Reducing Mishaps by 50%

THE NAVAL SAFETY CENTER'S AVIATION MAGAZINE

approach

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FOCUS ON: Spatial DISORIENTATION

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May-June 2004 Volume 49 No. 3

Mission Statement

Mishaps waste our time and resources. They take our Sailors, Marines and civilian employees away from their units and workplaces and put them in hospitals, wheelchairs and coffins. Mishaps ruin equipment and weapons. They diminish our readiness.

This magazine's goal is to help make sure that personnel can devote their time and energy to the mission, and that any losses are due to enemy action, not to our own errors, shortcuts or failure to manage risk.

We believe there is only one way to do any task: the way that follows the rules and takes precautions against hazards. Combat is hazardous enough; the time to learn to do a job right is before combat starts.

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Features

Spatial DISORIENTATION

Approach devotes a special section to SD.

2 **Toward the Goal**
By Capt. Nicholas Webster, MC
Our aeromedical division head discusses why we need to focus on this issue.

4 **Work Zone: Reducing Mishaps by 50%**
Spatial Disorientation Training
Information about Navy and Marine Corps programs.

5 **SD Happens Only to the Other Guy**
By Cdr. Rick Erickson
Many a top-shelf pilot has fallen victim to SD. Getting smart on it is the first step to avoiding problems.

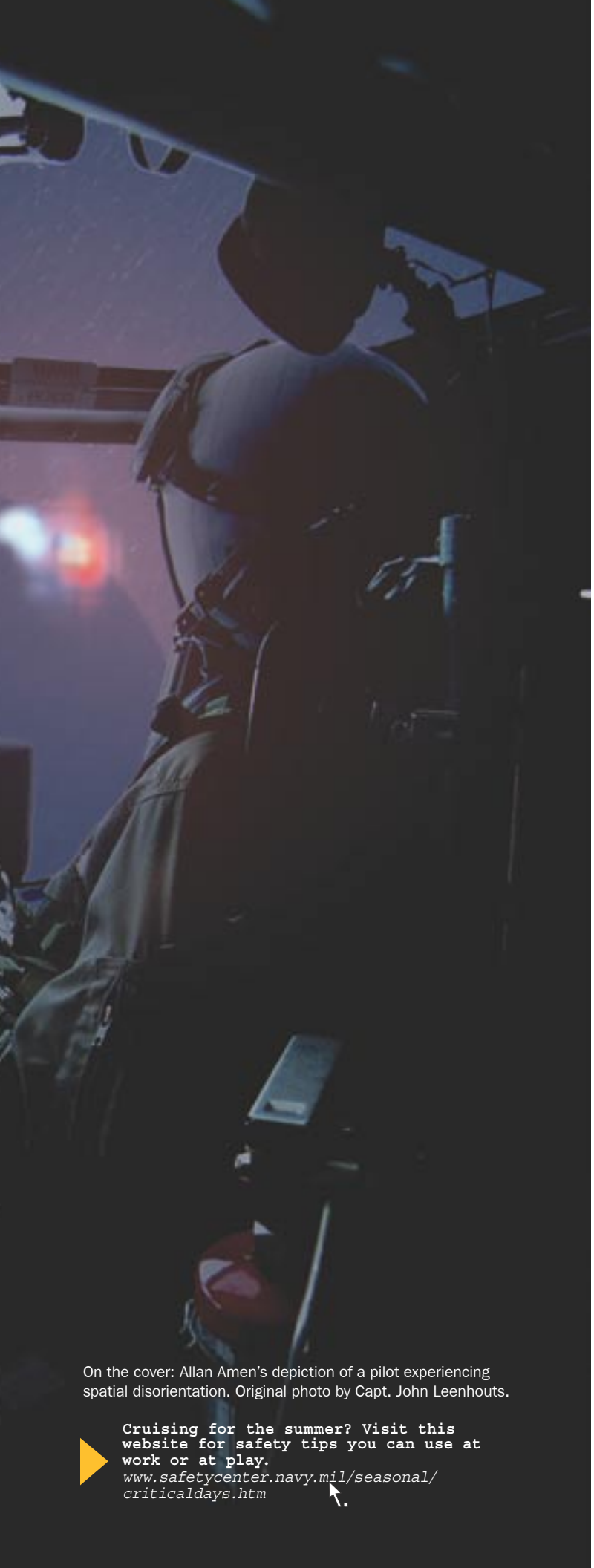
7 **Can We Prevent SD?**
By Braden McGrath, Ph.D., LCdr. Gustavo Gierber, MSC, and Capt. Angus Rupert, MC
Can NAMRL's tactile-situation-awareness system help our pilots avoid SD?

10 **Welcome to OZ**
By Leonard A. Temme, Ph.D
Turning IFR into VFR to combat SD—that's the plan with the OZ simulation.

12 **The RadAlt is On**
By Ltjg. Scott Simpson
The entire crew played a role in this near catastrophe.

14 **Vertigo on the Ball**
By Lt. Rebecca Adams
As she began the descent, her nightmare began.

16 **I Think I Have the Leans**
By Lt. Ben Cone
A well-intentioned act by the HAC causes the copilot to get disoriented.



On the cover: Allan Amen's depiction of a pilot experiencing spatial disorientation. Original photo by Capt. John Leenhouts.

Cruising for the summer? Visit this website for safety tips you can use at work or at play.
www.safetycenter.navy.mil/seasonal/criticaldays.htm

18 **A Little Bit of Tension**
By Lt. Robert Fluck
A classic case of woulda, shoulda, coulda.

22 **Go Ahead, Have a Drink**
By LCdr. Denny Shelton
Here's the recipe for dehydration: take one student pilot, a hot summer day in Corpus, and a fam flight. Watch the water low-level light come on.

24 **Where'd the Boat Go?**
By Ltjg. Steve Audelo
This helo crew found themselves 40 miles from mom, separated by a fog bank in zero-zero conditions. Guess what else? Radio problems, of course.

26 **A Normal Flight With a Sandy Ending**
By Ltjg. Jill Dougherty
The crew was told, "601, your signal is bingo." Soon, they weren't sure whether to bail out or ditch.

30 **Don't Worry, That Never Will Happen**
By LCdr. Sean Maybee
This EP-3E crew discharges the fire bottles but they still see flames. What's the next plan of action?

Departments

3 **How Are We Doing?**
An update on our aviation-mishap rate. Visit our web page for the current status.

Mishap-Free Milestones

20 **ORM Corner: Not the Preferred Option, but...**
By Capt. Erik Bartelt, USMC, with Maj. Peter Calogero, USMC
A Super-Cobra crew during Operation Iraqi Freedom make tough decisions under combat conditions.

28 **CRM: Single Seat, but Not Alone**
By Lt. Christopher Cochran
Find out the secret to a single-engine approach.

IBC **Bravo Zulu**

BC **Ready Room Gouge**

May-June Thanks

Thanks for helping with this issue…

LtCol. Spike Boyer, NSC
Lt. Dennis Malzacher, HSL-46
Ltjg. Roger Jacobs, VAW-123
Lt. Chris Ognek, VAQ-136
LCr. Robert Quinn, VFA-83
Ltjg. Eric Bernsen, HSL-42
LCdr. Bob Ware, HSL-48
LCdr. Victor Weber, VFA-25

Spatial DISORIENTATION

By Capt. Nicolas Webster, MC

Spatial disorientation (SD) is a normal response of a normal human to the abnormal environment of flight. Humans are terrestrial born and bred, and the systems that orient us to up and down are designed to work when we are attached firmly to the ground, or return us to the ground in an upright position. The body's spatial orientation systems were not designed for prolonged flight.

About 100 years ago, man entered the air in dynamic flying machines and quickly realized flight was a very hazardous environment. We soon learned that when we lost our peripheral-visual inputs of the horizon, very bad things start to happen, and the ground and sky are not where we think they are. For many years flight was a daytime visual activity until the development of instruments to assist in orientation. Even with modern instruments, aviators still manage to crash aircraft at a staggering rate because they continue to have difficulty adapting to the abnormal flight environment.

Researchers at the Naval Aerospace Medical Research Laboratory (NAMRL) in Pensacola, Fla., reviewed all naval Class A flight mishaps from 1997 though 2002, to identify the occurrence of SD. They used this definition to identify the mishaps: Spatial disorientation describes "a variety of incidents occurring in flight where the pilot fails to sense correctly the position, motion or attitude of the aircraft, or of himself within the fixed co-ordinate system provided by the surface of the earth and the gravitational verti-

cal." SD also refers to "errors in perception by the pilot of his position, motion or attitude with respect to his aircraft, or of his own aircraft relative to other aircraft"

The study revealed the magnitude of lives and assets lost to the hazard of spatial disorientation in naval aviation.

FY97 to FY02 Rotary Wing Aircraft

- *47 Total mishaps – rate 1.94 per 100,000 flight hours*
- *65 Total deaths*
- *14 SD mishaps – rate 0.58 per 100,000 flight hours, cost $118,251,279*
- *35 SD deaths*

FY97 to FY02 Fixed Wing Aircraft

- *120 Total mishaps – rate 1.81 per 100,000 flight hours*
- *100 Total deaths*
- *22 SD Mishaps – rate 0.33 per 100,000 flight hours, cost $475,909,083*
- *23 Deaths*

The following series of articles provides additional information on the hazards associated with spatial orientation in flight, and some technological advancements being fielded or evaluated for future incorporation into aviation platforms. We're also including a few "There I was" articles to show how dangerous SD can be.

Capt. Webster is the aeromedical division head, Naval Safety Center.

HOW ARE WE DOING?

Here's information on our safety status as we work toward the goal.

Aviation (Rates = Mishaps Per 100,000 Flight Hours)

Class-A Flight Mishaps (FY04 thru 8 Apr)

Service	*Total/Rate*	*FY03 thru 8 Apr:*	*FY04 Goal**	*FY05 Goal**	*FY01-03 Avg*	*Fighter/Attack*	*Helo*
USN:	8/1.51	14/2.35	14/1.24	10/0.88	20.3/1.77	6/4.93	1/.89
USMC:	8/4.81	7/3.62	10/2.75	7/1.94	10.3/2.77	3/4.29	4/5.56

** Goals based on FY02 baseline.*
FY04/05 rate above goal.

For current information on aviation statistics visit: www.safetycenter.navy.mil/statistics/aviation/default.htm

Mishap-Free Milestones

VP-10	31 years	197,000 hours
VAQ-139	12 years	19,430 hours
HS-8	23 years	73,500 hours
HS-14	9 years	31,000 hours
VP-1	22 years	125,000 hours
HSL-41	21 years	120,000 hours
VP-40	37 years	241,000 hours
VFA-14	9 years	35,606.9 hours
VP-5	26 years	159,000 hours
VT-27	12 years	300,000 hours
VAQ-138	22 years	37,422 hours
HMM-265	15 years	60,000 hours
HS-6	15 years	51,000 hours
VF-11	10 years	33,548.6 hours
VP-1	22 years	125,000 hours
HC-11	12 years	100,000 hours
VAQ-133	8 years	11,090 hours
VAQ-142	7 years	10,318 hours

Spatial Disorientation Training

Do you know what the SD training requirements are? Are you getting the training you need? Here's information from our aeromedical staff for easy reference.

• OPNAVINST 3710.7S, the NATOPS General Flight and Operating Instructions (available online at: http://neds.nebt.daps.mil), identifies the spatial disorientation training requirements. Training is required every four years through Naval Aviation Survival Training (ASTC). However, we recommend training be completed annually. When the instruction update (3710.7T) is approved, annual training will be required.

ASTC training includes: Spatial disorientation and misorientation, visual illusions, visual scanning, induced myopia, situational awareness, spatial strategies.

To find out where to get SD training, locations and points of contact, visit the ASTC website at:

www.nomi.med.navy.mil/Text/Std/Default.htm

Each of the ASTC detachments has a link from this website.

• Additional SD modular-course training can be obtained by contacting one of the following commands:

Marine Corps commands

– MCAS Yuma, AZ MAWTS-1
folgarv@mawts1.usmc.mil DSN 269-3652/6042
– MCAF Quantico, VA HMX-1
vitatoela@hmx-1.usmc.mil DSN 278-2583
– MCAS Camp Pendleton, CA MAG-39
balciusja@3mawcpen.usmc.mil DSN 365-4956
– MCAS Miramar, CA MAG-16
schoonoverrl@3maw.usmc.mil DSN 267-7815/6
– MCAS New River, NC MAG-29
mccarthysm@2mawnr.usmc.mil DSN 752-7558/9
– MCAS Cherry Point, NC MAG-14
bilesad@mawcp.usmc.mil DSN 582-4540/6054
– MCAS Beaufort, SC MAG-31
bohrerbl@2mawbft.usmc.mil DSN 335-7103/7145
– MCAS Futema, Okinawa MAG-36
coopercl@1maw.usmc.mil DSN 636-3319/3322
– MCAS Iwakuni, Japan MAG-12
repassjj@1mawmag12.usmc.mil 001-81-611-753-5227
– MCBH Kaneohe Bay, HI MAG-24
lindsey@mag24.1maw.usmc.mil DSN 315-457-5707/5708
– JRB Fort Worth, TX MAG-41
salazargj@mfr.usmc.mil DSN 739-7589

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– NAS North Island, CA HSWINGPAC
debra.yniguez@navy.mil DSN 577-1633
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– NAS Oceana, VA SFWSLANT
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Photo composite

SD Happens Only to the Other Guy

Spatial DISORIENTATION

By Cdr. Rick Erickson

Accidents always seem to happen to the other guy. How could a good pilot, who's a great stick, be lured into the trap of losing reference to his or her surroundings and end up crashing with no knowledge of impending doom? Where was the breakdown that could lead to tragedy? Was poor leadership, training, or inexperience to blame? Maybe, after exploring all possible causes, we just don't know. Unfortunately, many a top-shelf pilot has fallen victim to this loss of reference, and statistics suggest more mishaps will occur in the future.

Over the last year, the aircraft-mishap boards (AMBs) for several Class A mishaps identified spatial disorientation as the cause. Two recent mishaps illustrate that no community is safe from this aviation hazard. The scenarios were different, but, unfortunately, the results were the same. At the last moment, the pilots realized their predicament but were unable to recover, resulting in fatalities and destroyed aircraft.

The first scenario was a zero-dark-thirty flight. The helo was Dash 3 of a four-aircraft division, and the pilot cued off the No. 2 aircraft to maintain position. The nighttime mission was over featureless landscape that provided minimal visual markers. Before launch, the aircrew had been awake many hours. Although the crew had time to rest, numerous distractions kept any crew member from getting adequate, uninterrupted sleep. Because the flight was during the early morning hours, the crew experienced circadian dysrhythmia, which put them near the daily low of the circadian-rhythm cycle and amplified their fatigue.

The weather conditions were worse than forecast and added to a growing list of cascading events for the crew. Other pilots reported visibility of less than one-half mile. Blowing sand and smoke diminished the effectiveness of night-vision goggles. The visible horizon did not exist. Despite numerous factors, including

fatigue, poor weather, NVG use, and formation flying, the flight was launched.

As the flight proceeded on the planned route, they approached a checkpoint identified as an intersection of two roads. Approaching this intersection, the mishap aircraft was observed to pitch up slightly, followed by a downward pitch, and then departed from the section. Dash 4 of the division made a radio call for Dash 3 to pull up—to no avail. Dash 3 struck the ground at high speed, killing everyone aboard.

By noting the position of the cyclic at the crash site, postflight analysis showed the pilot tried to recover the aircraft. The AMB surmised the deteriorating weather conditions caused the pilot to mistakenly believe the road was the horizon. Consequently, the pilot perceived he was too high and needed to correct.

Adverse weather conditions, combined with formation flying, contribute to scenarios conducive for spatial disorientation. Formation flying minimizes the opportunity to scan instruments. The pilot's attention is directed at maintaining visual contact with the lead aircraft, isolating the pilot from any source of accurate orientation information. False visual and vestibular cues supply the pilot with inaccurate information and results in improper control inputs. In this case, the blowing sand and smoke could have created an illusion of drifting off course. The dark road, in the absence of other visual cues, provided a false horizon, giving the impression of an inaccurate flight altitude and attitude. Fatigue can rob a pilot of the ability to adequately perform instrument crosschecks.

In the second scenario, a tactical aircraft was returning to base on a daytime mission. During descent, the aircraft entered IMC conditions with heavy precipitation and low ceilings. The mishap aircraft hit the ground in a nose-low attitude, with a significant right bank. Aircraft-mishap evidence indicated the pilot recognized his predicament and tried to recover with a high-G pull moments before impact. The safety investigation concluded the pilot was time-sharing his attention between IFR and VFR scans in an IMC environment, thinking he would break out into VFC on final approach.

Laurence Young, in his chapter on "Spatial Orientation," in the book *Principles and Practices of Aviation Psychology* observes, "A particularly dangerous period for the pilot occurs when making the transition from instrument flying to flying by external cues. There is not a specific illusion associated with the transition but, rather, a period of uncertainty concerning orientation. A pilot who has been concentrating on the instruments in lining up for landing may easily experience SD during the several seconds after looking up and trying to find the runway and horizon through broken clouds. Just as disturbing is the loss of orientation when a pilot in a turn enters a cloud and must reorient on the instruments. The delay in distance accommodation, which becomes more severe with age, is another factor in this problem."

The pilot unsuspectingly placed the aircraft in an unusual attitude by not staying on instruments, allowing incapacitating disorientation to encroach on him. Fatigue also may have played a significant role in this mishap. Although given sufficient time to rest, the pilot experienced self-imposed, interrupted-sleep problems.

SD is a normal response of the body's neuron system to abnormal environments. Humans orient themselves with peripheral cues. Removing or altering these cues during flight causes SD.

Though many of you have gone through the Naval Aviation Survival Training Course, and are between your quadrennial refresher training, a quick reminder on the types of SD may help keep you alert to this hazard.

Type I – Unrecognized disorientation is when the pilot does not perceive any disparity between artificial and real orientation perceptions. The pilot feels the aircraft is responding correctly to inputs, but he is oblivious to the false cues and maneuvers the aircraft to match the false perceptions.

Type II – Recognized disorientation is when the pilot is able to rectify a conflict between the artificial and natural and take corrective actions to maintain safe flight. Pilots talk about vertigo where they may recognize that trouble exists in maneuvering the aircraft.

Type III – Incapacitating disorientation, as defined by A. J. Parmet in the *Fundamentals of Aerospace Medicine*, is when the pilot "experi-

ences an overwhelming—for example, incapacitating—physiologic response to physical or emotional stimuli associated with a disorientation event." The bottom line is the pilot may be aware of the disorientation but is unable to respond to correct the situation.

For more information on spatial disorientation, contact your local wing aeromedical safety officer or the Aviation Survival Training Center. Remember, to the other guy, you are the other guy.

Cdr. Erickson is an aeromedical analyst at the Naval Safety Center.

Can We Prevent SD?

By Braden McGrath, Ph.D., LCdr. Gustavo Gierber, MSC, and Capt. Angus Rupert, MC

Spatial DISORIENTATION

The Tactile-Situation-Awareness System

Spatial disorientation (SD) and its effects and remedies have been discussed repeatedly over the years in every ready room; yet, we continue to lose aircraft and lives. Based on accident rates for the Air Force, Navy, and Army, SD mishaps result in the tragic loss of 40 lives per year on average. The cost of SD mishaps also includes mission failure, the impairment of mission effectiveness, and the cost (in billions of dollars) of aircraft and equipment loss.

The losses are staggering when compared to how many could have

been saved if they had had something in the cockpit to help the aircrew cue into their situation. In today's military aviation, there is an added emphasis on night flying, all-weather capability, and low-altitude missions, which are all scenarios that increase spatial disorientation.

Researchers at Naval Aerospace Medical Research Laboratory (NAMRL) have developed a product to cue in the aircrew; it's called the tactile situation-awareness system (TSAS). TSAS uses the sense of touch to provide spatial-orientation and situational-awareness information to aviators. The system reads data from current aircraft systems, processes it, and relays designated information, using miniature tactile stimulators called tactors. Two types of tactors are currently available: pneumatic and electromagnetic. The pneumatic tactors are made of plastic bodies with latex bladders. Air is pulsed through the tactor and felt as a distinct tapping when placed against the body. The electromagnetic tactors have a magnet and electrical coil, which, when energized, produce a unique tapping sensation that "feels" different than the pneumatic tactors.

This research taps into our underutilized sense of touch. For example, when you're engaged in a conversation and someone comes up behind you and taps you on the shoulder, the urge to stop talking or listening and turn around to see who tapped you is irresistible. You always turn quickly toward the tapping. It's this overwhelming sense to react that TSAS bases itself: tactile stimulation. TSAS is designed to support the pilot by providing another avenue of cueing, besides the visual and aural cues already integrated in today's aircraft.

The TSAS system accepts data from the aircraft via 1553 interface as a bus monitor to obtain the aircraft position, velocity, attitude, altitude, and threat information. This information is then displayed via the pneumatic tactors arrayed

The system reads data from current aircraft systems, processes it, and relays designated information, using miniature tactile stimulators called tactors.

Photos provided by NAMRL

around the torso in columns, and electromagnetic tactors located on the shoulders and lower thighs. The tactors are mounted in a cooling vest, weighing less than one pound, and in the aircraft seat. A quick-connect-disconnect fitting does not impede egress in an emergency.

Similar to "pages" on a multi-function display, TSAS has different modes for displaying critical information. In the forward-flight mode, TSAS provides attitude and altitude cueing. It also can provide backup navigational cueing in conjunction with existing navigation displays.

In a hover mode for helicopters, TSAS provides horizontal drift and vertical-altitude information. TSAS has proven to be especially valuable when visual cues are degraded, as in high hovers during fast-rope situations over a target, when the pilots are on NVDs. TSAS also is valuable in high-low hovers over open ocean, as in SAR, mine sweeping, dipping, or even Doppler approaches and hovers.

The Army specifically has requested that TSAS provide approach glide-slope cueing for a pilot-adjustable-hover altitude, as well as a zero-zero, no-hover landing. This cueing provides deceleration and lateral-drift information during the approach. This information will aid in alleviating brown-out and white-out landing mishaps, where lateral drift during landings has led to rollovers.

In the threat mode, TSAS provides cueing toward the enemy, whether it's another aircraft or incoming missile. It tells the pilot where the threat is, enhancing his situational awareness (SA), while cueing him to look or react to the threat without having to first look in the cockpit, identify the threat, go back outside the cockpit (visually) to reacquire the threat, then react to it. These few seconds are critical in a wartime environment.

An added benefit of the system is the cooling effect provided by the vest. TSAS currently provides ambient air through the vest to provide some cooling, and it can be modified to allow heated and chilled air through the system.

Currently, simulator and aircraft testing have begun with the Special Operations Command MH helicopters and CV-22 aircraft programs.

The authors are with the Naval Aerospace Medical Research Laboratory, Pensacola, Fla.

The Naval Aerospace Medical Research Laboratory in Pensacola, Fla. is dedicated to solving medical issues that effect naval aviation. The laboratory reports to Naval Health Research Center (NHRC), San Diego, Calif.

Through its research, NAMRL directly supports the Fleet and Sea Power 21 by enhancing human performance, optimizing equipment, preventing mishaps and improving personnel selection. The laboratory's areas of research includes spatial orientation, situational awareness, effects of hypoxia, motion sickness, aircraft mishap modeling, vision, pharmaceuticals and human performance, and adaptation to unusual acceleration environments. The laboratory has experts in aircraft mishap investigations and is the Department of Defense's only laboratory for aviation selection research. NAMRL also has the world's finest collection of man-rated, acceleration-research devices.

Welcome to OZ

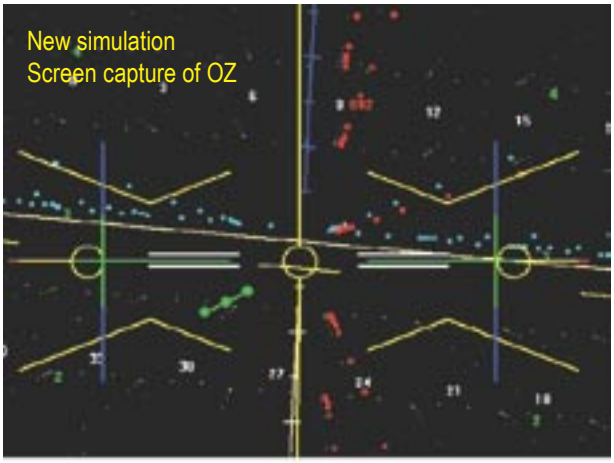
By Leonard A. Temme, Ph.D.

Spatial DISORIENTATION

"Quite possibly, I believe, OZ may represent the most significant step forward in instrument flying since Elmer Sperry invented the artificial horizon in the 1920s." That is the opinion John Sheridan expressed in his article on OZ, published in the June 2003 issue of *Aviation International News*, a leading magazine for senior aviation business personnel.

I agree with Sheridan, but I really can't be objective about it because I'm one of the two people who invented OZ. It's especially heartening when a crusty pilot with more than 4,000 hours stick time, like Sheridan, so strongly praises OZ. For the curious, the OZ name came from the need, during early experiments, to have a rear-projector operator behind a curtain, reminiscent of the 1939 movie.

OZ was born at the Naval Aerospace Medical Research Laboratory (NAMRL), where I work as a research physiologist. It is the result of at least six years research collaboration with Dr. David Still, who was on active duty as a research optometrist at NAMRL. When Dave retired from active duty, he joined the Institute for Human and Machine Cognition (IHMC), also in Pensacola, so we're still working together on OZ. The Navy and the IHMC jointly own the OZ patent.



Both pictures represent the same aircraft situation. Can a change in instrumentation help a pilot avoid or recover from SD?

OZ grew from two projects. One was a study of instrument-scan patterns. We had put an eye tracker in one of the motion-based, high-fidelity, helo-training simulators at NAS Whiting Field and used it to record the scan patterns of student pilots as they went through their basic and radio-instrument training.

Although I'm not a pilot, I appreciated what the pilots were saying as they explained to me why instrument flight is so difficult. At the very least, it takes about a quarter of a second to look from one gauge to another. If you're monitoring six gauges, that's nearly two seconds before you come back to look at the same gauge a second time. A lot can happen with an aircraft in two seconds. Add to the instrument-scanning task all the headwork you're doing to understand what the instruments are indicating. And, don't forget you're doing this while ignoring what your inner ear and other bodily sensations are telling you about gravity and inertia—because they're wrong. You're telling yourself to believe the instruments, and, sometimes, this trust is counter-intuitive, and every successful instrument pilot knows it.

The other study concerned the impact of night-vision devices (NVD) on flight. Maintaining spatial orientation in the restricted field of NVDs compounds these problems for the military aviator. Dave and I believed there was a better way to conduct instrument flight. After all, no one wants to fly on instruments when they can fly with an outside visual scan. The reason why is obvious: The instruments are user-hostile.

One day, I saw a picture of Jimmy Doolittle's 1929 instrument panel, the one that he used to make the world's first controlled, blind landing. I recognized the instruments; they were the same ones the pilots were learning to use in the helo simulator at NAS Whiting Field. The instruments hadn't changed in 70 years, but, of course, the aircraft have. Modern aircraft with 70-year-old instruments—amazing.

Dave and I knew we could do better than that, so we started designing a suite of cockpit instruments that essentially turns IFR into VFR, and, in a nutshell, that's what OZ does. Actually, we thought modern technology might make IFR easier than VFR.

We had several design goals for OZ. Primarily, it should provide all the information to the pilot in the same way the pilot gets information when he looks outside the cockpit. OZ should provide a panoramic (360-by-180-degree) map of airspace in a visually compelling fashion. This map could be used as a single frame of reference for the engine and radio instruments, and then be put together as a picture for the pilot. This setup should reduce the workload needed for a pilot to stay ahead of the aircraft. In doing this, OZ should not lose or bury any information in hidden or covert calculations, but make all the information available to the pilot. If OZ could do that, we figured it would help combat spatial disorientation.

Recently, we completed a study of OZ, in which 36 instructor pilots from Training Air Wing 6 at NAS Pensacola volunteered to compare flight with OZ to flight with conventional instruments. The pilots flew NAMRL's high-quality, research-grade, desktop simulator in a straight-and-level, slow-flight task—slow enough to make the simulated aircraft dynamically unstable. The pilots were breathing air equivalent to 18,000 feet for 13 minutes for each display, so they were slightly hypoxic. To make the air equivalent to 18,000 feet, we used a small, portable, computer-controlled device also invented at NAMRL. The idea behind the experiment was that the pilots would fly OZ better than with conventional instruments, even if they were hypoxic. That's what we found: By using OZ, a pilot would have more time to recover in an emergency.

The pilots told us the experiment—being hypoxic while performing a flying task—was a worthwhile training experience they could not have achieved in the altitude chamber. NAMRL's small, portable device that simulates altitude by reducing the oxygen content of the inspired air has a future for training.

Dr. Temme is with the Naval Aerospace Medical Research Laboratory, Pensacola, Fla., and Dr. Still is with the Institute for Human and Machine Cognition at the University of South Florida.

Contact Dr. Leonard Temme at temme@namrl.navy.mil or Dr. Dave Still at dstill@ihmc.us for more information and how to fly OZ on your computer. –Ed.

Photo composite.

The RadAlt Is On!

By Ltjg. Scott Simpson

Spatial DISORIENTATION

Our detachment had been together for a short time, and we quickly were burning through the work-up cycle. Our OinC checked in just before week-one work-ups, and we worked hard to get through all of the wickets before deployment. Our detachment consisted of a new HAC, three H2Ps fresh out of the FRS, and the OinC, who was returning from his aviation-appreciation tour.

I just had passed my first fleet NATOPS check. The brief wasn't my finest hour, but, when I showed up for the flight, my game face was on. I had finished the flight with a surprising amount of praise from my instructor. This solid check flight gave me a mild confidence boost going into the final phase of work-ups and the deployment. I also had the detachment ops job as a 2P, so I was jumping through flaming hoops to figure out what I was doing.

My OinC and I were scheduled for a good-deal .50-cal shoot, and, being a gun lover, I couldn't have been happier. I would be in the right seat and get the majority of stick time. We also would get some AWs requaled. The OinC was a calm and educational HAC to fly with; the evening couldn't have been better.

After the brief, we launched at 1600, with five souls on board for the first half of the event. We had an hour and a half of daylight left. The helo flew nicely and behaved well; my confidence in the aircraft was high. It was a fun flight that boosted my piloting confidence level—sounds like a rookie waiting for a mistake.

Once we got on range and the first AW's quals nearly were complete, the gun jammed with a round in the chamber—no big deal. We called the squadron on the way back, and they had everything we needed ready for our return. The tower sent us to pad three to clear the jammed round, and, within 20 minutes, we were fixed and ready to go.

It now was dusk, and we needed to do the night portion of the shoot, so we relaunched on the second half of the bag. We arrived on the range and promptly put a smoke float in the water. Knowing we were short on time, I hurried to get on target so the AWs could open up on the evil smoke float. It now was dark with a broken cloud cover and a barely visible horizon.

Once the AW reported he was ready, the HAC told me to turn back in to the target. I knew where it was because we had plotted it on the multi-purpose display and had a fly-to-point on its location. We also had FLIR up so the HAC could guide me directly to the target. We were flying at 200-feet AGL when I started my turn.

Because I now was a "super pilot," I thought I could turn the helo around in near-total darkness without referencing my gauges. After all, the aircraft had flown like a champ all day. As I started my turn, the AWs focused on looking for the target, the HAC kept an eye out for the marker, and, just to make sure no one was watching the gauges, I figured I also would look outside. (After all, I am night VMC-qualified—barely—and we had a strong aircraft.)

About halfway through the turn, I decided to look at my gauges. About that time, the HAC heard his variable-altitude-warning-indicator tone and looked at his gauge.

As I focused on the gauges, I heard him yell, "Power!"

I realized our situation about the same time he did. I started to pull power on the collective an instant after his call. It seemed like an eternity to us. I had lost 120 feet of altitude in just a few seconds. I hadn't added any power during the turn, and I hadn't been hawking the radar altimeter (RadAlt) like I should have. As we passed through 90 feet on the way to 80 feet (which is where I started the recovery), the pucker factor in the front seats went through the roof. True to form and very calmly, he said to me, "Don't do that again."

After thinking it over, I suppose he figured it had scared me bad enough I would be extremely careful, so he let us finish the flight. On the return, we heard our HAC calmly discuss how close the five of us were to not going home.

In retrospect all of the things I did to make that evening extremely hazardous are crystal clear. Overconfidence in the aircraft and myself were big factors. I routinely had allowed myself to get so bogged down with deployment preps that I wasn't focused. When finally a good deal came along, I was too complacent and too relaxed.

Although we work, succeed, and fail as a crew, and we all played a role in this near catastrophe, it was my job as the pilot at the controls to make sure we were in a safe-flight envelope. I should have called for my copilot and aircrewman to keep one eye on their tasks and one eye as a backup. Because they were engaged in other assignments, no one was checking on me. It's a good idea to continuously remind ourselves that our copilots and aircrewman are essential to our survival.

Fortunately, the worst thing that came from this near-tragedy was the cost of some trust I had earned from my OinC over those previous weeks. In time, I managed to earn back his trust. But, as new aviators, the last thing we want, second only to planting a perfectly good aircraft in the water, is for our HACs and OinCs to lose confidence in us. I have learned never to rely only on systems like RadAlt and AFCS. There isn't, and never will be, a substitute for keeping a good, solid scan.

Ltjg. Simpson flies with HSL-46 Det 5.

Vertigo on the Ball

Spatial DISORIENTATION

By Lt. Rebecca Adams

I had heard the vertigo stories: It feels like you're spinning in circles, or in a constant angle of bank, unable to differentiate between upright and inverted. I, however, was a vertigo virgin, until one night during Operation Enduring Freedom.

The rolling sensation started as I passed through platform and never stopped.

Let me set the stage. The weather was anything but clear—1,500 feet overcast, three-to-four-foot seas, and not a hint of a horizon. I was returning from a 6.5-hour mission over the beach for the final recovery of the night. I hoped the debrief would be minimal, so I could make rats. The flight had been uneventful: We had had five hours of solid NVG tac wing, with some exciting tanking to mix things up a bit. My lead and I were above 20,000 feet for the majority of the flight, and we had no idea what awaited us during our CV 1 approach.

After receiving marshall instructions, I detached from lead to attack the dreadful time-distance-heading problem that preceded each Case III, CV 1 approach. I began the descent, and my nightmare began. The turbulence was like nothing I ever had felt before. My Hornet was tossed around, and I seemed to bounce between layers of black and gray storm clouds, with lightning in the background for added excitement.

I couldn't tell when my descent started and stopped by looking outside, only by what my altimeter read. The rolling sensation started as I passed through platform and never stopped. I broke my rate of descent, but that did not help the sensation. As I leveled off at 1,200 feet, I stared at my instruments in hopes of recaging my head for the landing—no luck.

The boat seemed to be jackknifing up and down, like a little cork in a bowl of water. I could not make out the back of the ship from the front; the ship appeared to be flipping end over end. I continued with the approach and followed my needles. The ball call was stem power at its best; I don't remember making the call. At that point, the LSO took over. I was low and going lower.

"Power…power…easy with it…power back on," the LSO called.

My left hand was responding to the LSO calls, not to what my eyes were seeing. From three quarters of a mile and in, I could not make out the shape of the landing area, let alone tell you which way was up. The sudden deceleration of my jet in the wires was a shock but a welcome one. I had shaky legs like you read about, and I hardly could taxi out of the landing area.

One of my squadronmates was on the pickle that night, and I credit my survival to that familiar voice. I could not have landed the jet by myself, and, in retrospect, maybe I should have been waved off. However, paddles had no idea I had such a severe case of vertigo, and how could he? I never told him.

I never had heard someone call vertigo on the ball, and I didn't think that was an option. I just thought I needed to stop flying. I hoped I wouldn't crash into the back of the ship—maybe not the best train of thought.

Lt. Adams flies with VFA-83.

As aviators, we calculate risks, analyze control factors, and decide whether we can do the mission. Aviators routinely push the edges of their envelope, but it is difficult to decide when we just are pushing our skill level or jumping beyond what we can handle. One of the most difficult skills to hone is to know when to ask for help. There are many control factors available to assist the carrier aviator: aircraft instruments, CATC reps, and LSOs, to name a few.

When our bucket is overflowing or is reaching capacity, fall back on those who are in place to assist us. Fess up, and admit your situation. It is better to be a little embarrassed about calling up CATC with the leans or calling vertigo on the ball than to lose lives and assets. Had the pilot called vertigo on the ball, she could have been waved off and set up for a Mode 1 approach. The LSOs did an excellent job staying ahead of the pilot and talking her down. The pilot did a good job listening to the LSOs. But neither realized until later how fortunate they were at the outcome of this pass.

In the Hornet, getting the switchology correct is imperative for a coupled approach. Don't wait for it to be your night in the barrel to figure out which buttons to push. Try one or two Mode 1 approaches during each line period—it will not hurt your GPA. Practice will keep the procedures fresh and give you confidence in the system.

If CAG or squadron SOP prohibits nuggets from flying Mode 1 approaches, try one or two in the simulator to keep the skills fresh.

—Lt. Lyndsi Bates, FA-18 analyst, Naval Safety Center.

Photo by Matthew J. Thomas. Modified

I Think I Have

By Lt. Ben Cone

Unaided approaches to and landings on to small decks at night aren't necessarily difficult, but they can be dangerous. In the HSL community, we regularly practice this core competency as a prerequisite for NVG-deck currency.

the Leans

Spatial DISORIENTATION

Any helicopter pilot who regularly lands on the deck of a "small boy" at night, can tell about events ranging from the benign to the terrifying. You'll hear about the dreaded "black hole," whose sole job is to sucker a helicopter pilot into landing 100 feet short of the ship. You'll hear about excessive closure rates or about the time pilots were so high they lost sight of the flight deck. My story isn't quite as hair-raising as others, but the consequences could have been just as disastrous.

It was an hour after sunset. My crew just had completed another CD-ops mission in the Eastern Pacific. The last part of our flight was to include a 30-minute DLQ period for my copilot. Our ship recently had returned to deployment from a two-week, mid-cruise maintenance period, and my copilot hadn't flown at night in nearly three weeks. Before sunset, we had noticed several isolated showers in the area. The weather did not concern us, however, because visibility seemed only to be reduced mildly in those areas.

We rolled into his DLQs, and his first approach to landing was uneventful. As we took off for our second approach and turned downwind, the ship drove into one of the isolated showers. When we set up for final at more than two miles out, the ship easily was visible; the rain was only a minor annoyance. I briefly turned on the windshield wipers to get a clear view of the ship. There wasn't enough rain to keep the wipers on during the course of the approach.

My H2P was flying his approach right on the numbers, and we hit one-half mile at 200 feet. As he continued to descend, the water again pooled on the windshield. I turned on the windshield wipers to see the lights on the boat. I also had turned on my copilot's windshield wipers. At precisely the time I turned on his wipers, he glanced up from his instruments to check his lineup with the ship. He saw an obscure light source completely disappear as the wiper crossed his view; then a very clear set of lights reappeared. There was enough visual stimulation to give him the leans; he was convinced we were turning, even though the aircraft was wings level. Getting the leans is not good when you are below 200 feet in a descending and decelerating profile. Much to my copilot's credit, he immediately recognized his situation and told me. I took the controls and waved off the approach. We climbed to a safe altitude, as I turned away from the ship. We talked about what had happened, and he quickly regained his sense of balance.

To give my copilot a better sight picture to the back of the boat, I inadvertently gave him the leans during a critical phase of flight. This bad situation could have turned a lot worse if he had remained silent. Fortunately, he quickly realized the problem, and he said something. If I only had mentioned I was turning on the wipers!

Lt. Cone flies with HSL-42.

A LITTLE BIT OF TENSION

Photo by PH3 Coss. Modified.

By Lt. Robert Fluck

We were sitting on the deck of USS *Kitty Hawk* (CV 63) off the coast of Japan. The weather was standard, with a broken layer at 3,000 feet. The seas were six to 12 feet, which made the boat bob like a cork. It was my fourth at-sea period, flying EA-6Bs with the Gauntlets, so I was used to the carrier environment and felt as comfortable as one can in such a place.

We looked at each other, instantly remembering that not a week earlier, the deck had launched an S-3 without receiving a salute from the pilot.

We briefed at 0515 for a morning surface-reconnaissance mission. The usual morning fatigue gripped us, but we felt good to go. Our crew had flown this mission profile each of the previous three days. The battle group was on the lookout for a surface group simulating an enemy force, and we were just one of the many assets looking for the bad guys.

We briefed all aspects of the flight, and everyone had a solid grasp of their responsibilities and the scenario. We walked on time and started our Prowler.

As part of the launch evolution, we were broken down and taxied to cat 1. I acknowledged the weight board after confirmation from my pilot, and we spread the wings. While the wings were lowering into position, the catapult director taxied us forward and engaged the holdback. After the wings were spread, locked, and the handle stowed, my pilot lowered the flaps and slats. He called the configuration over the intercom system, while I arranged my cockpit for the cat shot.

The director usually will taxi you far enough to get the tow link down in front of the shuttle, but our director had not paused us for this step. Instead, he taxied us directly in front of the shuttle. He had expedited the process and combined the two steps. Normally, this change would not have been an issue, except while he did this, the wings locked into position, and we received a master-caution light in the cockpit; we had a rudder-throw-caution light.

My pilot was calling out his integrated-position indicator, located by his left knee, and I was turning the IFF (located on the center console) from standby to on. He first saw the caution light, gave a hold sign to the taxi director, and called my attention to the indication. I told the air boss we were down on cat 1 and needed a spin-off. My pilot again was checking his configuration, so we didn't realize the director had put us into tension. Because of the high sea state, we also didn't notice the mild shudder a plane gets when being put into tension. We weren't expecting the shudder because we didn't realize the tow link was in front of the shuttle. Obviously, we did not go to military power.

My pilot quickly realized everyone was staring at us. The hairs on his neck stood up. He posed the question, "Are we in tension?"

We looked at each other, instantly remembering that not a week earlier, the deck had launched an S-3 without receiving a salute from the pilot. As we were coming to terms with our situation, the catapult was suspended, the director stepped in front of us, and we were thankful the last link in the mishap chain was broken—preventing the Prowler community from being one step closer to a replacement airframe. One moment of inattention at the most inopportune moment can result in near-disaster. We were a head scratch away from going swimming.

How did we get so close to such a disaster? The catapult director and my pilot had failed in their agreement to always keep eyes on each other. If they had, the director would have seen the hold sign, or my pilot would have seen that the director was not looking at him when the signal was given. The pilot would have seen the tension signal, and the director would have seen my pilot was not looking at him when he gave the signal. I am also at fault for not backing up my pilot. I should have had my cockpit in order before taking the cat; then, I would have seen the tension sign, and I could have told my pilot we were being put in tension.

A flight is never routine. The regime in which we deal with is unforgiving of error. The tendency is to become comfortable with the dangers we face on a daily basis. That day, we were reminded of the dangers, and the lessons will not be forgotten.

Lt. Fluck flies with VAQ-136.

ORM Corner

Not the Preferred Option, but…

By Capt. Erik Bartelt, USMC, with Maj. Peter Calogero, USMC

This account is not unique in its operating environment: personnel from every active-duty HMLA squadron and the fleet replacement squadron (FRS) engaged enemy forces during Operation Iraqi Freedom.

On April 4, 2003, we were Dash 2 of a three-ship of AH-1W Super Cobras on a close-air-support mission along highway 6, about 15 miles southeast of Baghdad. We just had checked in with a forward-air controller for one of the leading elements of 1st Marine Division, who were with a convoy fighting in a small city along the highway. There was a great deal of smoke in the area from burning vehicles and oil trenches the Iraqis had lit before our ground elements moved through.

Our typical operating altitudes were below 200 feet and above 100 knots. As is standard in the Cobra, I did most of the flying from the backseat, while the frontseater navigated, worked the radios, and used the sensor package in the nose to look for targets. We had been on station for two to three minutes and were getting the lay of the land from another section of Cobras that had been on scene for some time.

Our division lead suddenly called out "Taking fire," and broke away from the city. After looking for the source of fire for a couple of seconds but not seeing a target to engage, I broke hard left to follow lead. I also came under fire (follow-on flights found concealed-fighting positions underneath our holding pattern).

I could hear multiple hits in close succession, and Plexiglas canopy shards hit me in the face. I usually wear a double visor, and I'm glad I did. We heard an immediate master-caution tone and continued the break turn to clear the area. Numerous minor electrical-caution lights were on, including the light for the utility-hydraulic system that powers the oil cooler for the two main gearboxes.

At this time, both wingmen had joined on lead, who also had taken about 10 hits and had made the call for the flight to RTB. It was about 60 miles, about 30 minutes flying time, to our nearest FARP (forward arming and refueling point). By now, I had switched the oil cooler to its secondary position to run off one of the two main-hydraulic systems, which also power the flight controls.

I came inside and gave all the gauges a more detailed look for any other problems. The gunner kept a lookout for other threats and for the numerous high-tension power lines in the area. He made at least one hard pull on the cyclic to avoid wires, while I concentrated more

ORM Corner

Please send your questions, comments or recommendations to:

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on the gauges and less on flying the aircraft. The entire area was by no means secure, and we fully intended to bring all three aircraft back along the highway (over friendlies) to our FARP.

About two minutes after being hit, we received a temperature-pressure caution light for the combining gearbox (which joins both engines to the main transmission that then spins the rotors). Oil pressure was stable, so we weren't losing oil, but the temperature already was 15 degrees above NATOPS red line and climbing. All Cobra pilots have had the ready-room discussion about overtemping the C-box if necessary, but neither of us thought we had another half-hour of flight time left on this gearbox. We elected to put down the aircraft and told our division leader of our intentions.

After another minute or so of flight—about five miles from where we had been hit—we saw a turnout off of the highway that met three criteria for landing: The site was clear of the numerous towns along the road, it looked more than big enough with a relatively hard surface, and a large number of friendly armored vehicles were moving past. As soon as we landed, I performed an emergency shutdown, while the gunner ran to the column along the road and coordinated security.

Lead also landed and shut down to inspect for damage, as we saw several hits near his tail-rotor driveshaft. His aircraft looked flyable back to the FARP, but some of the electrical system had been shot out, and he was unable to restart either engine. Dash 3 remained airborne, providing security, and coordinated for a section of our squadron Hueys, which also were in the area. One of the senior crew chiefs inspected both aircraft and determined neither was a quick fix to fly out of the area. The Hueys and Dash 3 then departed the area to coordinate a maintenance recovery.

Several antitank Humvees from 2nd Battalion, 5th Marines, almost immediately surrounded our helos. They were relieved by elements of 4th Light Armored Reconnaissance Battalion, which stayed around the aircraft until our squadron maintenance team and MWSS-271 were able to truck them out two days later. Inspection revealed Class B damage from 7.62 mm rounds to the oil cooler, both rotor blades, sighting unit, No. 2 engine, forward fuel cell, and structural supports in the tail boom, along with other superficial hits.

Several things helped turn an air emergency into a ground emergency. Our squadron routinely had flown training missions involving long ranges and FARP operations (including brownout landings), which we encountered during OIF. Pilots had been paired in combat crews for two months before hostilities started, so we were familiar with how each other dealt with cockpit responsibilities and stress. Most importantly, we had discussed, as a squadron and as individual crews, modifications to EPs, based on combat conditions. Most of the modifications involved flying with a "land as soon as possible" EP for what normally would be associated with "land as soon as practical" distances, or continuing the mission with "land as soon as practical" EPs.

A month before, the gunner and I had agreed the impending loss of any gearbox was not one of the EPs we could stretch for an extended period to reach a friendly airfield. That agreement made landing a no-brainer once the C-box caution light came on.

Don't be afraid to alter your perceptions of which options are good, ones that aren't great but probably workable, or ones that still are unacceptable. While we did create a logistical and security headache by landing, the aircraft probably would not have made it back to our FARP. Also, don't make fun of your brethren in the ground-combat arms.

Capt. Bartelt (pilot) and Maj. Calogero (gunner) fly with HMLA-267.

Photo by Matthew J. Thomas. Modified.

Go Ahead, Have a Drink

By LCdr. Denny Shelton

Summer in South Texas—what could be better? I mean, the fishing is good, the beer is cold, and South Padre Island is kickin'. OK, the heat is oppressive, the days are long, and Corpus approach occasionally calls out radar contact on the mosquitoes.

I was a well-established IP, about to take out my umpteenth on-wing for early fam maneuvers. Our flight was scheduled for just after lunch, right as the sun was approaching its highest point. The student was solid and a real go-getter; the pressure he exerted on himself was more than I ever could. We completed our brief and walked to the aircraft for preflight. As promised, the temperature was in the high 90s, and the humidity was matching. We were sweating profusely, and I was more than glad this was not a fam 1, where it would take a good 30 minutes just to get the air conditioning going.

Once airborne, we practiced level turns, and, after chasing the horizon with the nose a couple times, I took the controls. I began my normal spiel about fixing a point on the nose with the horizon and then pulling that point across the blue Texas sky. We completed a 360 at 45 degrees AOB one way, rolled through level and into a 45-degree AOB in the other direction.

Halfway through the turn, my student said he didn't feel well, so we rolled out. I offered sage advice about going to 100-percent O2, fully turning up the air conditioning, looking at the horizon, and making sure your bag is ready—just in case. When I thought everything was all right, I saw my stud go for the bag and then hunch his back as he dry heaved. No big deal, I've

been here before; just wait until he's done and RTB. Nope—fate dealt me a different set of cards this time. After watching another quick heave, I saw his entire body stiffen, go into convulsions, and then go limp.

"Holy frijoles" and "Madre de Dios," I exclaimed. This kid just died on me, and I can't do a thing about it. Not only that, but, when he convulsed, his feet shot up under the pedals and jammed them solid—no rudder control at all for the home team.

So, what'cha gonna do now? Done dropped yer pistol when ya jumped through the winda!

After a good four hours—actually about 10 seconds—I saw his chest rise and fall in a normal rhythm. But, he still was out cold.

I turned toward Corpus, calling to my student and going over contingencies in my mind. I'll make as many approaches as I need to put down safely, even if it means gear up. If I don't feel I can get it down and bring us home, then I'll point it toward the Gulf and take the silk-nylon elevator down. *[I trust the author would've waited for the student to come to and make it a team bailout—Ed.]*

After watching another quick heave, I saw his entire body stiffen, go into convulsions, and then go limp.

As it turns out, I never had to make any approaches with stuck pedals. After about two minutes, my copilot woke enough to understand me. It still took a couple seconds for him to become coherent; his condition reminded me of G-LOC.

We landed, and I got my student to medical for a complete checkup. He returned to flight status soon after.

What happened up there? He experienced a combination of several physiological effects. First and foremost, he was dehydrated, which lowered his tolerance for stress. The dehydration also helped to bring on the nausea and affected his blood pressure. When he became sick, he literally gave himself G-LOC by cutting off the blood supply to his brain, which turned out his lights in a dramatic show.

While we each had water in the aircraft, I should've made him drink all he had. There's no way I could keep him from getting airsick (yes, Sully, for once my flying was smooth), but, since his flight suit was drenched before we strapped in the plane, I should've been alarmed. I also should have had him drink water before we even went flying.

Our Navy is operating in some oppressive regions around the world. I've preflighted aircraft where the OAT gauge was about pegged out, and you couldn't touch the bird without gloves on. You can sweat your life away before you even get in the air.

The only solution is to drink a lot; within 12 hours or 12 feet, it later can save you a headache. Oh, that's water by the way; sorry y'all, I don't write the rules.

LCdr. Shelton flies with HSL-42.

Makes you wonder how this article would have been written had no IP been in the aircraft.

Normal body functions such as urination, sweating, and breathing can result in the loss of three to four pints of water per day. Add a 90-degree day with high humidity, flight gear, anxiety, and the greenhouse effect from an enclosed cockpit, and the potential exists for some type of physiological episode.

Dehydration in the aviation environment is very common, even when not dealing with extreme temperatures as discussed in this article. A pilot can show up dehydrated for a variety of reasons. Dehydration could be a result of increased sweating from a strenuous workout without adequate fluid replacement, or by consuming caffeinated drinks (such as colas, coffee or tea), which cause the elimination of more fluid than has been consumed. Drinking four cups (eight ounces) of caffeinated beverages causes the body to excrete five cups of fluid. Some aviators even go as far as dehydrating themselves before flight to avoid urinating while airborne.

The good news is that dehydration can be monitored. You might think that thirst would be considered the primary indicator of dehydration, but, unfortunately, thirst is not a good indicator as it occurs after dehydration has started. Dehydration, however, can be monitored by urine color. Darker-colored urine indicates worsening dehydration. Nearly colorless or slightly yellow urine indicates the proper amount of water has been consumed.

Those are the facts about dehydration. What can you do? Drink plenty of water, especially when the ambient temperatures are high. Stay away from caffeinated beverages; if you feel the necessity to consume them, drink water to offset their effects to stay hydrated. If you need flavor to make the water more palatable, add a little lemon or lime to perk things up.

—Cdr. Rick Erickson, aeromedical analyst, Naval Safety Center.

Where'd the Boat Go?

By Ltjg. Steve Audelo

If you have been off the Virginia Capes operating area in January, then you know how bad the fog can get. I'm talking fog so thick you can cut it. That's exactly the kind of weather we experienced during a JTFX.

The night before our fateful flight, the other crew on our detachment diverted because of poor weather. After shooting two emergency-low-visibility approaches (ELVAs), they had called it quits and flown to another ship in our group, which had reported better ceilings and visibility.

We launched on an SSC mission, returned to mom following the first bag, hot pumped, and relaunched to provide range clearance for our ship's missile shoot.

After the shoot, we were vectored south to search for an "enemy submarine" suspected to be in the area. During the range clearance, we spotted some nasty fog that appeared to be heading our way. However, the tasking we received took mom and us away from it.

Even though we wouldn't be in range of a shore divert, we also had USS *Seattle* (AOE 3), an FFG, and an LST (not part of our group) for possible divert options. Looking at our gas quantity, the progression of the fog, and the direction of our tasking, we were confident we easily could do the bidding of our warfare commander and return home with plenty of fuel.

Once we arrived at DATUM, it was easy to find the sub: It had surfaced. We called a visual on the sub and zoomed in for a photo rig. We marked-on-top a couple of times and reported course and speed before the sub did a 180 and increased speed. Our ship tasked us to stay on top the contact and to update course and speed changes. We continued the updates until the submarine disappeared into the heavy fog bank we had been monitoring all morning.

Not seeing the FLIR turret on the nose of the helo convinced us to break contact and to head to the boat. Heading back was a good idea in theory but not in practice. The fog that had been hugging the coast during our "hunt" had begun to move between our ship and us.

At the time we called lost contact on the sub and let the controller know we wanted to RTB because of deteriorating weather, the now fast-moving fog bank had overtaken our ship. Our predicament found us 40 miles from mom, separated by a fog bank in zero-zero conditions. We asked, via our ASTAC, if mom would close our position and try to find better visibility for our recovery. This request never was passed on to the TAO, who wasn't aware of our situation until the only reference the ship had to our position was an old DATUM. The ship no longer had a solid track on us.

Our situation worsened. The radios started to break up, and we lost HAWK, our encrypted data link. We couldn't locate mom's position on radar because of interference from the fog. We checked our gas and calculated we had one hour before we went swimming. Normally, that amount of time would be a comfort.

The fog was moving east, toward us, but at a rate that mom wouldn't be able to get ahead of in time for us to land. A mere 40 miles separated our comfortable racks from us, but there wasn't any way for us to get to them.

The HAC kept talking to the ASTAC, providing him with our location and inten-

tions. Meanwhile, the sensor operator and I tried to locate *Seattle*, which was nearby and our intended divert. As we turned toward *Seattle*'s last known position, I tried raising them on their land-launch frequency. As we rolled out on a heading toward them, the same fog bank overtook the ship. This day easily and quickly had become my worst fear.

We knew an FFG and an LST still were in the area, but we weren't sure if the fog also had swallowed them up. While the HAC communicated with mom, still trying to relay our intentions and position, the sensor operator and I tried to visually, and with FLIR, find the other ships.

After what seemed like an eternity, the sensor operator spotted on FLIR what looked like a warship. The contact was USS *Tortuga* (LSD 46), which had an ample flight deck. As the HAC closed their position, I tried calling them to explain our situation and to request permission to land. We couldn't establish communications, but we continued to make calls in the blind. We later found out they had heard everything we had said but couldn't broadcast to us because of radio problems.

We circled the ship and had our aircrewman signal we needed to land. Then we saw an amazing sight: The entire crew was scrambling to set flight quarters. A figure stepped out onto the bridge wing and enthusiastically waved us aft to land—that figure was the XO.

The day could have ended very badly. Only two minutes after we touched down on deck, the same fog bank overtook the ship. The *Tortuga* had been our last chance at landing; after that, we would have had to ditch.

We checked our gas and calculated we had one hour before we went swimming.

Photo composite.

Many factors led to this near-mishap. While crew coordination was amazing inside the cockpit, the communication flow outside, back to our ship, could have been better. Granted, we were having problems with the radios at just the wrong time, but we could have done things differently to make our plight more known: We could have spoken directly with the TAO as soon as we thought the gravity of our situation wasn't understood.

Communication can be the vital thing that will keep you out of the water.

Ltjg. Audelo flies with HSL-48.

Photo by PH3 Mark J. Rebilas. Composite.

A Normal Flight With a Sandy Ending

By Ltjg. Jill Dougherty

I was the radar operator on a mission over Iraq during the early, critical phase of Operation Iraqi Freedom. My Hawkeye crew of five was providing the critical link between the troops on the ground and their airborne support. Scheduled for 4.7 hours, we just had turned over responsibilities to a follow-on crew and were headed back to USS *Abraham Lincoln* (CVN 72). The pilots had hawked our fuel state the entire flight; we had enough gas for a normal recovery.

Marshal set us up for a Case II recovery because the sandstorm brewing over Iraq hadn't reached the Arabian Gulf with its full intensity. We held in the stack while the deck folks fought visibility problems that were not passed to us. Finally, the copilot, the carrier-aircraft-plane commander, was forced to call priority fuel to marshal. At the same time, marshal switched to a Case III recovery, and we heard, "601, your signal is bingo."

Without a second thought, the pilots turned toward our divert, Shaikh Isa, Bahrain, which was said to have VFR conditions. We immediately took bingo profile, squawked 7700, and started talking to Bahrain Center. To stay on the safe side, the copilot asked for updated

Marshal set us up for a Case II recovery because the sandstorm brewing over Iraq hadn't reached the Arabian Gulf with its full intensity.

weather for Bahrain International and Shaikh Isa. Neither option sounded appealing, as the visibility at both airfields was fast approaching zero, with virtually no ceiling. To make matters worse, they did not have published approaches the E-2C could use. We also realized with Shaikh Isa IMC, our bingo numbers were not sufficient, and we actually were proceeding below bingo fuel.

The pilots mulled over the pros and cons of landing at either field, considering distance, available navaids, ground services, and the weather. We decided on the lesser of the two evils: Shaikh Isa, which had VORTAC and VOR DME approaches. Bahrain Center had called 200 to 300 meters visibility. We decided to fly the approach, using only our viable navigation assets for a field landing: TACAN, GPS, and radar altimeter.

At this point, the crew realized we might have to bail out or ditch the aircraft. We decided it would be safer to point the aircraft over water and bail out. We had enough gas for two approaches and a climb to a safe altitude before jumping. The uncertainty of getting a visual on the runway weighed heavily in our thoughts. We broke out the pocket checklist and went over the steps in preparing to bail out.

Talking to approach control, the copilot asked for vectors to a short final. We followed the TACAN inbound, with as much help as we could get from the controller. He gave us vectors to intercept final at four miles. All we had left were the radar altimeter and the pilot's ability to fly a visual approach in a horrendous Middle Eastern dust storm. The copilot made one last radio call to make sure the field lights were on at full intensity, and then he tried to catch sight of something. The crew in the back made out the water at 100 feet and one mile out, but the pilots still couldn't see the runway.

Maintaining 100 feet on the radalt, the pilots finally saw the runway off to the left, directly below, and reported the good news to the CIC crew. Quickly, the pilot banked to the left to line up with the runway, and he made an amazingly smooth landing. We landed with about 500 pounds of fuel per tank, with both FUEL LOW caution lights on—we had only 20 minutes of flight time left before flameout.

What did we learn? After holding in marshal for 15 minutes and going through two push-time delays, the pilots made it known they would be close to 2.0 on the ball. We did not know why we were being delayed, but we heard numerous aircraft being sent to the tanker. Our copilots' forceful priority-fuel call to marshal probably gave us an additional 300 to 400 pounds of fuel for the bingo.

As soon as we were signaled to bingo, we pointed our nose in the direction of the divert field without questioning the decision made by air ops. Even though we were unsure of the reason for diverting, we followed directions and bought ourselves several minutes' worth of fuel, as well as much needed time to get our ducks in a row.

Be familiar with the diverts your ship has picked out for the air wing. We knew Shaikh Isa did not have an IFR approach we legally could use, yet the ship was considering it a divert for us.

What about bailing out? We started thinking about it early, which gave us time to prep our seats and to get into the proper mindset. We considered the 40-knot winds at the surface that would have made it difficult to control a parachute, as well as the low visibility, which would have made it difficult to conduct a timely search and rescue. We were fortunate, and the search and rescue was not necessary.

It turned out to be just another night in a tent at an Air Force base for us.

Ltjg. Dougherty flies with VAW-113.

Situational Awareness
Assertiveness
Decision Making
Communication
Leadership
Adaptability/Flexibility
Mission Analysis

Single Seat, but Not Alone

By Lt. Christopher Cochran

As a nugget, I've found I learn something new every hop. Sometimes the lessons are small, and sometimes they affect everything about how you look at flying.

My story began at 0600 on a Wednesday morning. I briefed our combat hop over Afghanistan with the skipper as my lead and CAG as our airborne spare. At the end of the brief, CAG jokingly asked me what I was going to "go down for." I replied, "As long as I had two good engines, I'll be going over the beach."

After sorting out a few minor aircraft problems, I took the cat and launched, relieved to get airborne. I ran through the combat checks to verify all systems were working. I then called red crown "as fragged" and started to rendezvous with the skipper and the KC-135 who was waiting en route.

The trip north was uneventful, and we had a few plugs on the tanker to keep our fuel states high. We increased our speed for the last 50 miles to make our vulnerability window.

About 10 miles before entering Afghanistan, my heart jumped through my chest as I felt a large clunk on the right side of the aircraft. I had a sharp starboard yaw with an "engine right, engine right" voice alert. In disbelief, I looked down at my left DDI to see a growing stack of cautions on the display. I looked down at the integrated fuel and engine instrument (IFEI) and saw my right engine rpm had dropped to zero, and the exhaust-gas temperature (EGT) quickly was dropping. I pulled the right engine to idle while this information worked its way into my head, and then I shut off the engine. At that moment, I realized I was single-engine, 600 miles from mom.

For the first time in my career, I looked down at the yellow- and black-striped handle and actually thought about what using this handle could mean. I tried to calm my voice before saying anything on the radio and then transmitted, "Sir, I just lost one of my engines."

The skipper responded in a hopeful tone, "Did you lose an engine, or do your indications just show you lost an engine?"

We sorted out the details, and he flew in close to check on my jet. Throughout this time, I had the left engine at military power, and I

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slowly was decelerating. The jet had no visible damage on the outside, but I quickly was decelerating while trying to maintain altitude. We decided to maintain 200 knots by pushing over the nose and establishing a slight descent.

While in the descent, the skipper asked my fuel state. He said I didn't have enough gas to make it back to mom, and I wasn't flying fast enough to refuel. He talked about the option of diverting to a field in Pakistan. We then asked our controller for approval to jettison my ordnance, to improve my jet's performance. After losing about 6,000 feet of altitude, the skipper told me to jettison the ordnance and to try holding altitude. I jettisoned the bombs and gently pulled back the stick to level off. As I stared at my airspeed in the HUD, the skipper turned back to verify the impact point of the dud ordnance. He reported a visual on their hitting the ground, and they had not gone high order. I was happy to hear it but still was worried about my inability to accelerate.

I was level but holding only 220 knots. I would need to accelerate quite a bit before I could refuel from any of the airborne platforms. We also were below the minimum refueling altitude in theatre, and I couldn't climb and still maintain a reasonable airspeed. I had selected our divert field in one of our waypoints, and we had plenty of gas to get there. We started flying west, through Afghanistan, toward another exit point while we sorted out the problem. Our controller initially gave us a "snap" to the KC-135 that just had refueled us. In the cockpit, all I could think about was trying to tank on the "iron maiden," on single-engine, in blower.

As the skipper talked to the controllers, a KC-10 in the area came up and said they had plenty of gas to give and could rendezvous on us. I breathed a sigh of relief as I saw the big tanker overtake us and descend with its hose extended. The tanker slowed to its minimum tanking airspeed as I selected afterburner and caught up. I emergency extended the refueling probe because my utility hydraulics didn't work. I fell into trail on the tanker, but I needed max afterburner to get any closure. The tanking went smoothly, and, after topping off, I moved out of the way while my wingman filled his tanks. After refueling, I checked my distance to mom and figured I would have enough fuel to return to the ship. The tanker stayed with us until we were halfway home, and we thanked him as he departed.

The trip back was as uneventful as the trip up had been. I kept the left engine at mil, and we slowly limped back to mom. Once we were feet wet, we called the ship and were told we would have a ready deck. I set up for the straight-in and tried to stay calm. Once I had received my gas, the only thing left to think about during the 1+45 trip home had been the single-engine trap that lay ahead. I had seen that trap a few times and had done quite of few of them in the simulator. In the simulator, though, I didn't always get aboard, and, sometimes, I even didn't make the ramp. I completed the NATOPS procedures for emergency-landing-gear extension, called a "see you" at six miles, and switched-up tower.

"Paddles, 412 checking in at five, single-engine," I called.

CAG paddles was on the pickle, and asked me if I had a second to chat. I told him to go ahead. We cleared up exactly which engine had failed and if anything else wasn't working. He asked me if I had done a single-engine approach before, and I responded "no."

"It's doable," he replied. "Since you lost your right engine, don't worry about a ball call (our comm switches are on the right throttle).

He said, "The secret to a single-engine approach is not to go low. Also, your waveoff capability is reduced, so don't go high because you don't want a high come-down, in close, without the ability to wave off. So, remember, don't go low."

The paddles logic didn't sink in very well; I still was stuck on "It's doable." Looking back, it seems like I got the same information when I asked paddles how to improve my grades: "Just fly a centered ball all the way to touchdown." After the pep talk, paddles talked me down into an OK 3-wire. These stories usually end with a slider, but chow was secured before I could make it to the wardroom.

A few hours later, I checked with maintenance to see what had happened. They still weren't sure why, but it seems the engine-accessory gearbox had failed. There were large chunks of metal shavings on the chip detector, but, until they opened it up, they wouldn't know exactly what had caused the failure. What they could tell me was in 1.9 seconds, I had gone from having a perfectly good engine to having a large chunk of useless metal on my cheek.

I am thankful for the calm voices, sound judgment from those airborne at that time, and for the skipper's reassuring voice on the other side of the radio. Thanks to the Air Force pilot who offered to hunt us down and give us gas, and to paddles and his well-trained eye that helped me get aboard.

A lot of teasing and joking occurs in a ready room, but, when the chips are down, I know there are a lot of guys who will pull together to help a fellow aviator.

Lt. Cochran flies with VFA-25.

Don't Worry, That Never Will Happen

By LCdr. Sean Maybee

This story, like many aviation stories, could start, "It was just another normal day…," but many days that start normally don't end up that way.

We were scheduled for a zero-dark-30 (middle-of-the-night) preflight and launch on a 10-hour grinder of a mission. Our mid-December flight over Afghanistan was in support of Operation Enduring Freedom. I was the officer in charge of the EP-3E detachment and the mission commander on this flight. I also would be certifying a newly arrived crew on the special instructions and procedures related to our mission. The arriving crew was very seasoned and had plenty of theater experience.

We were airborne at 0330, started our transit toward on-station, and completed routine checks and system run-ups. After 45 minutes, and while cruising at our max-range altitude of FL190, I got up to use the head and to grab a cup of coffee. I barely had made it to the back of the plane when I heard the sound no pilot likes to hear come over the PA, "EWAC *[electronic warfare aircraft commander]* to the flight station!"

Having not achieved either of my goals, I hustled to the flight station to see the flight engineer (FE) pointing to a steadily dropping oil-quantity indicator for the No. 3 engine.

"Not a big deal," I thought, "we'll shut it down, go home, and I'll be in bed by 0600." I should have gone to the bathroom.

While strapping in, I called for the No. 3 emergency-shutdown handle, which the FE acknowledged, checked and pulled. The copilot, in the left seat, flew the plane while I strapped in, slid my seat forward, grabbed the checklist, and started to go over it.

EMERGENCY SHUTDOWN HANDLE.....PULL (FE)
HRD (FIRE ONLY).....DISCHARGED (P, FE)
CROSSFEED AND BOOST PUMPS……..CHECK (FE)
PROPELLER.....FEATHERED (P, CP, FE)
OIL TANK SHUTOFF VALVE CIRCUIT
BREAKERS.....AS REQUIRED (P, FE)

The FE pulled the emergency-shutdown handle (the fire bottle was not required), the propeller feathered, and we reset the oil-tank shutoff-valve circuit breakers to prevent further oil leakage. Almost immediately, the No. 3 fire-warning light illuminated, and the loud, distinctive fire-warning horn sounded. We were surprised, since the engine already was shut down, and the propeller was feathered. We silenced the fire-warning horn and quickly revisited the checklist, hurrying to item No. 2:

HRD (FIRE ONLY).....DISCHARGED.

About this time, the events got interesting. To our even greater surprise and growing alarm, dispensing the fire bottle into the engine only extinguished the fire-warning light for about a second, which restarted the fire-warning horn. We continued the checklist.

ALTERNATE HRD (CONFIRMED FIRE ONLY).....AS REQUIRED (P, FE)

I called aft for somebody to look at the No. 3 engine.

Soon, the very calm and reassuring voice of our off-duty FE, who had more than 10,000 flight hours, said over the headset, "Yep, commander, we definitely have flames out here. Some are coming out the tailpipe, and a little is coming out the cowling."

"Well," I thought, "he doesn't seem too excited, so it must not be that bad."

We continued with the checklist. The FE selected the alternate fire bottle and discharged it into the engine, but nothing happened. The fire bottle had no effect on the fire. I recalled glancing at the FE and the copilot, and, for about half a heartbeat, we looked at each other with huge eyes and "What do we do now?" expressions.

Anticipating a bad button or circuitry, the FE immediately checked the circuit breakers. He then reached up and punched the fire-bottle-discharge button about 10 more times, while the words "You've got to be kidding!" escaped my mouth.

Until this point, the events were straightforward and our flight-station crew quickly went through the procedures and checklists and coordinated with the back-end crew. But, we now were faced with a serious emergency not covered by NATOPS. Although I never have flown a tactical jet, it's my understanding that, at the end of their engine-fire checklist, pilots have the option to eject.

So, there we were: 0415 in the morning, 19,000 feet, flying south over the southern Arabian Gulf, three engines, getting slow because we were 137,000 pounds (our max gross weight is 142,000 pounds), and no remaining fire bottles on the right side, but a pesky fire still burning on the No. 3 engine.

Photo by PH2 Michael Sandberg. Modified.

The off-duty FE then piped in with his very calm and reassuring voice, "Yes, sir. It looks like about 18 feet of flame out the tail and 9 feet of flame from the cowling, just aft of the turbine."

Those of us in the flight station could not see the fire. Clearly, the FE's words were not what we wanted to hear. To me, time stood still while I pondered a long-forgotten flight-school lesson about how a fire could burn through a wing in about 90 seconds. Then, the copilot, who calmly had been flying the plane and working with me and the FE on the checklists, pointed out we were slow.

Almost simultaneously, I remembered another lesson from T-34 trainers about how to put out a wing fire by accelerating and slipping the aircraft to starve oxygen from the fire. The copilot started to descend (to increase speed) and put in a slip, while the crew in the back secured their equipment.

Anyone who has flown in the middle of the night, in relatively remote areas, knows there is little air traffic, and the controllers tend to be tired, slow to respond, and about as happy to be up at that hour as you are. When overseas, this situation often can be compounded by language barriers. Fortunately, a British expatriate was controller working that night, and, though justifiably slow, tired and bored when we did our initial check in, he became the world's most-awake controller after I called him the second time.

"Control, this is BR-549. I am declaring an emergency. My No. 3 engine is on fire, and the fire will not go out—repeat—the fire will not go out. I have 24 souls on board and fuel for about 12 hours."

After a long pause, where he probably was making sure he heard what he thought he had heard, a very alert British accent replied, "Copy all bravo romeo. Say intentions."

We just had started our descent, and I was looking out the window at all the oil platforms, pipelines, and tankers in the southern Arabian Gulf, and I didn't yet know my intentions. I was wondering where to ditch when I heard good news.

"The flames seem to be dissipating. Definitely getting smaller," came the ever-calm voice in my headset.

I figured two things had happened. The slipping and speeding up were blowing out the flames, or all the oil that had leaked was burning away. Regardless, ditching was not my first choice anyway, so I decided to land immediately. I requested vectors to the closest field from the controller.

"You are cleared to Dubai, Abu Dabi, or the military field," the British voice said.

With visions of another EP-3E international incident (like China) flashing before my eyes, I wracked my brain, thinking, "Military field, military field—what is he talking about?" After a few seconds, I realized I knew what field it was, and it definitely was the best choice for us.

Our situation was better with the fire dissipating and a place to go, but we still needed to land our plane, which currently was 20,000 pounds over the maximum recommended landing weight. I started to worry about being so full of gas, so I called to dump fuel. The crew's permanent EWAC cautioned me about the flames still coming out the engine—even though the fuel dumps from the other side of the aircraft.

We compromised and waited to see if the fire died out as we descended. We eventually dumped about 5,000 pounds of gas while still over water. Our goal was to land as soon as possible because we had no idea of the actual state of the fire, other than the flames had receded into the tailpipe, which had a red-orange glow.

It took about two minutes from when we secured the engine to the time we initiated the descent and only about 15 minutes from the time of the emergency until we landed. During this time, everyone on the crew was busy securing equipment, reviewing procedures, and discussing possible scenarios once on deck. With all the classified material on board, we had discussed executing our emergency-destruction plan. Because of our choice of airfield and landing country, we decided not to destroy anything, but to take special care to account for all material.

At 3,000 feet and 15 miles from the field, we had reached a stable situation, so I swapped seats to the pilot side for the landing. The flight-station crew reviewed our normal and emergency checklists, while the crew in back reviewed their procedures. The United Arab Emirates approach and tower controllers were excellent, and the crash crew was rolling when we made an uneventful, 132,000-pound, three-engine landing.

The subsequent engineering investigation of the No. 3 engine revealed the oil leak was caused by an aft scavenge-pump-bearing failure, which punctured the pump casing. The fire erupted because of the increased temperature resulting from the decreased airflow through the engine after it was shut down.

How often do you hear people say, "Oh, that never will happen." But, unlikely things happen all the time. As aviators, we need to think, train and practice for events we think (or hope) never will happen: Don't get complacent. Crew coordination was a major factor in handling this emergency. Everyone involved knew their job, how their role fit, and everyone contributed.

This experience taught the men and women of Combat Reconnaissance Crew 6 that teamwork in the execution of NATOPS procedures, along with sound judgment, are critical to handling any emergency situation. Crew-resource management is the key to success.

LCdr. Maybee flew with VQ-1 at the time of this incident.

While flying a day functional check flight (FCF) off the South Carolina coast, LtCol. Karl D. Brandt faced multiple emergencies. During the 500-knot roll checks, his FA-18 had dual, bleed-air warning lights. He completed the NATOPS boldface procedures and immediately headed back to MCAS Beaufort.

During his RTB, the left fire light came on. He secured the engine, and he did not see any smoke or fire. About 10 miles from the airfield, with only his right engine operating, the right fire light illuminated. Again, he checked for visible secondaries and found none. Because of his projected approach path over the city of Beaufort, and with both bleed-air-warning lights and both fire-warning lights on, he flew a modified, visual straight-in approach to runway 32. While avoiding the city as much as possible, he configured the aircraft for landing at three miles on short final. He made a single-engine, short-field arrested landing. Postflight analysis confirmed a fire in the keel area of the aircraft.

For his performance, LtCol. Brandt was awarded the Air Medal.

BRAVO Zulu

Bear Ace 602 departed NAS Jacksonville en route NS Norfolk, following a mid-week cross-country flight. After leveling off at FL240, the pilot felt a loss of elevator and rudder trim, and the copilot saw a popped elevator and rudder trim circuit breaker. The pilot engaged the automated-flight-control system (AFCS) to keep the airplane in balanced flight. The aircrew continued north toward Virginia.

NATOPS has no procedures for a loss of rudder trim. The crew decided to reset the circuit breaker, to regain normal elevator and rudder trim, on the approach to NS Norfolk. With the circuit breaker reset, the pilot regained elevator trim, but not rudder trim. The copilot momentarily regained the use of both trims. The copilot then lost the use of rudder trim, which stuck at four units right. The pilot maintained balanced flight with manual rudder inputs and with help from the copilot.

The aircrew declared an emergency to expedite their recovery. As they transitioned to the landing configuration 10 miles from the field, the rudder trim ran out over six units fully right. The pilots continued the approach using differential power while applying over 100 pounds of force on the rudder pedals to keep the Hawkeye in balanced flight. The aircrew recovered at NS Norfolk. The postflight maintenance inspection showed a seized rudder-trim actuator.

From left to right: LCdr. Elton "Thumper" Parker, Lt. Matt "Gucci" Thomas, Ltjg. Trace "Turtle" Head, LCdr. Rob "Chachi" Polvino.

Ready Room Gouge

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