strikes.

In the mid-1980s the USAF began the effort to reduce the incidence of off-airfield bird strikes with the development of a Bird Avoidance Model (BAM). Early BAMs were crude by today's standards. Rough bird migration corridors of species, such as waterfowl and some birds of prey, were overlaid on navigation charts to depict concentration zones. More detailed analyses required manual data collection and months of effort for individual flight routes. The current BAM has built upon the earlier results to the web-based product now widely used by units throughout the continental Unites States. Today, analyses can be accomplished in minutes, at much finer resolution, and for any portion of the area of coverage.

The BAM uses the most up-to-date information on bird distribution and abundance gathered from myriad sources and updated as new information becomes available. It also depicts a wide variety of environmental, human infrastructure, and operational flight data that can be customized by the user for flight planning purposes. The bird risk surfaces, color-coded by relative severity, are based on historical averages of bird population data over the most recent 30-year time span.

It is widely recognized that bird distribution is not as static as might be implied by the BAM. Species populations fluctuate and even historic migration routes can change over time. For these reasons, new data is added to the model whenever it becomes available. New risk surfaces resulting from updated information, new interpolation techniques, and advanced statistical analyses will be available on the website very shortly. All users should be made aware of the upcoming changes.

Along the same lines, we also know that local and regional weather patterns are not static over time and can have strong influences on bird movements, particularly during migrations. The Avian Hazard Advisory System (AHAS) was designed to address these concerns.

Many people mistakenly confuse the AHAS and BAM as separate systems when in fact they are a single integrated system and should be used as such. Think of AHAS as a dynamic version of the BAM. The BAM underpins all of the AHAS forecasts in the following manner. Data from the BAM are used to predict the seasonal occurrence of birds based on their historical patterns over long periods of time.

Weather has a strong influence on the timing and scale of bird migrations, particularly when favorable atmospheric conditions and winds occur. Thus, an integrated system of weather radars is monitored around the clock and across the continent. The radar network data is used to adjust the underlying BAM risk surfaces based on the current and forecasted meteorological conditions. If birds are predicted in the area by the BAM, and the AHAS system depicts favorable weather conditions, the risk may be elevated until the weather settles back to "normal" conditions. At that time, the risk may stabilize or even be reduced.

These radars can also detect large flocks of birds such as geese or swans as they migrate across the landscape. The velocity and direction of such movements allows a forecasted bird condition downstream, up to 48 hours in advance of the birds' arrival. This may also result in the temporary adjustment in the BAM risk surface during the birds' passage. If flight planning occurs within the forecast window of up to 48 hours in advance, the user should consult the AHAS portion of the system for the most current conditions on the intended flight route. Any request made outside that window reverts to the underlying BAM risk surface, based on the historical trend along the route.

Due to the enormous amount of data being analyzed on the fly in the AHAS system, the output can only be queried by specific routes or operating areas and in tabular format. In the future, as computational capabilities improve, a graphic format that mimics the BAM is planned.

Users of the BAM/AHAS system are aware that the risk of bird strikes is never completely eliminated. The system is intended to minimize the risks and tilt the odds in the favor of hazard reduction. As with any safety program, it is impossible to measure what doesn't happen, but the system appears to be very successful, based on strike statistics. Efforts are underway to improve and update the models in its continuing evolution. One of these efforts is the expansion to new regions where the USAF operates.

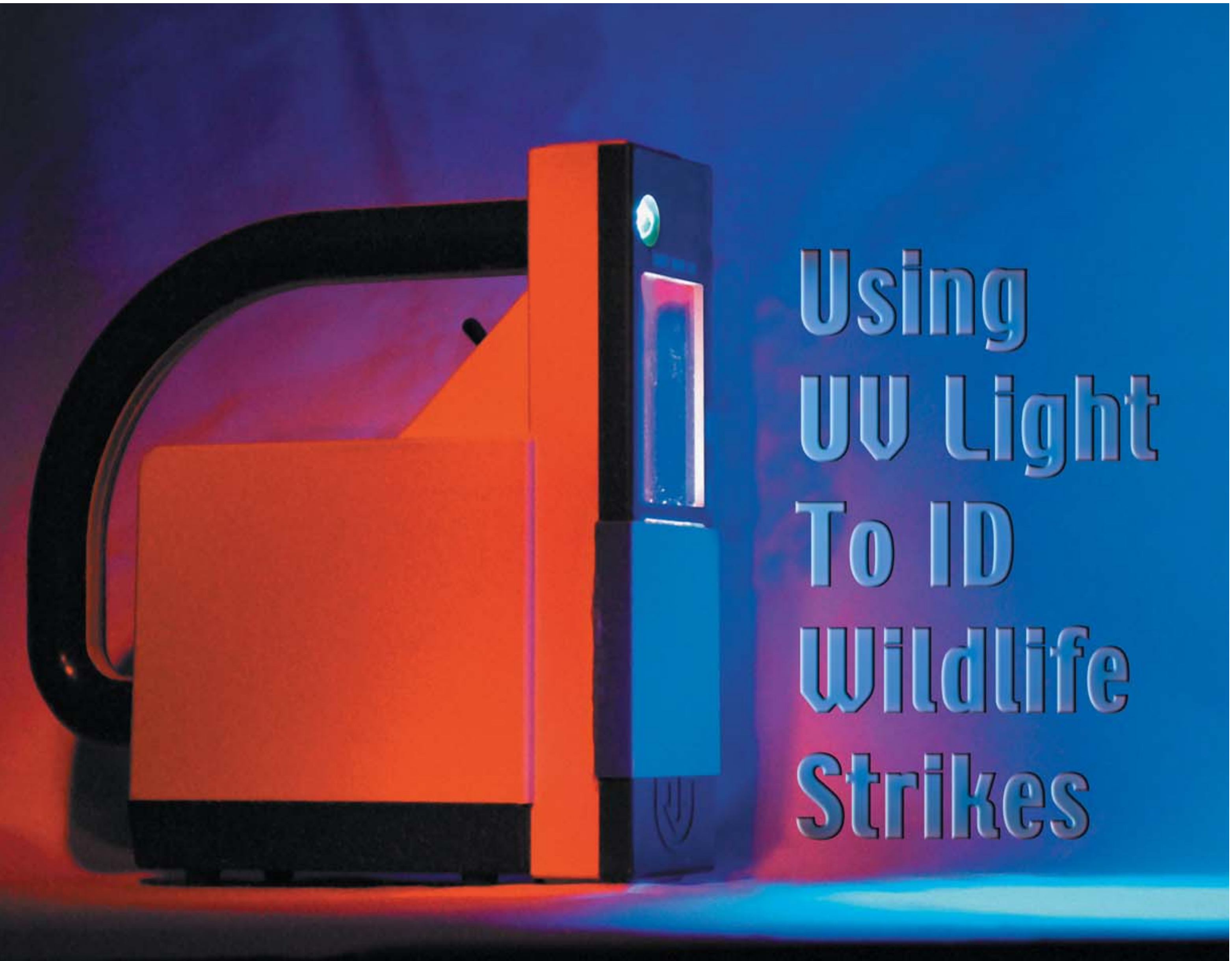
The Air National Guard has recently provided some end-of-year fallout funding to begin the development of a Bird Avoidance Model for the state of Alaska. Seed money has been provided to initiate the project, but will fall short of the full funding required to develop a system of the caliber currently operating in the CONUS. The USAF BASH Team is seeking partners in the using Commands, and elsewhere, to continue the effort. An Alaskan BAM, and ultimately AHAS, is very critical because there is an enormous volume of airspace used by Alaskan flying units, as well as global exercises such as Cope Thunder, in areas with extremely high bird concentrations. Many species of birds nest in the Arctic, and vast migrations occur throughout the state.

The challenges facing the development of the Alaska BAM are numerous. Data is sparse in many regions, particularly where human populations are low. Radar coverage is scant or non-existent in many areas of the state. Fortunately, many federal, state and private agencies have indicated willingness to participate with the USAF as the data gathering effort is initiated.

The German Geophysical Institute is also sending a visiting scientist to spend a year with the research team at the USAF Academy in Colorado Springs. He will be an integral part of the team and will assist in the project during his visit. The goal is for him to learn the USAF bird avoidance system and take it home where a compatible system can be developed for Europe.

Development of systems to avoid bird strikes in the off-airfield environment are being aggressively pursued. Hopefully, compatible formats for an envisioned global system will result in much safer flying environments for USAF aircraft wherever they operate. Improvements are being made continuously in the existing systems, and new regions are being addressed as interest and funding becomes available. These improvements will result in safer flying environments as we charge into the 21st century.

Lt Col (Ret) Russell P. DeFusco, PhD, is a graduate of the USAF Academy with advanced degrees in Wildlife Biology and Ecology/Ornithology. A former Chief of the USAF BASH Team and retired Associate Professor of Biology at the USAF Academy, he has worked on the development of the Bird Avoidance Model since its inception in the mid-1980s. He is Vice President of BASH Incorporated and now manages the research team conducting the current work under contract with the BASH Team from the USAF Institute for Information Technology Applications at the USAF Academy.



Using UV Light To ID Wildlife Strikes

HQ AFSC Photo by TSgt Michael Featherston

GENE LEBOEUF
HQ AFSC/SEFW

That old college UV light may actually be useful.

If it is suspected that a bird or some other animal has struck an aircraft, how does an investigator go about determining what may have happened? One of the "trade secrets" of such an investigation involves the use of Ultra Violet (UV) light. Natural materials, such as body fluids, oils or other small objects will fluoresce a bright chartreuse color under UV light.

UV lights are used for a number of industrial and medical purposes. Aircraft engines may be "borescoped" by technicians using UV lights and doctors commonly use them to illuminate foreign objects in a patient's eye. That's right, that old college UV light may actually be useful for something other than showing off your old "black light" posters.

Is there a special light used for this task, or can you use the old college light? The answer is no, there is no "special" UV light used to identify bird remains. Most Quality and Assurance shops will have a UV light available if needed. BASH Team members use more than one type, and all will do the job to sufficiently illuminate bird remains. There simply are different lights for different applications. How or where the light will be used will dictate which type will work best. If you were going to be using it out at a mishap scene, you would obviously want a battery-powered type. Choose one that uses readily obtainable batteries because if you purchase one with a special-use battery, it will surely leave you when you need it most, and it is likely that no one will have the replacement battery when you need one.

Battery-powered UV lights are available in sporting goods stores and through catalogs. Apparently, sportsmen use them for night fishing. These are robust enough for fieldwork and are easily transportable. If you can't find one in a local store, a sporting goods catalogue dealer such as CABELAS© sells several models. A benefit of purchasing from sporting goods dealers is that these models will normally use regular batteries. When all else fails, check out websites.

If you will be working in a hangar, a plug-in shop or work light with a UV bulb works well. For close-in work where there is electricity, a Woods Lamp works very well. The Woods Lamp is the kind that doctors use to look for foreign objects in a patient's eye, as mentioned earlier. These lights can be purchased through a medical supply source. Check with employees at your doctor's office to inquire how and where they purchase their supplies. The Woods Lamp uses a fluorescent ring-shaped UV light with a magnifying lens in the middle. It is the best one for going over a control surface where there may only be small droplets or splatter. The magnifying lens is great for finding small feather remnants when inspecting under these circumstances.

A fluorescent shop light, the kind that uses a straight fluorescent light tube of about 12 to 18 inches in length can be used; you simply have to replace the standard bulb with a UV tube. Be sure the type purchased will accept a UV bulb. These can be really handy if you are tasked with looking for remains inside an engine. The narrow bulb can be inserted between fan blades to inspect for material. If there are bird remains in the engine, you can usually ferret them out with this light and the old nose. (Smells like chicken!)

If you can't find any of the lights suggested above, you may have to be creative with what is available; a handheld fluorescent camping light could be outfitted with a UV replacement bulb if you can find the right size. Even a standard incandescent shop light, replaced with a UV bulb, will work. As mentioned earlier, they will all fluoresce bird material (or, as we say, "snarge") with a readily observable chartreuse color. The best type of light will be one that is usable for the situation, be it field or shop. Keep in mind, all lights work better if you can shade or darken the area being illuminated by UV light for the best effect. Having a tarp to shade the area may be very useful for that purpose.

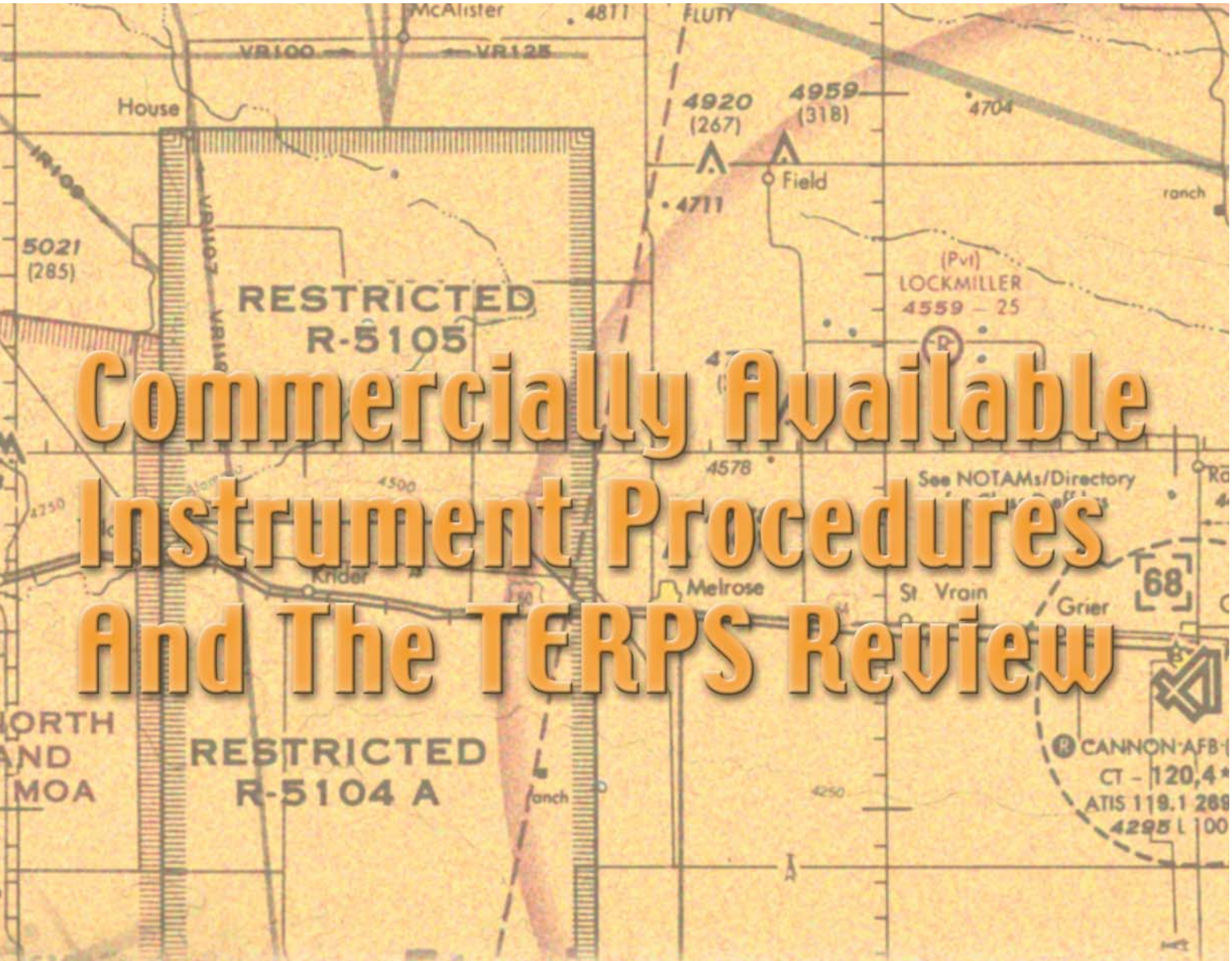
Normally, when birds or other wildlife strike an aircraft, there are usually enough visible remains left behind to collect and send off to the Smithsonian Institution for identification. However, in some cases, there isn't much snarge left to collect, and that is why the USAF is partnering with the Federal Aviation Administration to develop a DNA lab.* When the DNA lab becomes fully functional, identifying strikes will enter a new era. With DNA, it is possible that even small bits of previously unidentifiable material may be identified.

Whereas it may not be necessary to use DNA to identify all strikes, in some cases where the information is vital to the testing of new and sophisticated systems or during a mishap where there is no one left to explain what happened, collecting a sample for DNA analysis may be the only way left to turn. Over the years, members of the BASH Team have learned to use more technical approaches to locate minute bird remains on aircraft involved in mishaps. In these situations, the BASH team may use special equipment to locate these remains on the skin of the aircraft or inside engines. With the advent of DNA identification, future remains collection may require the use of specialized equipment.

In the near future, when DNA identification for bird and other wildlife remains becomes a reality, using UV lights will allow you to quickly identify the impact area and where you may try to collect samples.

* *See "DNA and Birdstrikes" on page 4.*

The Woods Lamp is the kind that doctors use to look for foreign objects in a patient's eye.



Commercially Available Instrument Procedures And The TERPS Review

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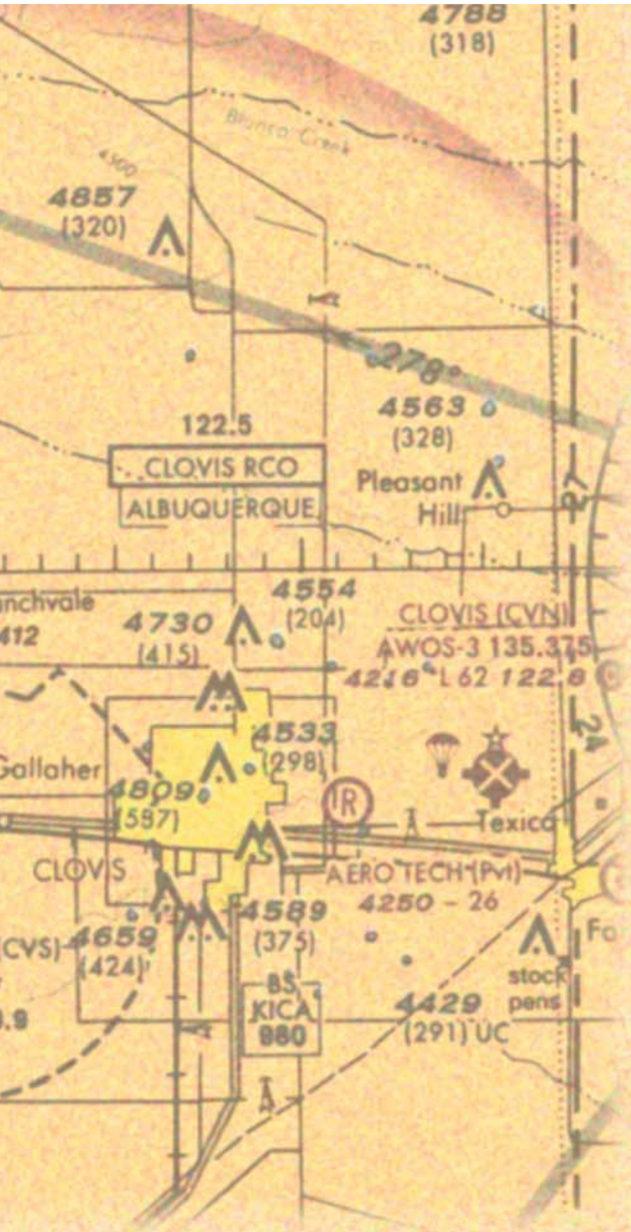
Imagine you're at the end of a long mission and a little tired. The weather is challenging, but your home field weather forecast promises an easy instrument procedure. The flight is flawless so far, except the actual weather is less than forecasted. As you have many times before, you plan the perfect approach by studying and briefing all pertinent items on the commercial vendor's plate. Everything looks good, and you're reassured when you hear the confident controller say "Heat 11, turn left heading 3-6-0, maintain 1500 until established on localizer, cleared I-L-S runway 2." You even catch yourself getting a little complacent, knowing another successful flight will be terminating shortly.

"We can't guarantee..."

Just as you remind yourself not to fall into the complacency trap, the controller interrupts your peaceful thoughts. "Heat 11, I'm sorry but we can't guarantee the adequacy, reliability, accuracy, safety or conformance with government standards of this instrument procedure." Puzzled, you ask the controller to "say again," to which he replies, "The flight procedure chart you're using simply depicts in a graphic form convenient for the use of knowledgeable, instrument-rated pilots, the flight procedures exactly as designed, flight-tested and prescribed by government authorities. The company that supplies your chart doesn't design or flight-check any published procedures, and has no authority to alter, modify, add to or subtract from any flight procedure prescribed by a governing authority. Additionally, the publisher of the chart doesn't accept



responsibility for any adverse outcomes from using this procedure chart, including hitting terrain or obstacles." Fortunately, you break out of the overcast before the controller finishes his transmission, you pick up the field visually and land, trying to figure out what the controller was talking about.

As crazy and unlikely as this hypothetical situation seems, you may be taking the same risks that the fictitious pilot of Heat 11 unknowingly did when using commercially available instrument procedures (CAIPs) OCONUS. There are a number of circumstances that pilots and aircrews may be unaware of when using CAIPs. This article will discuss common misconceptions about CAIPs, potential problems using CAIPs, why the requirement for TERPS reviews exists for any non-DoD or non-NOAA instrument procedure, what aircrews can do to help the non-DoD review process, and what can be done to minimize the risks when using CAIPs.

Looking at a highly polished CAIP may give pilots a false sense of security. A common misconception is that if a procedure plate looks good, the procedure must be current and developed using proper criteria. Unfortunately, looks can be deceiving. Vendors that offer commercially available procedure charts simply copy information from host nation governments' documents, then publish the procedures in a recognizable, easy to use format. The commercial vendor may not ensure proper obstacle clearance criteria has been applied. The two most common problems with CAIPs are failure of the commercial vendor to reflect changes made to the Foreign Terminal Instrument Procedure (FTIP) by host nation governments, and the publication of instrument procedures that do not meet FAA or international standards.

I know, you're asking yourself, "So if the CAIP matches the information in the host nation Aeronautical Information Publication, and the host nation government applies the correct TERPS or ICAO PANS-OPS criteria, then what's the problem?" If the host nation FTIP is designed using proper criteria and is current, there's no problem. Unfortunately, there's no way to determine this without a TERPS Review. Before talking about what problems may exist in an FTIP, an explanation is needed of how USAF TERPS classifies host nation TERPS programs, how non-DoD reviews are performed, and how FTIPs are published in the DoD FLIP.

One item that needs explanation is the USAF Host Nation Acceptance Program. HQ Air Force Flight Standards Agency (AFFSA) establishes the guidelines for this program and is the final approval authority. Each MAJCOM completes a detailed host nation evaluation checklist and conducts on-site host nation visits. There are three classifications of host nation TERPS programs. They are: special accredited, accredited, and non-accredited. Special accredited status may be granted to host nation civil or military programs and to individual airports where the USAF has placed the highest degree of confidence in their instrument procedure development and publication

Looking at a highly polished CAIP may give pilots a false sense of security.

In some cases, the host nation may not publish ceiling and visibility on their charts.

practices. These development and publication practices are equal to FAA or DoD standards. The TERPS programs at special accredited locations are so good that aircrews may use the host nation FTIP directly (if proper training is provided to the aircrews to make them aware of the differences between the host nation product and DoD Flight Information Publication (FLIP) product). The non-DoD review and publication process for instrument procedures based on the special accredited host nation source is minimal. In some cases, the host nation may not publish ceiling and visibility on their charts (this in not an ICAO requirement) and MAJCOM TERPS must determine and provide these values for the aircrews. When these values are furnished by the host nation, then the aircrew can fly the host nation plate as published. If the crew wants to use a CAIP, a corner-to-corner comparison must be conducted between the host nation plate and the CAIP during a non-DoD review. The corner-to-corner review is necessary to ensure the CAIP contains the current host nation data. Although current data is important, the way a host nation applies standards is also important.

If a host nation's TERPS program is good, but the USAF doesn't have the highest confidence, then accredited status may be granted. Unlike special accredited status, which may be granted to qualified military or civil airports and military or civil host nation programs, accredited status is applicable only to military or civil host nation programs. The non-DoD review and DoD publication process is more in-depth for FTIPs based on accredited host nation sources. A detailed checklist that analyzes each segment of an instrument procedure must be completed during the non-DoD review or DoD publication process.

When a host nation's instrument procedure program isn't granted either accredited or special accredited status, or if it hasn't been evaluated by the MAJCOM TERPS function, it's considered non-accredited. Non-accredited status applies to programs that the USAF doesn't have confidence in their instrument procedure development or publication practices.

When HQ AFFSA doesn't recognize a host nation as meeting basic safety requirements, the nation is left off the list, making FTIPs from that host nation unusable until a complete TERPS review can be completed and ORM assessment is completed by the MAJCOM DO. Full instrument procedure development is required during the non-DoD review and prior to publication in the DoD FLIP. The non-DoD review process and procedure development for non-accredited locations can take from several days up to several months to complete.

As you can see, the various host nation accreditation statuses result in different levels of scrutiny during a non-DoD review. Now that you have a basic understanding of the different levels of accreditation of host nations, we can talk about some common problems with CAIPs.

One of the most common problems occurs when the host nation FTIP's effective date is more current than the CAIP. This means that it's highly likely that something changed on the host nation procedure, and that this change isn't reflected on the CAIP. Granted, the change could be anything from a change in the ground control frequency to a drastic change in an MDA or DH which may keep your aircraft from hitting a newly-erected cell phone tower. Or, maybe nothing has changed at all. The only way to know is to check the CAIP against the host nation FTIP. The other problem occurs when the commercial vendor copies a host nation FTIP that doesn't apply proper TERPS or ICAO PANS-OPS criteria. This situation usually occurs in host nations in the non-accredited group. Procedures that do not apply proper TERPS criteria could be published exactly as the host nation plate but still get your aircraft dangerously close to terrain or obstacles.

Now that there's an understanding of what problems can be experienced when using CAIPs, we can look at how aircrews can help the MAJCOM TERPS office before, during and after a non-DoD review is accomplished.

The MAJCOM TERPS office must conduct a TERPS review whenever the mission dictates use of an OCONUS airport that doesn't have instrument procedures published in the DoD FLIP. Of course, the MAJCOM DO can waive the review, if operationally necessary. Sometimes the flight planning process allows TERPS reviews to slip through the cracks, and a TERPS review isn't requested until it's too late. Unfortunately, MAJCOM DO waivers are rarely approved because of administrative errors. Although the process is simple, it's easy to miss some seemingly insignificant items, if not careful.

One such item is timely requests. When a short-notice requirement comes up, that's understandable, and the MAJCOM TERPS office will exhaust all means to get the review accomplished in time to be useful to the aircrew. When a mission is being planned, there's a requirement for host nation review requests to be forwarded to the MAJCOM TERPS function at least seven duty days prior to the date of anticipated use. Check with your applicable MAJCOM for other time requirements that may be specified. This lead time ensures all data can be gathered and analyzed before the departure date. Remember, there may be times when the specified lead time may not be enough time to complete the necessary review at some locations, so the sooner the request is entered, the more likely a procedure will be available to you for the mission.

Another item of concern to TERPS is that the AF Form 3992, *Instrument Procedure Flyability Check—Instrument Approach Procedure (IAP)*, and AF Form 3993, *Instrument Procedure Flyability Check—Departure Procedures (DP)* aren't being completed and then forwarded to the TERPS office after the aircrew flies the procedure successfully. The flyability check is the only way the TERPS office can verify that the host nation procedure data is accurate, or inaccurate. I believe aircrews are under the impression that once they "sign off" an instrument procedure, they become legally responsible for the safety of the procedures. This impression is not correct. Aircrews aren't liable, nor are they approving or flight-checking a procedure, when any of the satisfactory boxes are checked on the form. The form is simply a feedback tool the TERPS office uses to make the non-DoD TERPS review process better, safer, and more accurate for future reviews. The more information that's put on the forms, the better.

For instance, being the thorough pilot you are, you want the most data available for the flyability checks. Rather than just asking for vectors to final, you ask for the full approach. Upon your request, ATC replies, "If you want to land here, you will fly straight in." So you have no choice but to accept vectors to the final approach course. Now you're thinking, "Too bad I couldn't get the full procedure so I could fill out the flyability check form." Did you realize that your word is the most important feedback TERPS can ever get on the flyability of host nation procedures? The TERPS office would rather get a form that only has comments on the final segment than nothing at all. Every completed (or partially completed) form helps the TERPS specialists get an overall idea of a particular location. The TERPS review process isn't over after you get the review from the TERPS office; it's not even over when the TERPS office receives the AF Form 3992 or 3993. The TERPS review process is dynamic and always changing, and the non-DoD TERPS review guys need all the help they can get.

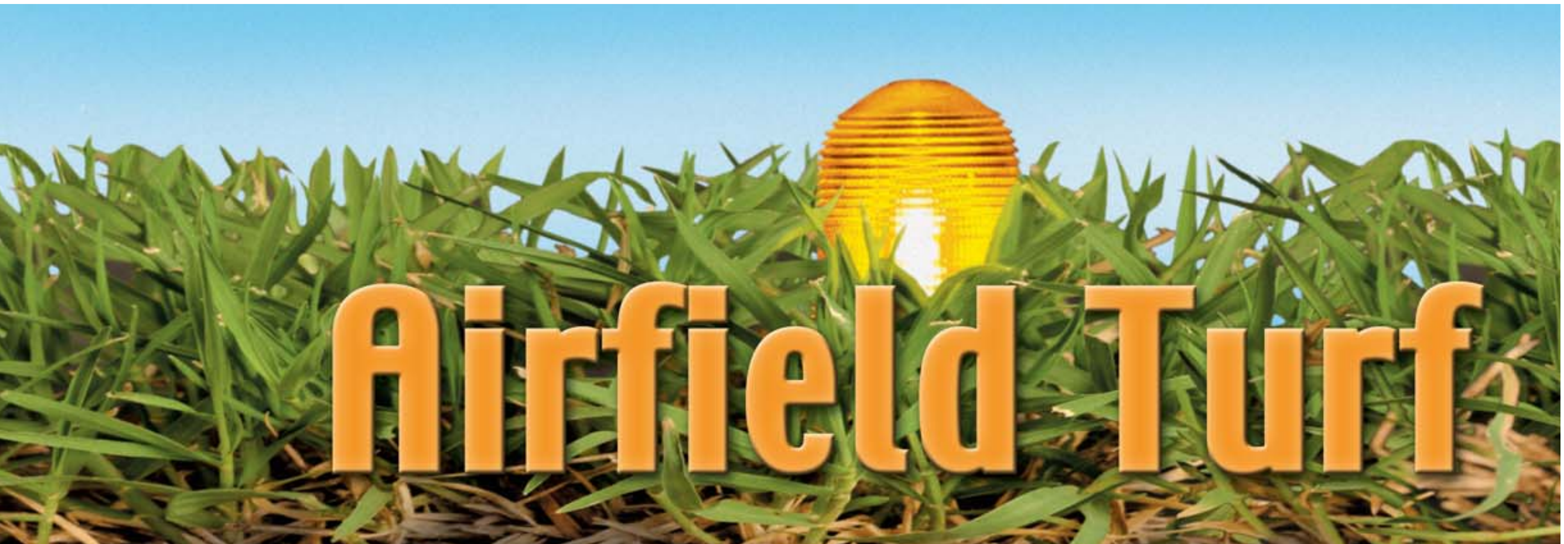
Speaking of needing all the help they can get, there's one more thing that sometimes happens. It seems the TERPS office is sometimes the last organization that knows a mission has been canceled. It's very important to let them know that a mission has been canceled, and the TERPS review is no longer needed. Actually, in some cases the TERPS office only finds out the review was not needed anymore when the flying unit gets the review sent to them and says, "That mission was canceled three weeks ago."

I hope that this article clears up any misconceptions you may have had about non-DoD reviews and their relationship with CAIPs. Hopefully, you also understand why your MAJCOM TERPS office is so meticulous when dealing with non-DoD reviews, host nations' CAIPs, and trying to get flyability checks.

Of course, if you have any questions you can always contact your friendly TERPS office for any clarifications. That's what the pilot of Heat 11 did as soon as he landed, and guess how surprised he was when the TERPS office told him that the controller's new phraseology is actually part of the disclaimer that the commercial vendor puts on the instrument procedures this pilot was using!

(Editor's Note: Our thanks to Mike Clayton, Air Force Flight Standards Agency, for his help with this article.)

Your word is the most important feedback TERPS can ever get on the flyability of host nation procedures.



Airfield Turf

GENE LEBOEUF
HQ AFSC/SEFW

If your work environment happens to include a runway, you more than likely have had more than your share of questions regarding grass, or more correctly, turf management. Rest assured, you are not alone: Most airfield managers regard turf maintenance as a royal pain in the posterior.

Actually, turf, or other forms of cover, is necessary and provides a vital function to the airfield. Turf grass keeps dust and other blowing grit away from engine intakes. Most importantly, turf protects paved surfaces by keeping dirt along the runways/taxiways and other paved surfaces around aircraft movement areas from being blown away by repeated jet blast.

All that grass around aircraft movement areas also functions as a safety area. Keeping areas around the runways covered in some form of vegetation maintains the surface such that it does not cause harm to an aircraft that may have to leave the prepared surface during an emergency, under normal dry conditions.

It is a given that airfields must be mowed regularly. However, mowing is an intense attraction to many birds and other forms of wildlife, and the more frequently an airfield is mowed, the more wildlife will be attracted. Mowers not only maim many insects and small mammals, but mowing to a short height exposes these sources of food. In addition, new growth that follows mowing is more succulent to grazing species.

That being said, care must be exercised to assure whatever is used to cover the safety area and protect the runway/taxiways does not create another hazard. One such hazard would occur if the cover used poses a direct attraction to, or creates excessively good habitat for hazardous wildlife. This is the primary reason why it is specified in AFI 91-202, *The US Air Force Mishap Prevention Program*, that vegetative height be maintained between seven to 14 inches. The question on airfield management's mind then becomes, "Why seven to 14 inches?"

There are several reasons why the BASH Team recommends airfields be mowed or maintained in that range. The seven-inch side of the range is there to allow grass to grow taller than the normal mowing height of approximately four inches. Seven inches is tall enough to disrupt the line of sight of smaller flocking birds. Species like the European Starling are a frequent problem on airfields due to the airfield being mowed too frequently and too short. This normal mowing height and cycle brings birds, such as the starling, to the airfield in very large flocks. A grasshopper with both legs working in 10-inch grass is far more difficult for a bird to catch than one who is missing a leg and lying upon a scalped area.

On the other hand, keeping vegetative cover below 14 inches assures there is no visual obstruction of signs and airfield lighting to aircraft movement. Finally, allowing grass to grow longer between mowing cycles reduces the number of mowing operations that attract wildlife to the airfield. Greater spacing between airfield mowing cycles also has an added benefit of providing mowing contractors more flexibility to accomplish other mowing tasks around the base.

Another problem frequently encountered when managing longer airfield vegetation is that most mowers are factory-designed to cut at about a four-inch height. In order to mow to seven inches, the mowing machine will normally require alteration to assure a uniform cut above four inches. This alteration may be accomplished at most machine shops. Although most mowing contractors do not like to have this done, it is the best way to assure that the airfield will be maintained properly.

What about different turf selections? Is there any one type of vegetative cover that will be best? Actually, no one type of turf will suffice as a USAF-wide recommendation. Different parts of the country produce a variety of growth conditions. In the Southeast, Bermuda is not a bad choice, but neither is Bahia. Out West, one may have to consider totally different choices of vegetative cover. Some desert air bases have considered returning to native chaparral because it seems to be less attractive to horned larks, a bird that creates problems in that part of the country. In some extremely dry locations, where conditions are not good for grow-

Management

HQ AFSC Photos by TSgt Michael Featherston
Photo Illustration by Dan Harman

ing any vegetation and dust is a serious concern, some airfield managers have considered novel techniques of "armoring" their safety areas by using different cover materials, such as recycled asphalt or river rock.

Let's look at a few choices. Where it can be grown, Bermuda is a good choice because most varieties, like Common or Coastal Bermuda, will naturally remain within the seven to 14-inch range. Bermuda will also go dormant during cold weather, reducing the need for mowing at that time of the year. Bahia grass is another species that provides cover; however, it produces a prominent seed head that is often viewed as unsightly. Some species of Fescue may be inoculated with an endophyte that many grazing species find distasteful.

However, one must keep in mind that changing turf species over an area as large as an airfield will require much field preparation and expense. The key in selecting a species can be found in reviewing local agronomist recommendations for the area, and consideration should be given to species native to the area. If these cannot be identified, choose a species which best matches environmental conditions of the area.

Earlier, I mentioned that some find Bahia grass undesirable due to the fact it produces a prominent seed head. This topic has raised many questions and needs to be addressed more fully. Most grasses produce seed heads and some, as in Bahia, are more pronounced than others. Are seed heads automatically bad? Not necessarily. When AF PAM 91-212, *Bird Aircraft Strike Hazard (BASH) Management*, was written, it addressed the problem of plants going to seed. This guidance was intended to provide information regarding "weed" seed heads and was most likely referring to broadleaf and other species that were significantly taller than the surrounding mosaic of grasses. Weeds, as used here, refers to tall plants that are obviously not part of the natural canopy of mixed grasses present on the airfield. These should not be allowed to go to seed, as they could spread and cause other sources of problems.

Seed heads from Bahia, while considered aesthetically unattractive, do not normally produce an intense attraction to wildlife. Most grass seeds are small and, if allowed to fall naturally into a closed canopy of turf, are not readily available to birds. Also, if the grass is near the 14-inch height, small seed-feeding birds are not able to maintain flock integrity because the grass is too tall for them to see one another.

One final point on seed heads in turf is that no matter how short you mow grass, sooner or later it will go to seed. Thus if you continue to "chase" these seed heads you may find yourself mowing way too frequently and too short. These actions will provide more attraction to wildlife than just letting the Bahia go to seed. In addition to attracting birds, frequent mowing can maintain turf in a more succulent growth stage and provide an attraction to browsing deer. Grass that has begun to seed is tougher and much less palatable to grazing wildlife such as deer and Canada Geese.

One last word of caution about selecting a turf type needs to be mentioned while on this subject. This problem frequently arises following earth moving work that occurs during the completion of construction projects around an airfield. Engineers have routinely used a seedling specification to stem erosion following such projects. This seed mix is heavily infused with millet, a species that roots rapidly but literally produces a seed commonly used in bird feed. While this mix may work well on a highway project, it should never be used on an airfield. Active runways have literally been shut down following the use of this mix. The Federal Aviation Administration has noted this problem and issued guidance to notify engineers working on airfields to avoid using this mix. This guidance is spelled out in Cert Alert 98-05, issued in 21 September 1998, and may be found online at www.faa.gov.

So remember, all that turf around the airfield is more than just grass; it protects the hard surfaces used by aircraft. Although vitally important to the proper functioning of an airfield, it does not have to resemble a golf course or provide wildlife habitat. With a little planning and forethought, one can have a nice-looking airfield that is safe for both aircraft and wildlife, and shouldn't be so painful for managers.

Editor's Note: The following accounts are from actual mishaps. They have been screened to prevent the release of privileged information.

Mother Nature. This version is about Mother Nature affecting our operations and aircraft, plus cargo handling causing damage to our aircraft. We can't control the weather or Mother Nature, but we can control when we fly into bad weather or the potential for bad weather. We also can control the status of our cargo. Be sharp and look for the unexpected.

When Things Change

The flight of F-16s was off on a surface attack sortie, and unfortunately one of the aircraft surfaces got attacked. The weather forecast and ATIS contained no mention of thunderstorms or adverse weather conditions. However, ATC, which had some capability to paint thunderstorms, had numerous possible thunderstorms on radar. In addition, there were no AIRMETS or SIGMETS applicable for the area. So everyone thought the weather was peachy keen and no problem, or if they thought differently, they didn't tell anyone.

As the lead aircraft returned home from the sortie, he relayed to his flight in trail to take a different route home than planned, as he had just flown through hail. He was then able to uneventfully recover back to home station. Damage was luckily only to the LANTIRN pod. How do you prevent this? Better forecasting and everyone talking to each other would surely help. Mother Nature, by nature, is unpredictable, but if everyone works together and communicates, we can avoid tempting her.

Cooked Bird

A T-37 was going to fly a normal instrument training sortie, and during engine start the crew received some bad indications and shut down both engines, ground egressed, and informed the crew chief they had shut down for an overheat indication. Shortly thereafter, the crew declared a ground emergency for smoke coming from the engine. Cause for the smoke? How about a bird's nest built on top of the mishap engine tailpipe. Been there, seen that!

The unit had been fighting a bird-nesting problem for several weeks and it was a special interest item. Supervision had directed that maintainers look for nests during their postflight and combo inspections. This aircraft was preflighted that morning and sat on the last parking spot, at the end of the parking ramp and was nearest to the grassy area by the taxiway. Was this aircraft set up or what? Now, it's above and beyond to inspect the engine bay during the preflight and/or the aircrew's walkaround, and it was not part of the special interest item. The special inspection was for postflights.

How do you avoid the bird nests? You post a 24-hour guard on all aircraft, create a scarecrow, be as vigilant as possible in preventing the nesting and/or find the nest before it causes problems. Be aware of what Mother Nature is doing around you as the birds will always be there, and airplanes make great nesting places.

Runway Clean Up

A sweeper was dispatched by base ops to remove some debris from a taxiway. The sweeper proceeded to the taxiway and a Navy C-2 was cleared to taxi to the active runway by ground control. The sweeper contacted ground via the ramp net and asked permission to conduct the sweeping operations up to the runway on the offending taxiway. Ground approved the sweeping operation, then issued ATC clearance to the C-2 and authorized them to switch to tower frequency.

The ground controller briefed the tower controller on the sweeper and the C-2 aircraft.

Tower saw the sweeper in operation, and the sweeper was short of the runway hold line. The tower then cleared the C-2 for takeoff. Do you see the conflict approaching? The C-2 began its takeoff roll and the tower again checked on the sweeper. Great vigilance on the part of the tower controllers! The tower then saw the sweeper cross the taxiway's runway hold line. The tower canceled the C-2's takeoff clearance and ordered the sweeper to vacate the area. The C-2 aborted its takeoff, and went back to the starting line and got to takeoff the second time. Tower reported the incident to base ops, and base ops had the sweeper driver report to them to determine what happened.

In this case there was miscommunication or misunderstanding about what clearance up to the runway meant. The sweeper driver thought it was to the physical edge of the runway. The ground controller thought his clearance meant up to the runway hold line. That is a big difference. In addition, this was at a deployed location, and the two people involved were from different bases with different procedures. To prevent this type of incident, no matter where you are, people need to ensure what they intended is what was heard. Everyone needs to ensure their communication is understood, and each individual needs to ensure they follow the rules of your current location. If you are unsure, ask, and if you are working at a different location than usual, make sure the person on the other end of the conversation is singing the same song as you!

How To Damage A C-5

The aircraft had flown to a stateside base for an airshow and had taken along an SU-30 tow tractor and tow bar, just in case they needed to move the aircraft. The tow tractor and tow bar were downloaded for the airshow, and everything went fine until time to reload the tow tractor. The operator of the tow tractor during the upload had been trained on the vehicle, but his license didn't reflect that he was qualified. So should he have driven the tow tractor? The loadmaster had the aircraft prepped to drive the vehicle onto the aircraft, and T.O. 1C-5A-9-2 states that the vehicle should be driven up the ramp. Now, there is much discussion on whether this means to drive forward or backward, or under its own power versus winching. The SU-30 has a pintle hook mounted on the front of the cab and a pintle hook mounted on the rear frame. This provides less ground clearance for the front hook to the axle versus the rear pintle hook when the vehicle is driven up the ramp. A reason for the discussion on whether or not the vehicle should be driven forward or backward onto the aircraft.

As the tow tractor proceeded backward up the ramp, in the wrong steering mode, the front pintle hook struck the ground, causing the vehicle to lose traction and the shoring to move. As they reset everything and tried again, the vehicle stalled. They tried a third time, and the shoring again slipped, causing the vehicle to come close to the edge of the shoring. The vehicle was finally into the aircraft. When the crew was closing the forward cargo ramp they found a three-foot tapered concave crush on the toe and another 4.5-foot crushed area on the ramp that was up to 1/2-inch deep. Amazingly, the length of the crush was about equal to the length of a piece of shoring. Maybe a piece slipped and was no longer protecting the aircraft?

Here is a case where experienced aircrew and maintainers were performing a routine operation and didn't follow established procedures, and there was confusion on what exactly were the proper procedures. Make sure the routine doesn't end up causing damage like this operation, as it cost the unit $86,000, plus downtime for sheet metal repairs.

Can You See The Dents?

A C-21 had set out for a simple mission, but Mother Nature intervened and the aircraft spent an extra night, as the crew didn't like the weather. Smart crew. During the night the wind was gusting up to 35 knots, and the only other aircraft in the area were a pair of Russian cargo aircraft. The next day, as the transit folks prepped the aircraft, they found an engine cover from the Russian aircraft behind the C-21. The crew arrived at the aircraft and performed their normal preflight checks. After a rough time getting started, they returned to home station. Once at home, the TA folks chocked the aircraft, and the crew did the normal postflight walkaround. A unit maintainer arrived and the aircraft was refueled and towed into the hangar for the night. The postflight inspection would have to wait, as the duty day had expired; normal procedures.

The next morning the maintenance crew arrived to perform the postflight inspection and were surprised to find three large dents, one inch by two inches, in the leading edge of the right wing. Here is a case where $25,000 in damage was done to an aircraft, and we don't know when or how it happened. There were several opportunities to find the damage, depending on when it happened.

- When the TA crew opened the aircraft.
- When the aircrew did their preflight inspection.
- When the engines were being started and there was a ground man in front of the wing.
- When the TA crew recovered the aircraft.
- During the aircrew postflight inspection.
- When the unit maintainer refueled and towed the aircraft into the hangar.

There were six chances to find this damage. We don't know, and never will know, if the engine cover hit the aircraft, if something else was blown into the aircraft the night before, if something happened in-flight, if the ground crew at the TDY location or at home station did the damage, or if something happened once the aircraft was alone in the hangar for the night. This all comes down to being observant at all times, especially when something unexpected happens, like an unplanned overnight stay due to bad weather. Keep your eyes open and look for anything out of the ordinary.

Maintenance Matters

Editor's Note: The following accounts are from actual mishaps. They have been screened to prevent the release of privileged information.

A-hauling we will go! This edition of Maintenance Matters is about cargo and things that went wrong when the folks preparing or loading cargo did not do it right, and the crew did not find out about it until it was too late. It's everyone's job to ensure cargo is properly prepared for shipment, especially the person shipping the cargo, as the aircrew is supposed to be the last line of defense.

Where Is The Paperwork?

A C-130 crew arrived at a sealed and preloaded aircraft. All events up to and including takeoff were uneventful, until the deck angle increased and the aircraft pressurized. As the aircraft began the climbout, over a gallon of fuel spilled onto the pallet and cargo floor. The crew declared an emergency and landed uneventfully. The postflight investigation showed that the cargo's fuel tanks were "FULL."

What happened? The load for this trip was to a data-masked location and there was no DD Form 2133, *Airlift Inspection Record, Joint*, accompanying the cargo. How dare they not have their DD 2133! This form certifies the status of the cargo and verifies, for the aircrew, that a joint airlift inspection (JAI) has been accomplished. Previously, cargo marked for certain areas did not have paperwork. The unit in question changed their procedures following this event to ensure all equipment is properly prepared for shipment, and the flight crew has the required documentation, no matter where it is going. How good are your cargo inspection procedures?

Da Boat!

Another C-130 had a short but exciting trip. They had loaded a 22-foot Boston Whaler boat and another vehicle onto the aircraft. Once settled, they departed their location. As they passed 2500 feet MSL the boat vented fuel, and fumes filled the aircraft. The crew followed their procedures and landed safely. After cleaning up the mess and draining the boat's fuel tank, they proceeded with the mission.

Now, according to AFMAN 24-204 (I) Attachment 28, Paragraph A28.3, "The following items are considered fuel leakers and must be drained of fuel for approved Chapter 3 and non-Chapter 3 movements. Purging is not required." The offending Boston Whaler is on the bad boy list.

This event comes down to everyone not taking the extra steps needed to know what condition the cargo is in and what the procedures are for that type of cargo. You can't "assume" anything! If things like the fuel gauge don't work, you need to find ways to ensure your cargo is safe. Be ready for the out of the ordinary!

A Slippery Cargo Run

A KC-10 had loaded up its cargo, and like so many of our locations, it was raining when they loaded the cargo. The cargo was safe and sound, but the cargo and the aircraft floor got a nice washing prior to takeoff. The aircraft took off, and as they passed through 10,000 feet MSL the boom operator began his cargo check. As he walked back through the cargo hold he slipped on the wet cargo floor and reached to catch himself. Unfortunately, he grabbed a metal cargo band and injured his hand. The crew then diverted back to their starting location.

How did he fall? Was he just clumsy? In this case, he had a lot of help. Some time in the past some enterprising individual painted over all the anti-skid strips in the cargo compartment, rendering them useless. So, the wet floor and the deck angle set him up for a fall. Make sure when you are improving your aircraft you don't defeat the required safety devices. Maintainers and aircrew members need to look for missing safety gear, as it is you it is there to protect. Help keep the aircraft safe for operations at all angles!

How Much Gas is Allowed?

Another case of a boat and bad gas. A C-17 was on an airland contingency mission, and the cargo consisted of two coast guard patrol boats and support equipment. The shipper declaration indicated that the boats were prepared IAW AFMAN 24-204(I). Shortly after takeoff they had to return to base due to an inflight emergency for a fuel leak.

Once again the decreased ambient pressure caused fuel to vent from the boat's fuel tank fill-port onto the cargo compartment floor. Paragraph 3.7.1 of AFMAN 24-204(I) states, "Units transported under the provisions of this chapter may contain additional quantities of fuel in tank based on operational necessity during deployments." Also, Paragraph 13.5.5 states, "Units prepared for airdrop and shipped under the authority of paragraph 3.7 may contain fuel in tank not to exceed three-quarters tank full." "Boats…must be drained to the fullest extent possible."

Airdrop preparations allow for extra stability, but this wasn't an airdrop mission, so the rules don't apply. Make sure when you are taking on cargo and the "mission necessity" card is played, that it really needs to be played and the rules are followed to the greatest extent possible. Safety isn't an afterthought, and cargo safety issues have sent too many missions back to where they started. To cancel or delay missions due to improper cargo preparation does nothing to help relieve the heavy demand on the cargo haulers. Make sure the rules you are applying are the right rules, and remember it's everyone's responsibility to ensure the cargo is safe and the aircrew has an uneventful sortie.

How Far Can It Go?

This incident applies to everyone, cargo loaders, maintainers and aircrews, as all were involved in one way or the other. It was a routine task: Download two KC-10 engines and some rolling stock from a C-5. It happens every day all over the world. The crew was tasked and briefed that the engines had a lateral overhang, so they had to back the K-Loader to ensure proper aircraft and cargo clearances. This crew looked for the unusual, but didn't look long enough. Each engine was mounted on a rollover stand and secured to a pallet train of two 463L pallets.

Here are the many steps that led to $278,000 in damage to a very valuable KC-10 engine.

- The first engine was downloaded onto the first K-Loader.
- They then backed a second K-Loader up to the first.
- They lowered the forward pallet stops on the first K-loader and the aft pallet stops on the second K-Loader.
- Then they transferred the first engine onto the second K-Loader.
- They raised the aft stops on the second K-Loader. What about the forward stops on the first K-Loader?
- While they waited for the second K-Loader to secure the load and leave, the workers downloaded the rolling stock.
- They tied down the first engine and the second K-Loader left.
- Once the second K-loader had left, the crew went back to download the second engine.
- The second engine was pushed onto the first K-Loader with no problems, and the crew helped secure the chains on the aircraft.
- While the first K-Loader driver waited for the crew to come back and secure the engine, he engaged the power conveyers to move the load forward for better clearance. However, the load would not move.
- The crew came back and started to tie down the second engine.
- The driver started to lower the K-Loader, but the engine overhung the aircraft cargo ramp.
- A worker on the K-Loader shouted for the driver to move the load forward.
- The driver heard, "Move the loader forward."
- The driver released the emergency brake and the power conveyers were automatically lowered at this time, and the load was free to move.
- The driver moved the K-Loader forward a short distance and stopped.
- Gravity/momentum took over when he stopped the loader, and the engine, which had not been fully secured, rolled forward.
- The workers tried to stop the engine and the driver tried to engage the power conveyers, as he noticed the forward pallet stops were not raised. Amazing how those little things can come back to haunt you.
- The 22,000-pound engine had already passed the forward pallet stops and the front end of the pallet train dropped off the K-Loader, hitting the ground.
- The incident damaged the K-Loader, the engine stand, the engine and the workers' reputations.

How do you prevent something like this? The crew had planned for the unusual, and they were an experienced crew of aerial porters, loadmasters and crew chiefs. You pay attention to the little things and follow the books. Never start one task until the last one is finished. If things aren't working right, stop and see what is wrong before you start the task.

USAF Class A Flight Mishaps

FY03 Flight Mishaps (Oct 02-Aug 03)	FY02 Flight Mishaps (Oct 01-Aug 02)
24 Class A Mishaps	27 Class A Mishaps
10 Fatalities	11 Fatalities
18 Aircraft Destroyed	14 Aircraft Destroyed

18 Oct	✈	A TG-10D glider crashed during a student sortie.
24 Oct		An F-15 experienced an engine failure during takeoff.
25 Oct	✈✶	An RQ-1 Predator crashed during a training mission.
25 Oct	✈✈	Two F-16s collided in midair during a training mission. One pilot did not survive.
13 Nov	✈	An F-16 crashed during a training mission. The pilot did not survive.
04 Dec	✈✈	Two A-10s collided in midair during a training mission. One pilot did not survive.
18 Dec		Two F-16s collided in midair during a training mission.
20 Dec	✈	Two T-37s collided in midair during a training sortie.
02 Jan	✈✶	An RQ-1 Predator crashed during a training mission.
26 Jan	✈	A U-2 crashed during a training mission.
06 Feb		A manned QF-4E departed the runway during takeoff roll.
11 Feb	✈✶	A QF-4 drone crashed during a landing approach.
13 Feb	✈	An MH-53 crashed during a mission.
08 Mar	✈	A T-38A crashed during a training mission.
17 Mar	✈	Two F-15s collided in midair during a training mission.
19 Mar	✈	A T-38 crashed during a runway abort. One pilot did not survive.
23 Mar	✈	An HH-60 crashed during a mission. All crewmembers were killed.
31 Mar		A B-1 received damage during weapons release.
16 Apr		An F-15 experienced a single-engine failure inflight.
21 Apr		A C-17 suffered heavy damage to the MLG during a landing.
02 May		A KC-135 experienced a birdstrike during landing roll.
22 May		An MH-53 suffered severe damage to the main rotor system.
29 May	✈	An F-16 crashed during takeoff.
04 Jun	✈	An F-15E departed controlled flight and crashed.

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10 Jun ✈ An F-16 crashed during a training sortie.
12 Jun ✈ An F-16 crashed during a training sortie.
13 Jun ✈ An F-16 crashed during a training sortie.

- A Class A mishap is defined as one where there is loss of life, injury resulting in permanent total disability, destruction of an AF aircraft, and/or property damage/loss exceeding $1 million.
- These Class A mishap descriptions have been sanitized to protect privilege.
- Unless otherwise stated, all crewmembers successfully ejected/egressed from their aircraft.
- Reflects only USAF military fatalities.
- "✈" Denotes a destroyed aircraft.
- "✶" Denotes a Class A mishap that is of the "non-rate producer" variety. Per AFI 91-204 criteria, only those mishaps categorized as "Flight Mishaps" are used in determining overall Flight Mishap Rates. Non-rate producers include the Class A "Flight-Related," "Flight-Unmanned Vehicle," and "Ground" mishaps that are shown here for information purposes.
- Flight and ground safety statistics are updated frequently and may be viewed at the following web address: http://safety.kirtland.af.mil/AFSC/RDBMS/Flight/stats/statspage.html
- Current as of 06 Aug 03.

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