The Navy & Marine Corps Aviation Maintenance Safety Magazine

Mech

Summer 2009

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Problems With an Aging Aircraft

Nitro Cart and Tow Tractor vs AM3

The School of Hard Shocks

The Navy & Marine Corps
Aviation Maintenance Safety Magazine
Summer 2009, Volume 48 No. 3

Mishaps cost 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. 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; the time to learn to do a job right is before combat starts.

Mech (ISSN 1093-8753) is published quarterly by Commander, Naval Safety Center, and is an authorized publication for members of the Department of Defense. Contents are not necessarily the official views of, or endorsed by, the U.S. Government, the Department of Defense, or the U.S. Navy. Photos and artwork are representative and do not necessarily show the people or equipment discussed. We reserve the right to edit all manuscripts. Reference to commercial products does not imply Navy endorsement. Unless otherwise stated, material in this magazine may be reprinted without permission; please credit the magazine and author. Periodicals postage paid at Norfolk, Va., and additional mailing offices.

POSTMASTER: Send address changes to Mech, Naval Safety Center, 375 A Street, Norfolk, VA 23511-4399.
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Features

Departments

Front cover: AM2 Wesley Goodwin performs maintenance on the arresting hook of a Strike Fighter Squadron (VFA-195) FA-18C Hornet in the hangar bay of the aircraft carrier USS *Kitty Hawk* (CV-63).
Navy photo by MC3 Patrick Heil

The New Guy

Please allow me to introduce myself: I'm Cdr. David Peacott. On May 4, 2009, I relieved Cdr. Roberto "Bert" Ortiz as the aircraft maintenance and material division head here at the Naval Safety Center.

Commander Ortiz is truly a great American and an exceptional naval officer, who now is headed for the retired list. I thank him for his 31+ years of honorable, faithful and dedicated service to our Nation and our Navy.

I reported aboard from the fleet's first and finest nuclear aircraft carrier, USS *Enterprise* (CVN-65), where I had the privilege to serve as the gun boss.

I'm learning the ropes here at the Naval Safety Center, and I look forward to seeing you—either at your command during a safety survey or at the FY10 Aviation Maintenance Safety Conference.

Use operational risk management (ORM) 24/7, and stay safe.

Thanks,
Cdr. David Peacott

Maintenance-Related Mishaps: What the Data Tell Us

By Ed Hobbs, Naval Safety Center

In general, today's naval aviation squadrons are flying well-maintained, safe aircraft. In general, it is not the material condition or maintenance of aircraft that leads to most aviation mishaps. Human error continues to be the major factor that results in aviation mishaps, and some of those human errors are made by maintainers (note that aircrew error occurs much more often than maintenance error).

Let's look at maintenance error to see what involved factors were present. The data in this article spans from fiscal years 1999 to 2008. Included are all Navy and Marine Corps aviation Class A, B and C mishaps, where an aviation maintenance person ("who" factor) or maintenance action ("what" factor) was included as an involved factor in a safety investigation report (SIR).

Maintenance error slightly increased from FY04 to FY08 when compared to FY99 to FY03 (Fig. 1).

A look at the specific involved factors sheds some light on what caused maintenance-related mishaps. The "who" factor from the SIR shows the number of times each maintenance billet (Fig. 2) was listed as a factor in a mishap.

The top two billets listed (and three of the top four) were leadership/supervisory positions. It is not the wrench turner on the flight line or in the hangar bay who most often is listed as a factor in mishaps. Leadership

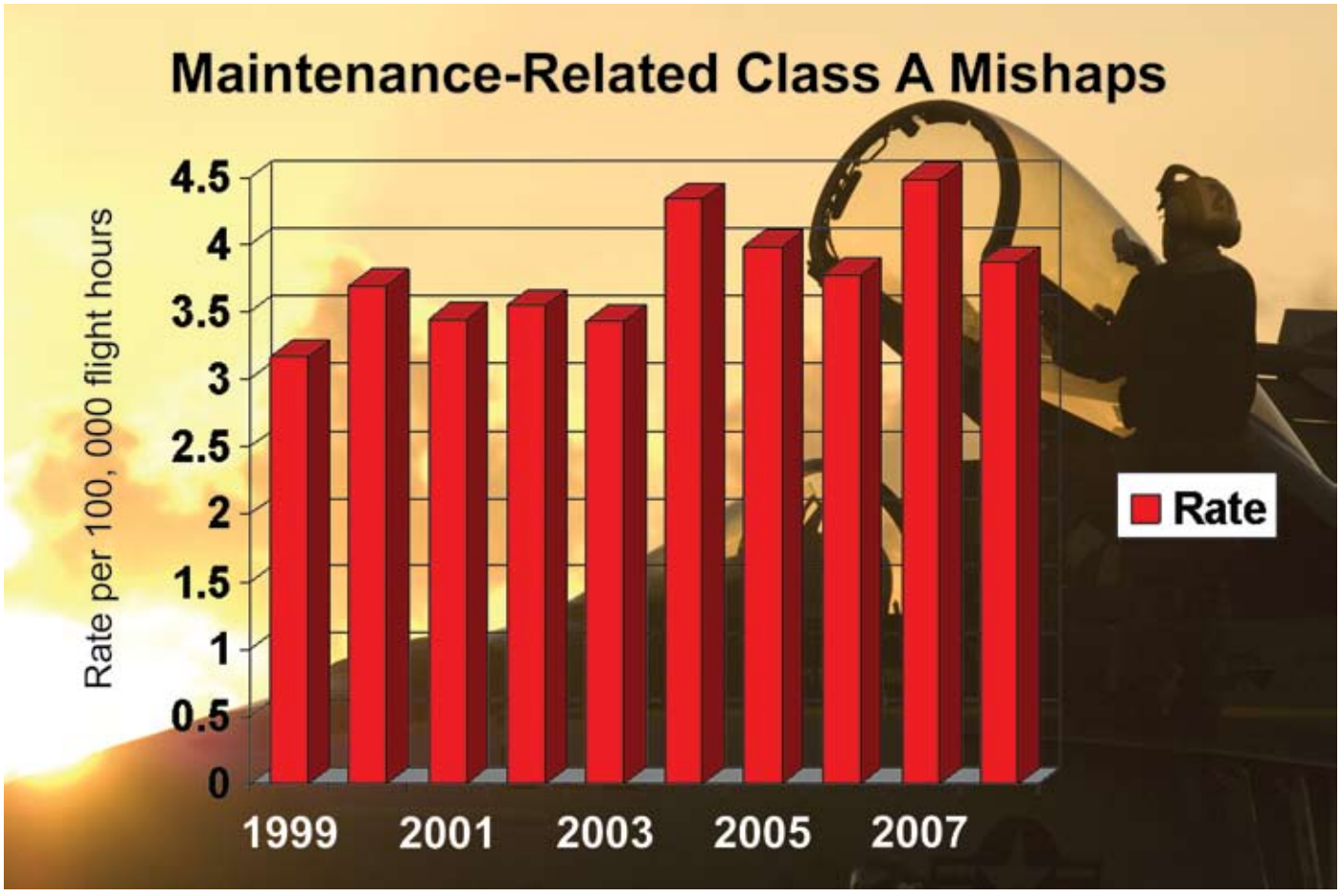


Figure 1

BILLET	EVENTS
Work Center Supervisor	76
Maintenance/Production Control CPO/NCOIC	70
Plane Captain	66
Maintenance Officer	59
Collateral Duty Inspector	57
Airframes, Structures	47
Ordnance	41
Quality Assurance Representative	40
Powerplants, Engines	39
Flight Line/Troubleshooters/Final Checkers	34

Figure 2 (Who Factors)

is the key to a successful maintenance department and to preventing mishaps. This holds true for the military in general. "There is no type of human endeavor where it is so important that the leader understands all phases of his job as that of the profession of arms," wrote Major General James Fry, a Civil War veteran. Few professions in the world depend more on outstanding leadership than the military, and few professions exist where the consequences of failure of leadership can be as unforgiving.


Navy photo by MCSN Andrew Skipworth


Navy photo by MCSN Andrew Skipworth

The maintenance action most often listed in an SIR (Fig. 3) was the failure to manage/supervise personnel/assets: a leadership function. So is the third item in this chart (failure to demand adherence to technical doctrine). Note that the second item (failure to follow procedures) underlines the value of closely following publications, instructions and manuals and not taking shortcuts or relying on memory or corporate knowledge.

ACTION	EVENTS
Failed to manage/supervise personnel/assets	150
Failed to follow technical procedure; step by step	140
Failed to demand adherence to technical doctrine	83
Inadequately inspected	75
Improperly installed	71
Lost situational awareness	55
Violated technical doctrine/procedure	49
Failed to follow safety procedures	44
Failed to provide adequate training	40
Violated technical doctrine/procedures	37

Figure 3 (What Factors)

AIRCRAFT	FLT HRS	MAINT MISHAPS	MAINT RATE	ALL MISHAPS	RATE
Fighter/Attack	4,086,091	271	6.63	861	21.07
Surveillance	1,811,454	90	4.97	221	12.20
Helo/Tilt Rotor	3,450,557	117	3.39	425	12.32
Transport	1,478,289	31	2.10	104	7.04
Trainer	3,306,646	20	0.60	168	5.08

Figure 4 (Mishap Rates by Community)

No aircraft community is exempt from maintenance-related mishaps (Fig. 4). However, a few communities had rates that stand out over other communities, in terms of the number of maintenance-related mishaps and the rate of maintenance-related mishaps per 100,000 flight hours. The fighter/attack community had the highest maintenance-related mishap rate. The training command had a significantly lower maintenance-related rate than the other communities.

AIRCRAFT	MAINT PERCENT
Fighter/Attack	31%
Surveillance	41%
Helo/Tilt Rotor	28%
Transport	30%
Trainer	12%

Figure 5 (Maintenance-Related Percentages)

The overall mishap rate mirrors the maintenance-related mishap rate with the fighter/attack community having the highest rate and the training command the lowest. However, in addition to having the lowest maintenance-related rate (Fig. 5), the training command also had a low percentage of maintenance-related mishaps.

The major difference between the training command and other communities is contract maintenance, which has a significant advantage in terms of continuity. Contract maintenance does not have the constant personnel turnover to which non-contractors are subjected. Contractors also bring many former senior enlisted personnel with years of experience repairing aircraft.

Figures 6 and 7 show the maintenance-related mishap rate for individual aircraft.

Evolutions that produced the most maintenance-related mishaps (Fig. 8) are a factor of frequency of occurrence and also the cost of the involved parts. Events which occurred with more costly aircraft parts obviously will be more likely to meet the threshold of a mishap than less costly parts.

T/M/S	EVENTS	FLT HRS	RATE
F-16	1	792	126.26
QF-4	2	2,501	79.97
EA-6B	45	422,738	10.64
F-14	32	320,328	9.99
AV-8B	25	358,077	6.98
F/A-18	164	2,908,686	5.64
F-5	4	72,892	5.49
MV-22	4	40,797	9.80
H-3	1	13,378	7.47
H-53	25	520,180	4.81
H-60	48	1,298,269	3.70
H-46	22	730,811	3.01
H-1	12	703,932	1.70

Figure 6 (Fighter/Attack & Helo/Tilt Rotor)

T/M/S	EVENTS	FLT HRS	RATE
S-3	25	308,696	8.10
E-2	20	253,120	7.90
E-6	10	156,199	6.40
P-3/EP-3	35	1,093,439	3.20
C-35	2	12,421	16.10
C-2	9	105,126	8.56
C-20	2	68,824	2.91
C-130	12	506,356	2.37
C-12	4	413,721	0.97
C-9	2	272,742	0.73
TH-6B	2	8,926	22.41
T-45	9	653,091	1.38
T-44	4	302,801	1.32
TH-57	3	494,504	0.61
T-2	1	179,088	0.56
T-34	6	1,413,333	0.42

Figure 7 (Surveillance, Cargo, Trainer)

Navy photo by MC1 Michael Obney

MISHAP EVOLUTIONS	EVENTS
Landing Gear Maintenance	18
Weapon/Drop Tank Load	18
Engine Maintenance	17
GSE Operations	15
Aircraft Movement	14
Main Rotor System Maintenance	13
Securing Panel/Cowling/Door	13
Daily/Turnaround Inspection	9
Flap Maintenance	9
Avionics Maintenance	8
Engine-Turn Operations	6
Canopy Operations/Maintenance	4
Hydraulic-System Maintenance	4
Jacking Evolution	3
Aircraft-Seat Maintenance	3
Fuel-System Maintenance	3

Figure 8
(FY05-FY08 Maintenance-Related Mishap Evolutions)

Note the high number of ground-support-equipment (GSE) operations and aircraft-movement mishaps. Most involved an aircraft running into something, or a piece of GSE running into or causing damage to an aircraft. These mishaps, more so than the others, can be prevented with more attention to detail and strict adherence to procedures.

An injury in a maintenance-related mishap is defined as an incident that caused five or more lost workdays, permanent partial disability, permanent total disability, or death. Figure 9 represents Navy data only

RATING	EVENTS	POPULATON	RATE
AD	13	6,444	2.02
AE	9	4,710	1.91
AM	11	7,410	1.48
AME	2	1,495	1.34
AW	4	4,499	0.89
PR	1	1,714	0.58
AO	4	7,774	0.51
AT	4	8,528	0.47
HT	1	2,495	0.40
AZ	1	3,075	0.33
AB	3	10,412	0.29
ET	1	6,078	0.16

Figure 9
(Injury Rate per 10,000 Personnel per Year)

(Marine Corps MOS information is not available in the mishaps database), showing the rate of injury per 10,000 personnel per year in maintenance-related mishaps.

A common tie that binds servicemen of the 21st Century and Americans who fought in World War I and each subsequent war is leadership. It has enabled the American military to excel against great adversity in the past and will be a key factor in reducing mishaps and enhancing combat readiness today. The Navy and Marine Corps have the best Sailors and Marines in the world. The British statesman and author John Buchan said it best: "The task of leadership is not to put greatness into people, but to elicit it, for the greatness is there already."

The author is an operations research analyst in the Naval Safety Center's data management department.

Problems With an Aging Aircraft

Navy photo by PH3 Philip Morrill

By AE2(AW) Patrick Kennally

As legacy FA-18C Hornets continue to age, every component in the aircraft becomes a potential failure point. This increases the complexity of system discrepancies and makes the use of troubleshooting checklists less straightforward. To successfully fix these recurring gripes, maintainers must get thorough debriefs from aircrew on the exact nature of the discrepancy, have accurate and clear verbiage from the NALCOMIS Maintenance Action Form (MAF), and make a conscious effort to "think outside of the box."

These were the lessons the VFA-146 Blue Diamond electrician shop (work center 220) learned from aircraft 311 during the 2008 Composite Training Unit Exercise/Joint Task Force Exercise (COMPTUEX/JTFX) on board USS *John C. Stennis* (CVN-74).

Throughout the four-week detachment, aircraft 311 had multiple instances of "momentary landing gear tones while taxiing on the flight deck." The source of the problem never was clear, and each time we thought we had the problem fixed, the tones returned. This

was especially frustrating, because each recurrence returned the aircraft to a "down" status and caused multiple sorties to be cancelled when a spare wasn't available. By the time the gear-tone problem was fixed, maintainers had jacked this aircraft 11 times and replaced every proximity switch, except the nose-landing-gear weight-off-wheels (WOW) switch. We had rigged the gear several times, changed an anti-skid control valve, and finally replaced the landing-gear-control unit (LGCU).

Troubleshooting landing-gear problems is usually straightforward. Depending on the nature of the discrepancy, technicians either debrief with the pilot or simply start troubleshooting immediately with a landing-gear functional check. Using BIT logic identification number (BLIN) codes and monitoring status panel (MSP) codes, technicians identify and replace the faulty component. That process didn't work on aircraft 311, however.

Initial troubleshooting revealed legitimate BLIN and MSP codes that called for replacing three switches. We also suspected that the bulkhead cannon plug in the right main-landing-gear (MLG) wheelwell was bad, so we replaced it. Beyond these easy fixes, we located shorted circuits and bad wires, using the "500 series" publications, instead of the relevant work packages. We used a megger on all the wiring from both port and starboard MLG proximity switches. This task meant we had to remove belly panels to access the fuselage disconnects. We were shocked to find that all of the wires and connections were in good condition. Workers in the electrician shop simply ran out of ideas after exhausting all these options.

Once done with the electrical side of the system, the airframes shop (work center 120) combed the landing gear, looking for rigging problems. Eventually, both MLG were disassembled, and the entire landing-gear system was rerigged. From there, the nitpicking began. Comments like these were heard: "Oh this looks a little loose." "Does that bracket look like it has slipped down a bit?" The servicing methods during the aircraft's preflight check also were audited.

Were the troubleshooters (work center 320) to blame? Were the struts being serviced correctly? Another work center found itself under the microscope when both MLG struts were discovered to have worn packings, but even after they were replaced, the landing-gear tones continued.

The squadron had to step back, brainstorm, and reanalyze the situation. We decided that maintenance wasn't doing sound, thorough debriefs with the pilots. Instead of accepting simple statements like "momentary landing-gear warning tones," we needed more specific information: Was it on deck or airborne? When exactly did they occur? How long did they last? How many indications were heard, and at what interval? Was the jet moving, in a turn, or standing still? The answers varied greatly, and it also became evident that the verbiage was vague.

What could be done next? The gear had been rigged and rerigged. All the switches had been changed, the wiring was sound (no shorts to grounds or openings in the wires), and all the packings had been changed. The pilot write-ups had been reviewed, and they became more descriptive. As COMPTUEX/JTFX was coming to a close, the discrepancy finally disappeared, and aircraft 311 was flown back to the beach with no apparent problems.

TWO MONTHS LATER, when the squadron headed out for deployment, the momentary tones returned. Although the FA-18A-D NATOPS manual states momentary tones are possible on the flight deck due to the harsh electromagnetic environment, the tones occurred on nearly every attempted or completed sortie. Through all this, the one component that was common to all of the discrepancies had been ignored: the LGCU. Because MSP 915 (an LGCU malfunction) never registered, we never suspected it was bad.

It was the only system component present in the aircraft for all of the gripes. Only when all the other options had been exhausted was it finally decided to change the LGCU. The aircraft passed the landing-gear functional check, and as of this writing, the tones had not returned.

This painful process provided many useful lessons learned for resolving landing-gear discrepancies: everything from pilot pass downs and NALCOMIS MAF write-ups, to basic everyday troubleshooting.

Maintainers learned to look beyond the checklists and determine the relationships between components in the system. When the obvious solutions don't appear, ask yourself: What's common to all the malfunctions? As the Hornet ages, this sort of thoughtful, analytical troubleshooting will be pivotal in providing assets for training and combat.

Petty Officer Kennally works in the electrician shop at VFA-146.

We Have 2 Jets Down—

By AME2(AW) Chad Petersen

Early one morning while on deployment at a forward air base in Iraq, my squadron was conducting what had become "typical" maintenance and flight operations in support of ground-combat operations. Aircraft 500 had been in a "down" status for a bad port-engine gearbox, and the Power Plants and Airframes work centers were working on replacing the component. Meanwhile, aircraft 501 was out flying a functional check flight (FCF) "Bravo."

The aircrew in 501 had radioed to let us know they were coming back with an incomplete FCF because the starboard engine had chugged several times. Our maintenance material control officer (MMCO) had to make a decision; we needed a fully mission-capable aircraft to get in the air to support the ground troops.

The MMCO made the call to pull a engine out of 500 and to put it into 501. Everyone knew what had to get done. Some went to recover 501, and others went to start dropping the starboard engine out of 500. We didn't stop to discuss how we were going to accomplish this job safely and in a timely manner—we were more concerned with the "timely."

—Can We Bring 1 Up?

Operational requirements had our squadron split: Half were operating aboard ship in the Arabian Gulf, and the other half were on detachment in Iraq—both in direct support of Operation Iraqi Freedom. Because we were split, we frequently had to make do with the available people on hand. In this case, even though I'm an AME, I was on the crew helping to remove the motor—one of a dozen engine changes during our 100 days there.

We took off the tailpipe door and started unbolting the mid-door. When we were about ready to lower the engine out of its cavity, two of my shipmates held the mid-door while I started pulling the last mounting bolt. That last bolt stuck. I had the other two guys wiggle the door, so the bolt would come out. It moved slowly for a bit but then stopped. We tried several different approaches, but none seemed to work.

Frustration set in. I told the other guys to shake the door really hard. Meanwhile, I pulled on the bolt as hard as I could, and it finally came lose.

ONE THING ABOUT ENGINE CAVITIES: They have heat shields. In the Prowler, it's a thin, molded, aluminum sheet that's form-fitted to the interior cavity. It prevents large amounts of heat from damaging the engine cavities. As the door and bolt came loose, my knuckles nicked an edge of the heat shield. When I lifted my hand to look and see how bad I'd cut myself, blood was rushing down my forearm. I immediately knew I would need some stitches. I went to medical and got three stitches in my ring finger and two in the middle finger on my left hand. The heat shield had cut my fingers to the bone.

As I sat in medical, waiting to get the stitches, I realized I not only had hurt myself but the squadron, as well. Right when they needed me the most, I was at medical getting stitches, instead of helping get 501 back in "up" status for our later missions.

Even when you're in a rush and starting to get frustrated, you have to continue working safely because injuries hurt more than just you. I'm lucky mine weren't worse.

Petty Officer Petersen worked in the AME shop at VAQ-139.

Feeling Comfy? Look Out!

By AT2 Justin Macezinskas

I was on another combat deployment with CVW-8 onboard USS *Theodore Roosevelt* (CVN-71) and was working night shift in the VFA-31 avionics shop. The flight schedule just had finished, and we didn't have much going on, so I decided to do some extra preventive maintenance on one of our advanced targeting forward-looking infrared (ATFLIR) pods.

The electro optical servo unit (EOSU) of the ATFLIR pod has 24 screws that have to be inspected as part of the daily inspection. These screws should not be loose and are held in place by thread-locking compound. To help us inspect the screws more effectively, the avionics shop had started a practice of painting a torque-inspection stripe on the screws around the entire circumference of the EOSU when we got new ones from supply. This stripe allowed us to rapidly inspect the pods for any loose or missing screws.

An aircraft in the hangar bay had an ATFLIR pod that still needed the torque stripes to be painted. I grabbed a couple of paint markers and a roll of tape and headed to the hangar bay. After painting the torque-inspection lines and removing the tape, I decided to give the EOSU one last spin to make sure I hadn't missed any tape.

I grabbed the pod and spun it, as I had done a dozen times before. This time, though, I didn't notice the position of my hands. My left middle finger was just over the lip of a notch on the EOSU. When the pod rotated, it pinched the tip of my finger between the EOSU and the unit that mounts the pod to the aircraft.

I instantly felt a pinch, tear, and crunch but didn't realize how badly I had hurt myself until I saw blood spurting on my shirt. I grabbed my finger and applied pressure to stop the bleeding. Then I got the attention of our hangar-bay chief and told him I needed to go to medical ASAP.

PERSONNEL THERE DISCOVERED that the tip of my index finger had been torn off. A post-incident FOD search of the ATFLIR pod turned up the missing tip, with some bone still sticking in the notch of the pod. The severed portion was taken to medical, but doctors later determined it couldn't be reattached. After surgery, I spent 24 hours sick in quarters (SIQ) and had light limited duty for two weeks.

I had gotten much too comfortable working on and around aircraft. I thought I knew what I was doing because I'd done it a dozen times before without incident. If I had *slowly* rotated the EOSU or rotated it counterclockwise, I'd still have my fingertip.

Petty Officer Macezinskas works in the avionics shop at VFA-31.

Navy photo by PHAN Timothy Roache Jr.

The Sailors in this photo are installing an advanced targeting forward looking infrared (ATFLIR) pod on an FA-18C Super Hornet. The author is in a different squadron than the Sailors pictured here.

Nitro Cart and Tow Tractor vs AM3

By AM1(AW) James Kocsis

During a 28-day special inspection on aircraft 602, our AM3 was on the flight line with two other petty officers, installing new chemical air dryers. When he was finished, he ran back into the airframes shop to get a CDI and then to hook up a NAN-4B nitrogen cart to a tow tractor.

Everyone from the shop already was out on the flight line. Wanting to get the job done quickly, he decided to hook the cart to the tractor himself. He pulled the tractor to the front of the hangar and then went for the NAN cart. He forgot to set the emergency brake on the cart.

HE SWUNG THE CART AROUND. While trying to pull it into position, he lost control. The eye loop on the cart smashed his hand against the back of the tractor and the hook point. The NAN cart bounced off his hand and rolled back about a foot. His hand felt numb for a few seconds, then started to hurt. He felt angry, and then he noticed his palm felt a little wet. Looking down, he found his whole hand was covered in blood.

He rushed into the line shack, told the LPO at the desk what had happened, and said he needed to go to the hospital.

Many stitches and two days later, he was facing two weeks of convalescent leave and about three weeks of limited duty. There also were four weeks of physical therapy, all of which added work for his shipmates in the shop.

SE gear always will win the battles against bodies. Take time and don't be afraid to ask for help when you need it. Ten more minutes would have saved several weeks of pain. I'm just glad my LPO was sitting around in the shop when I needed him most.

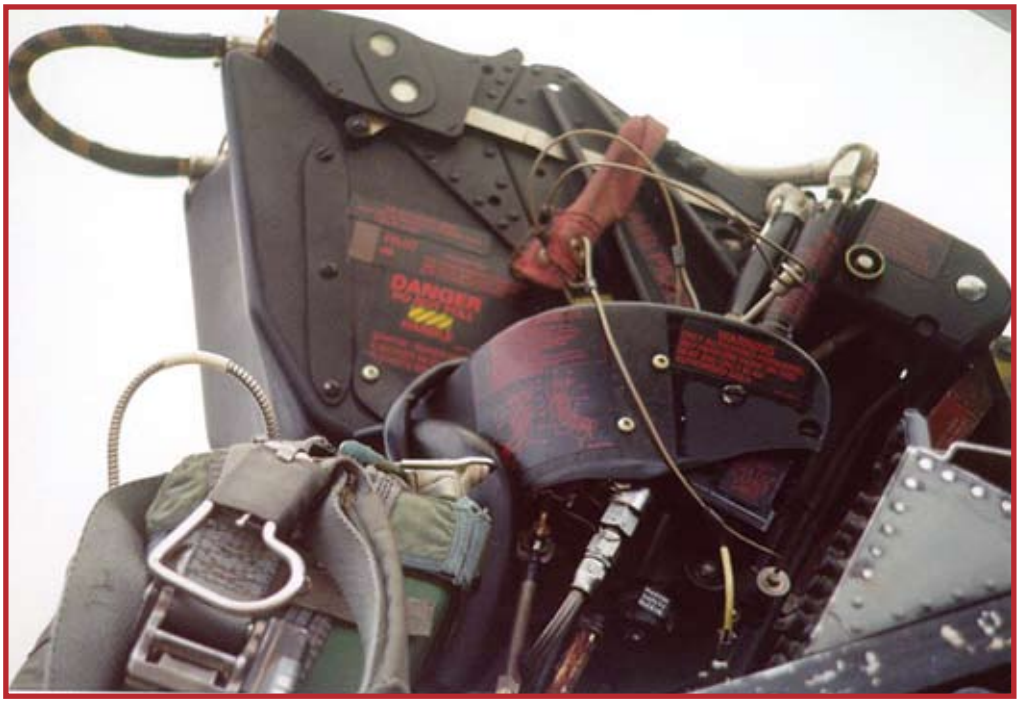
Petty Officer Kocsis works in the line division at VAW-125.

A Near-Miss

By AME2(AW) Christopher Carroll

Hearing a piece of metal hit the floor, I looked down to see wisps of smoke rising from the rigid gas line of the ejection-seat-harness retract unit. I immediately stopped work and removed my team from the Prowler. I secured the aircraft and hurried into Maintenance Control. The investigation began.

While dearming the ECMO-1 GRUEA-7 ejection seat in Ironclaw 501, I accidentally had discharged a cartridge-actuated device (CAD), nearly injuring myself and my ordnance team. I thought I had been following the checklist step by step. I didn't know what could have gone wrong. My assistant had felt that something was wrong as we were going through the checklist—like we perhaps had missed some steps. We reviewed the checklist and repeated the current step, but the mechanism still felt jammed. Later, we would learn the step we were trying was the wrong one.



HOW DID THIS HAPPEN? One of my co-workers had asked me if I possibly could have missed a page. He mentioned he'd done the same thing a few days ago but had caught the mistake early. I went back into the publication and confirmed that we, indeed, had missed an entire page in the checklist, telling how to safe the CAD.

I should have recognized some red flags leading up to this error. Because we were doing all of our 364-day inspections in the months following deployment, we were getting comfortable working on ejection seats. We had removed and replaced 12 seats in the previous two months, so we were perhaps getting a little overconfident.

Workload was another red flag. Coupled with the demands of multiple inspections, the community also was in the midst of an Airframe Bulletin (AFB), requiring a one-time check of the aircraft's bleed-air system during these inspections. Our work center was responsible for the inspection, as well as replacing any faulty valves. We didn't use ORM to recognize and mitigate this workload factor. We should have taken our time and paid meticulous attention to detail.

Deviating from established procedure was the last red flag. With an overcommitted work center and numerous tasks at hand, I chose to stray from the standard procedure by doing the work with fewer than the required number of personnel. With a dedicated safety observer, perhaps the missed page would have been caught before the CAD had discharged.

No inspection is so urgent that it requires skimping on safety. You have to focus, from start to finish. If anything feels wrong, stop, secure the area, and ask for fresh eyes to review the process.

Petty Officer Carroll works in the AME shop at VAQ-136.

... And on the Seventh Day

By AM1 Scott Perez

It was starting out to be a normal day of shore-based flight ops: a few clouds in the sky, a little chilly, and some wind. During a planned hot-pump crew switch after the first event recovery, a maintainer noticed a discrepancy on aircraft 404's starboard vertical stabilizer.

Initial investigation showed a distinct line from the damaged area and the surface directly aft of the area in question, suggesting that a leading-edge tip cap had blown off the vertical stabilizer. We shut down the aircraft and placed it in a down status.

After briefing maintenance control with the initial findings, I began to research the repair procedures. There was no rush to complete the repair, and since I never had done this one before, I was careful with my research. Meanwhile, a quality assurance representative (QAR) was submitting a "things falling off aircraft" (TFOA) report and doing his own research to find out if we could make the repair. Afterward, we got together and compared our repair procedures. We agreed that the procedure in the Maintenance Instruction Manual (MIM) was the right one.

WE WENT TO WORK installing a titanium, leading-edge tip cap on the vertical stab. My crew was loyal and respected me as their leading petty officer (LPO). They didn't question my plan of action.

It took the day and night shifts six days, including a weekend, to complete repair. On the sixth day, we got a message from a fleet service-support team engineer who had seen the TFOA report, saying that we had used a wrong repair procedure. The engineer referred us to the correct procedures in the MIM and also recommended that we remove the titanium patch we had installed to prevent possible further TFOA.

After hearing this news, I quickly went back to the shop to research the work package that the engineer had referenced. I couldn't believe that the repair I should have used was in the very next work package of the MIM that we had used to do our repair. Had I just flipped one more page during my initial research, I probably wouldn't have made the mistake.

We removed the titanium patch we had installed and completed the right repair, but at a huge cost to the squadron. Not only did we waste man-hours, we lost flight hours for the week and drew a lot of unnecessary negative attention.

We are all human. No matter how many maintenance hours we've logged or how many repairs we've done, we still make mistakes. The answer is always to treat every maintenance task as if it's the first time you've done it and thoroughly read the MIMs before you start a job. We did the right thing by researching the repair before we did it, but we weren't thorough enough and misinterpreted the MIM.

I now have a picture of 404's vertical stab as the desktop background on my computer. It's there as a constant reminder of my mistake.

Petty Officer Perez works in the airframes shop at VFA-34.

Maintainers in

Aircraft maintainers assigned to VX-9 perform final checks before launching the aircraft. Navy photo by Cdr. Ian Anders

AOAN Shantee Lancour tightens bolts on a missile container in the hangar bay of the aircraft carrier USS *John C. Stennis* (CVN- 74) in preparation for an ammunition offload. Navy photo by MC3 Josue Escobosa

AE1 Josh Deitrick and AD2 Mikhos Maneru, both assigned to the "Wallbangers" of VAW-117, perform propeller maintenance on an E-2C Hawkeye aboard the aircraft carrier USS *Nimitz* (CVN-68). Navy photo by MC3 J. D. Levite

n the Trenches

AE3 Christopher Houston, assigned to the "Blackjacks" of HSC-21, reattaches a distributor harness to the environmental-control system of an MH-60S Sea Hawk helicopter at Naval Air Station North Island. Navy photo by MC3 Joshua Valcarcel

ADAN Joan Medina, left, and AD3 Elman Pena perform a level III preservation on the NRFI F-414 fan module of a turbo-fan engine from an FA-18F Super Hornet aboard the aircraft carrier USS *John C. Stennis* (CVN-74). Navy photo by MC3 Kenneth Abbate

Plane captains wipe down the canopy windows of FA-18 Hornets between flight-deck operations aboard the *Nimitz*-class carrier USS *Theodore Roosevelt* (CVN-71). Navy photo by MC2 Jonathan Snyder

The School of Hard Shocks

By AME2 Josef Schmidt

We were 58 days into a seven-month deployment onboard USS *Theodore Roosevelt* (CVN-71), and things were going smoothly. I was in the AME work center when we got a VIDSMAF for a popping liquid-cooling-system (LCS) fan circuit breaker. I checked the debrief in IETMS but found no troubleshooting recommendations. It was time for some old-school troubleshooting: schematics.

We checked out our tools, put the MAF in work, grabbed the schematics and PEDD, and went to the AE shop with a few questions. The AEs confirmed that a symbol in the schematics was a thermal switch; we suspected it had failed and caused the LCS cooling-fan motor to short out. We knew that, when external power was applied to the aircraft, we could turn on the fan with its test switch. We pulled the cannon plug from the fan, thereby eliminating it from the system, so we could determine if it was the source of the problem.

WE PUT ONE TECHNICIAN in the cockpit to apply power and another next to panel 10L to operate the LCS fan-test switch and watch circuit breakers. I was up on the aircraft in panel 205L to verify that the fan worked. After I removed the cannon plug from the LCS fan, we applied power and flipped the fan-test switch. No circuit breakers popped, so I decided to test the LCS cooling-air shutoff valve (SOV), which was the other possible cause of the popping breakers within the system. Trying to troubleshoot quickly and thoroughly before an upcoming maintenance meeting, I pulled the cannon plug off of the SOV, and it unexpectedly arced, burnt the cannon plug, and shut down the system. We cut power and disconnected the power cord.

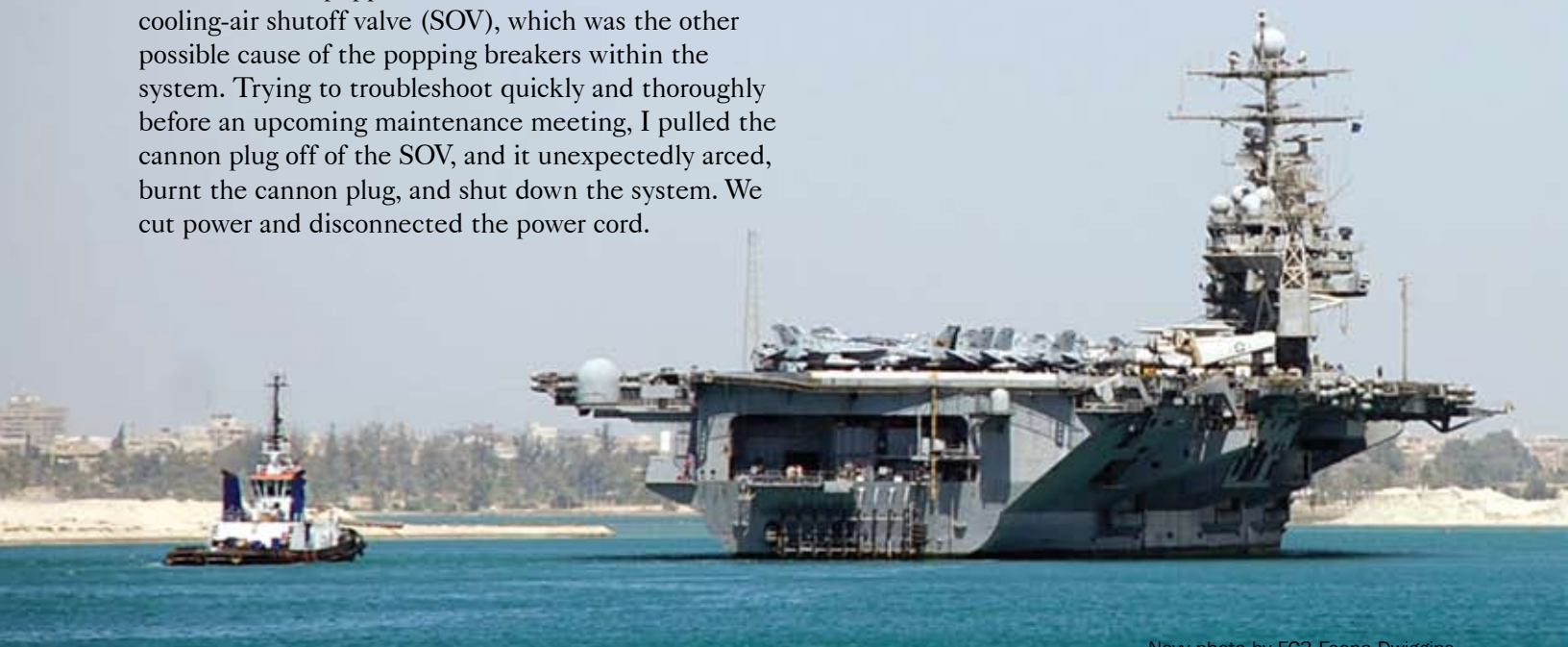
I went to Maintenance Control and told them what I had done. I also said we now needed to change the LCS fan. After removing and replacing the bad SOV, LCS fan, and SOV cannon plug, the system op-checked 4.0.

This incident wouldn't have occurred if we had read the wires in the system we were testing and eliminated the suspect components one by one. We also should have made sure that power was secured before disconnecting any cannon plugs. Finally, we shouldn't have rushed.

The PEDD is a wonderful tool that displays notes, warnings and cautions not found in the schematics. Therefore, when troubleshooting outside the PEDD, note the pop-ups that would prevent injuries to personnel and damage to equipment. Also, brief your entire maintenance crew. Never be afraid to ask for help if you're not 100 percent sure how to complete a certain task.

"Safe and expeditious maintenance" is our squadron's motto. While striving for the expeditious, we bypassed the safe portion of our doctrine. In the end, this maintenance wasn't safe or expeditious.

Petty Officer Schmidt works in the AME shop at VFA-31.



Navy photo by FC3 Feena Dwiggins

Good

A well-organized pre-ex bin keeps extra parts easy to find and account for.

Bad

Gear adrift in flight line tow tractor: a “grizzly” FOD hazard.

Ugly

Improvise. Adapt. Overcome. Daisy chain?

Out With the Old, In With the New

By Dan Steber and
Lt. David Robb

During a presentation this past spring in Norfolk, Cdr. Rusty Medford of FRC Patuxent River, Md., began, "Hydraulic fluid doesn't work well in transmissions or engines... or vice versa. We've lost some aircraft; we damaged a lot of equipment that cost us a lot of money; and, we ended up hurting some people." He then introduced the new, aircraft-fluid servicing units (AFSUs) that will replace the HSU-1 and PON-6 units.

Over the years, *Mech* magazine has featured many stories about maintainers who made mistakes while servicing aircraft. One story was about a mech who serviced an engine with hydraulic fluid because it was dark and he was in a rush. Another story concerned a manufacturer whose cans for oil and hydraulic fluid were nearly identical in color, making it easy for Sailors and Marines to make mistakes. You also

have read about mishap investigations in which aircraft were serviced with the wrong fluids.

NAVAIR developed the new AFSUs to address this problem. The new design of these units will make them easier to see and use, helping prevent servicing errors. As Bill Englehart of NAVAIR explained, "It's very difficult, if not impossible, to cross-contaminate systems. We've gone to great lengths to do away with those problems."

Each AFSU has a distinct color:

Hydraulic-fluid – red

Engine-oil – gold

Transmission-fluid – green

H-53 rotor-fluid – blue.

Also, reflective markings for night use and hardware for the associated fill-port-adapters (for use with bulk-dispensing units) are unique to each fluid, making it nearly impossible to cross-contaminate if filling from 55-gallon drums.

As Englehart noted, "We've done all we can to make it difficult for that Sailor or Marine to contaminate an engine or hydraulic unit or whatever."

Beyond the initial goal of preventing fluid-contamination mishaps, the new AFSUs are made of composite materials, making them much lighter. The new hydraulic unit (PMU-71/E), for instance, weighs 19 pounds—seven pounds lighter than the HSU-1. The new 22-pound engine-oil unit (PMU-72/E) is 10 pounds less than legacy PON-6. Those weight differences mean a lot to anyone who's lugged around a full servicing unit.

Other benefits of the new units include filter-replacement indicators, wear-pads on the bottom, and sight-level gauges. The 15-foot braided lines with clear outer plastic covers make it easier to reach certain areas. The AFSUs also are more efficient (3 ounces dispensed per stroke), compared to the HSU-1 (1.5 ounces per stroke) and the PON-6 (0.7 ounces per stroke).

AFSUs already are being delivered to units on the West Coast and will be available to all fleet units beginning this fall.

To learn more about the new units, visit the aviation video section of the Naval Safety Center's website at http://www.safetycenter.navy.mil/video/aviation/default.htm, or contact Bill Englehart at william.englehart@navy.mil.

Dan Steber is the audio-video producer at the Naval Safety Center. Lt. David Robb is the *Mech* magazine editor.

Flight, Flight-Related, and Ground Class A and B Mishaps 4/9/2009 to 7/08/2009

Class A Mishaps

Date	Type Aircraft	Command
05/05/2009	AH-1W	HMM-166

Aircraft impacted terrain. Aircraft destroyed. Two fatalities.

05/19/2009	HH-60H	HS-6

Aircraft impacted water during training mission. Five fatalities.

06/08/2009	FA-18E	VFA-106

Aircraft right main-landing gear collapsed during arrested landing rollout at naval airfield. No injuries.

Class B Mishaps

Date	Type Aircraft	Command
04/15/2009	FA-18A+	VMFA-115

Aircraft experienced in-flight fire during low-level ingress to simulated ordnance delivery.

04/16/2009	FA-18A	VMFA-314

Fuel cap came off in flight and was ingested into engine.

04/17/2009	FA-18D	VMFA-106

Aircraft right main-mount tire blew out during takeoff from runway.

04/21/2009	UC-35	CG 4th MAW

Aircraft encountered engine overspeed on both engines during climbout.

04/24/2009	AV-8B	VMA-211

Hot brake fire while chocking during hot brake check. No injuries.

05/03/2009	FA-18E	VFA-147

Starboard engine suffered FOD damage during night basket.

05/18/2009	SH-60B	COMHSMWINGLANT

Overhead AFFF system discharged in hangar.

05/19/2009	EP-3E	VQ-2

Bird strike damaged aircraft engine.

05/22/2009	P-3C	VP-40

Aircraft struck towing vehicle during tow evolution. No injuries.

05/27/2009	MV-22	VMMT-204

Engine exhaust ignited fire when aircraft was restarted for troubleshooting.

05/28/2009	FA-18A+	VMFA-115

Aircraft encountered in-flight fire during low altitude training flight. No injuries.

06/10/2009	MV-22B	VMX-22

Aircraft had right engine compressor stall in flight.

06/17/2009	AV-8B	VMAT-203

Aircraft ingested FOD while in high-power hush house. No injuries.

06/17/2009	FA-18C	VFA-125

Port forward main-landing-gear door departed aircraft in flight.

06/22/2009	AV-8B	VMA-223

Aircraft sustained damage during vertical landing. No injuries.

07/07/2009	T-45C	VT-21

Aircraft engine overtemp on start.

Printed as a supplement to *Mech* from
Naval Safety Center Data
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BRAVO Zulu

Sailors and Marines Preventing Mishaps

Send BZs to: SAFE-Mech@navy.mil

ADAN John Cain
HSL-42

Following a "C" profile functional check flight, while operating aboard USS *Nitze* (DDG-94) in the eastern Mediterranean Sea, Airman Cain did a routine turnaround inspection of Proud Warrior 424. The aircraft was needed for operations scheduled for later that afternoon. He went out of his way to inspect not only the required items but also the surrounding areas. He found a bonding seal that had detached from a heater core; it was resting loosely in its place. This piece would have become a deadly projectile when the rotor head was reengaged. The core assembly easily could have caused serious injury to deck personnel or catastrophic damage to the aircraft in flight.

AMAN Clayton Kelch
VAW-115

During nighttime carrier-flight-deck operations, Airman Kelch found a damaged cover panel below the radar dome of Liberty 602 just minutes before its scheduled launch. The plane already was spotted on the catapult, so he immediately informed the flight-deck chief, who signaled to stop the launch sequence.

AM3 William Killingsworth
VAW-115

While manning the flight deck for a night recovery of Liberty 603, Petty Officer Killingsworth saw a Sailor unknowingly cross the foul line and enter the landing area. He dashed to where the Sailor was standing and quickly pulled him to safety before an E-2C Hawkeye landed.

Cpl. Keith Turner
VMA-223

While hot fueling an AV-8B for a local, pit-turn flight, Cpl. Turner found an unusual bump on the belly of the aircraft. A closer look revealed hot air rushing out of door 26. Cpl. Turner immediately ceased fueling and opened the door. The air filter on the single-air motor-servo unit (SAMSU) had become dislodged from its housing. This unit allows the pilot to move the exhaust nozzles from fully aft to 99 degrees down, using engine-bleed air. All the air flow to run the SAMSU usually comes through this filter. Because the air filter was unseated, the SAMSU was receiving little to no air. This condition would have prevented the pilot from controlling the nozzle angle during flight, a very hazardous situation. Also, the hot air (approximately 1,600 degrees Celsius) leaking from the filter was venting close to fuel lines and a fuel drain. An engine-bay fire easily could have resulted on takeoff during high engine RPM.

AM1 Jose Castellanos
VAW–112

During a FOD walkdown onboard USS *John C. Stennis* (CVN-74), Petty Officer Castellanos found a metal clip on the flight deck. When he found several more during a FOD walkdown the following day, he reported this trend to the Carrier Air Wing Nine FOD team. While the air wing and air department investigated the problem, Petty Officer Castellanos independently determined that the clips came from FA-18 improved multiple ejector racks (IMERs). His discovery led to ordnance personnel inspecting IMER clips for integrity.

Sgt. Daniel Newberg and Cpl. Luis Rexach VMA-542

While doing final checks on an AV-8B at MCAS Cherry Point, plane captains Sgt. Newberg and Cpl. Rexach noticed two small paint bubbles on the left leading edge of one of the wings. They signaled the pilot to shut down. Further inspection revealed a small pinhole leak in the aircraft's reaction-control system (RCS). Pilots depend on this system to maneuver the aircraft during any type of slow- or hovering-flight regime. Leaks in the RCS network often are hard to find and can lead to catastrophic control failures.

AME2 Sergey Yeremeyev and AM2 Max Gibson VAQ-140

During carrier-flight-deck operations, Petty Officer Yeremeyev saw a wristwatch in the landing area. A member of the arresting-gear crew had dropped it. He alerted Petty Officer Gibson, who notified the LSO of the fouled deck. As the LSO waived off an approaching FA-18, Petty Officer Gibson ran into the landing area and recovered the watch. He then signaled the LSO, who continued the recovery cycle.

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Avionics

Lithium Battery Storage and Disposal: Are You Doing It the Right Way?

By GySgt. Todd McCreight

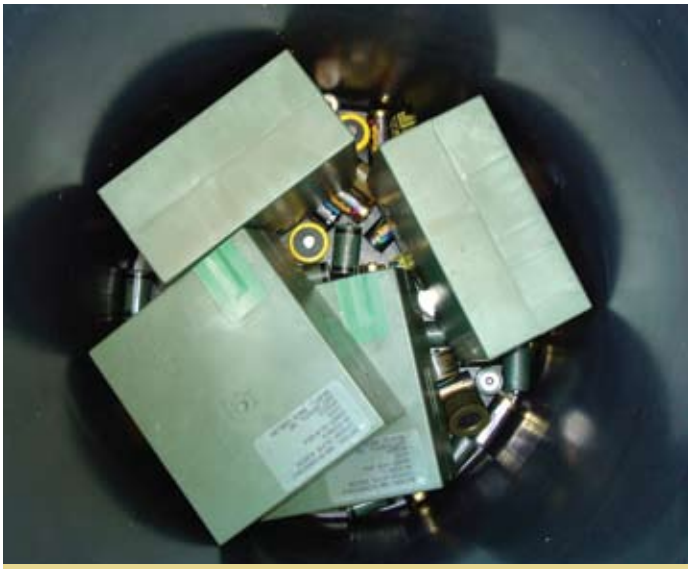
Problems: We often find that Sailors and Marines who use, store, handle, and dispose of lithium batteries are not familiar with the rules in NAVSEA S9310-AQ-SAF-010, "Batteries, Navy Lithium Safety Program Responsibilities and Procedures." Recent safety surveys have turned up many potentially dangerous situations:

- No storage facilities available in the command for new or partly used batteries
- Batteries stored in the work center (usually in desk drawers or on shelves)
- Batteries stored and disposed of alongside other types (such as alkaline or ni-cad)
- Accumulation of more than 30 pounds and/or 30 days or more of battery waste. It's not uncommon for us to find waste accumulations of six months or more.

Solutions: The first step in solving these problems is to ensure that battery-safety-program managers are familiar with NAVSEA S9310-AQ-SAF-010. Pay particular attention to paragraph 1.7, "Storage." Also, take a good look around your spaces and identify what sort of storage and disposal issues you have. Lithium batteries must be stored separately from all other types of batteries in isolated, ventilated and uninhabited areas.

Be sure to check your AT/COMNAV/Crypto and PR/Flight Equipment work centers (where lithium batteries are most commonly used) to see if they have any batteries stored inappropriately in consumable-parts bins or on shelves.

Furthermore, batteries—lithium or otherwise—must be disposed of through command hazmat programs. Have a separate container dedicated for lithium-battery disposal, and do not go beyond the authorized 30-day or 30-pound limit for used batteries.



The wrong way: Lithium batteries stored alongside other types of batteries.

All the information needed to set up a storage and disposal area is outlined in NAVSEA S9310-AQ-SAF-010. When the needs of the command are identified, set up tech training on the individual items for personnel most likely to use and dispose of lithium batteries. Be sure to include your hazmat petty officers and NCOs so they understand their roles and responsibilities. Follow up on a regular basis. It only takes a once-a-week, 15-minute spot check and open communication channels to keep this safety program running correctly.

Gunnery Sergeant McCreight is a maintenance analyst at the Naval Safety Center.

Power Plants

Parts Storage Made Easy

By ADCS(AW/SW) Chris Smith

Problems: Too often during surveys, I find a lack of accountability for parts removed. I frequently find components not linked to any particular aircraft or system. Consumables also are a problem: They sometimes aren't accounted for, or they're mismatched, not bagged and tagged, not capped or plugged, or they're just put "somewhere." All of these things can slow maintenance and/or lead to a wrong or defective component being installed back onto aircraft.

Solutions: I recommend a user-friendly way of accounting for and marking aircraft components. If your accountability system is too difficult to use, maintainers eventually will stop using it. A separate storage area, shelf or locker for each aircraft is a must. A simple tag that includes the aircraft BUNO, MCN, nomenclature, and quantity of contents will make your job as a maintainer a lot easier, especially when it comes time to complete your maintenance tasks and reduce the chances of installing the wrong parts. Also, remember to cap and plug your components to reduce the chances of damage and contamination.

Senior Chief Smith is a maintenance analyst at the Naval Safety Center.

Quality Assurance

Problems With Hydraulic Contamination Trend Analysis Charts?

By AMCS(AW) Robert Chenard

Problem: QA doesn't have all the hydraulic samples annotated in the QA hydraulic-contamination trend-analysis charts.

Solution: According to CNAF INST 4790.2A [para. 10.5.3.8(n)], the work-center supervisor shall ensure all hydraulic samples performed are sent to QA for hydraulic-contamination-control trend-analysis. This requirement should include samples taken for training on ready-for-use (RFU) equipment, whether from the electronic particle counter (EPC) or the patch-test method. Note: This procedure is how one MALS discovered that batches of hydraulic fluid were received contaminated from the manufacturer. The hydraulic-

contamination-program monitor also should spot check the work center EPC logbook regularly to ensure there are no missing entries in the trend-analysis charts.

Problem: Completed trend-analysis charts aren't routed to Logs and Records.

Solution: CNAF INST 4790.2A [para. 10.5.3.7] states that the Logs and Records section shall place the previous and current hydraulic-contamination-control trend-analysis chart (Figure 10.5-4) with the aircraft logbooks and the SE Custody and Maintenance History Record (OPNAV 4790/51) before aircraft or equipment transfer. This section also amplifies when entries are made to the Miscellaneous/History (OPNAV 4790/25A) section of the aircraft logbook and the SE Custody and Maintenance History Record (OPNAV 4790/51) Miscellaneous History Record. The hydraulic-contamination-program monitor also should spot check these records to ensure there are no missing entries.

Problem: Locally manufactured hydraulic-contamination trend-analysis forms are used, instead of the required NAMP chart.

Solution: CNAF INST 4790.2A [para. 10.5.3.5(d)] states that the program monitor shall maintain a hydraulic-contamination-control trend-analysis chart (Figure 10.5-4) for each assigned aircraft and SE requiring hydraulic sampling. A NAMP deviation would be required to use a locally manufactured form or electronic format. However, keep in mind that these charts are to be sent to Logs and Records once completed.

Senior Chief Chenard is a maintenance analyst at the Naval Safety Center.

Egress/Environmental Systems

Oxygen Can Burn

By AMEC(AW) Eric Wickham

Problems: Personnel working with liquid oxygen (LOX) often wear PPE improperly, or worse, not at all. Many times PPE is ripped, torn, cracked, broken, or contaminated with grease or oils.

Solutions: As maintainers, we must follow the guidelines and personnel-protective requirements in our manuals. For example, NAVSEA 06-30-501, sec.2, and NA 13-1-6.4-1, sec.3-33, outline the minimum PPE requirements when handling liquid oxygen to include wear and care of required PPE. Program managers and supervisors who continuously spot check their programs, personnel and areas for compliance are more likely to be successful and mishap-free.

Best Practices: These recently surveyed commands have a proactive ABO program: VP-30 and VMGR-234.

Chief Wickham is a maintenance analyst at the Naval Safety Center.

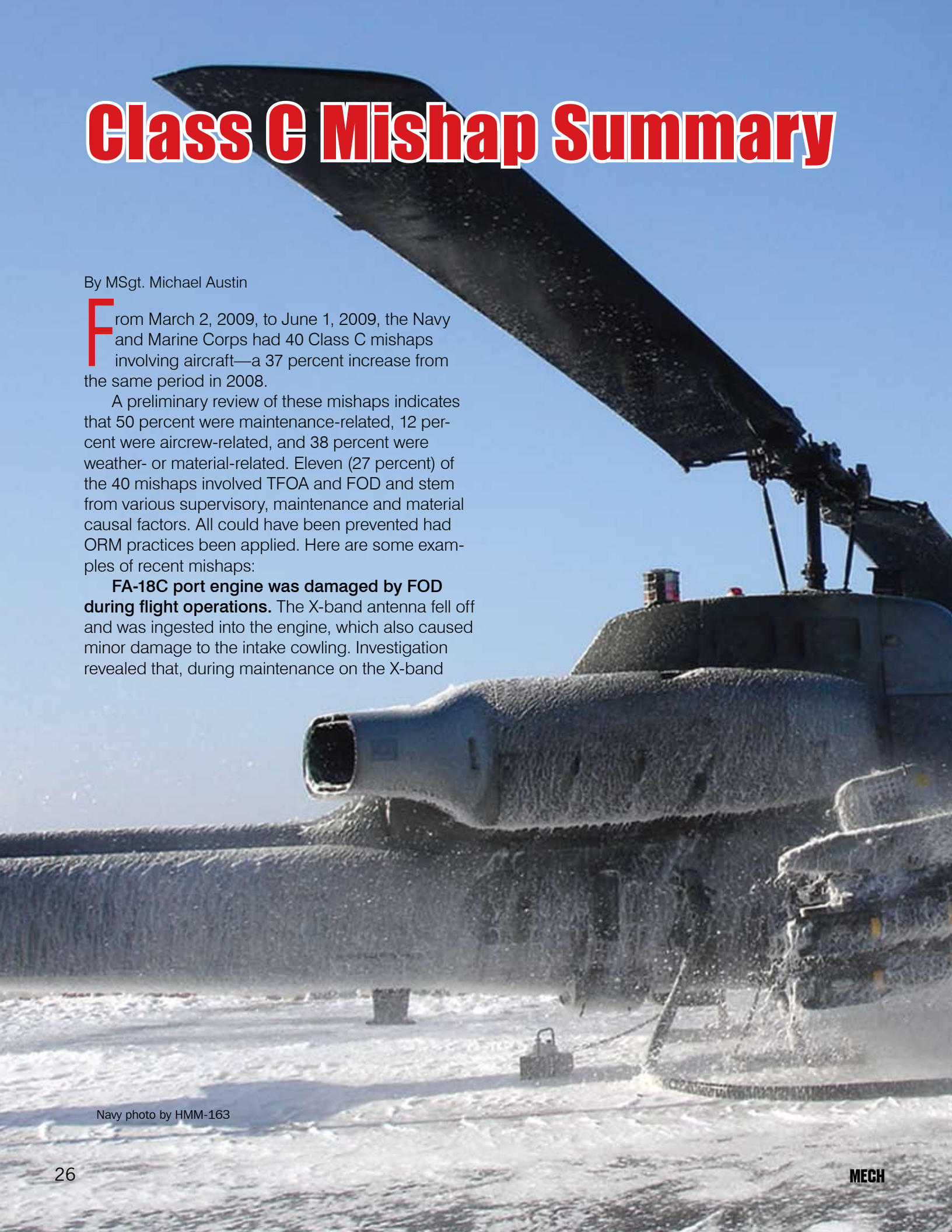
Class C Mishap Summary

By MSgt. Michael Austin

From March 2, 2009, to June 1, 2009, the Navy and Marine Corps had 40 Class C mishaps involving aircraft—a 37 percent increase from the same period in 2008.

A preliminary review of these mishaps indicates that 50 percent were maintenance-related, 12 percent were aircrew-related, and 38 percent were weather- or material-related. Eleven (27 percent) of the 40 mishaps involved TFOA and FOD and stem from various supervisory, maintenance and material causal factors. All could have been prevented had ORM practices been applied. Here are some examples of recent mishaps:

FA-18C port engine was damaged by FOD during flight operations. The X-band antenna fell off and was ingested into the engine, which also caused minor damage to the intake cowling. Investigation revealed that, during maintenance on the X-band



Navy photo by HMM-163

antenna, an aircraft maintainer had overtorqued the mounting bolts and retaining fastener hardware. Lack of supervisory and publication guidance also contributed to this mishap.

AH-1W canopy-removal system (CRS) detonated while depot-level maintenance personnel worked on the aircraft. The front, center and rear sections of the canopy were damaged, and two civilian ordnance technicians suffered minor injuries. Although the preliminary investigation is ongoing, this mishap highlights the importance of proper CRS, egress and explosive-safety training within both military and civilian maintenance teams.

AH-1W was damaged by a fire in the vicinity of the starboard engine during hot-fuel operations. The AH-1W was operating with a weapons load and had landed on spot 5. The aircraft was de-armed and chained. The aircrew requested a hot fuel prior to shutdown; the supporting crew complied. Maintenance had been done on the assigned fueling station (station 4); however, the equipment to be used was not marked accordingly, and a defective fuel nozzle was placed back into service.

The AH-1W aircrew had permission for hot fuel, but when the system was activated, fuel sprayed immediately from the sample port of the defective nozzle. It covered an area of the starboard side of the aircraft, from the rear-seat canopy to the exhaust duct. Once the fuel spray reached the hot exhaust duct, personnel nearby heard a "Pop!" Fuel vapors ignited on and around the aircraft. The pilots observed a fire-caution warning light and activated the fire-suppression system. Both aircraft engines were shut down, and the pilots egressed the aircraft. The crash-fire-rescue team extinguished the fire and sprayed the ordnance for a long time.

This mishap could have resulted in much greater damage and loss of life had the ordnance detonated. Fortunately, no Marines or Sailors were injured seriously, but two suffered minor injury from smoke inhalation. The root causal factors of the mishap were failures of ground support to supervise, manage assets, and clearly mark the operational status of support equipment.

The Class-C mishaps this quarter involved a broad range of maintainers, from depot to organizational level, as well as operational support. They show a lack of continued supervision, a lack of attention to detail, and a lack of applied operational risk management. Coupled with safety training for all ranks and phases of aircraft maintenance, these elements are essential to mission success and a safe Navy and Marine Corps team.

Master Sergeant Austin is a maintenance analyst at the Naval Safety Center and coordinator of the Crossfeed section of Mech.

Helping Sailors and Marines Help Themselves

Sierra Hotel

Commander, Naval Safety Center would like to recognize the following aviation commands for their recent participation in safety surveys, culture workshops, and maintenance-malpractice resource-management (MRM) presentations for the months of April-June.

Safety Surveys

April:
VT-9
VT-7
VFA-137
VFA-115
VFA-113
VFA-22
VFA-151
VFA-14
VFA-41
FRC W Lemoore

May:
VFA-25
USS *Truman*
VMR Maryland
FRC MA Washington
VR-53
VR-1

June:
VFA-34
VP-9
VR-51
HSL-37
VMR Kaneohe
ETD Hickam
MALS-24
HMH-463
VP-47
VPU-2
HMH-363
PMRF Kauai

MRMs

AMO Course, NAS Pensacola, Fla.
DCMA Boeing, Saint Louis, Mo.
VFA-105
VFA-37
HCS-84
MALS-29
VFA-81
FRC SE Mayport
HS-2
VFA-34
Hornet International Conference
FRC Ft. Worth
MALS-41
TSW Conference
VR-59

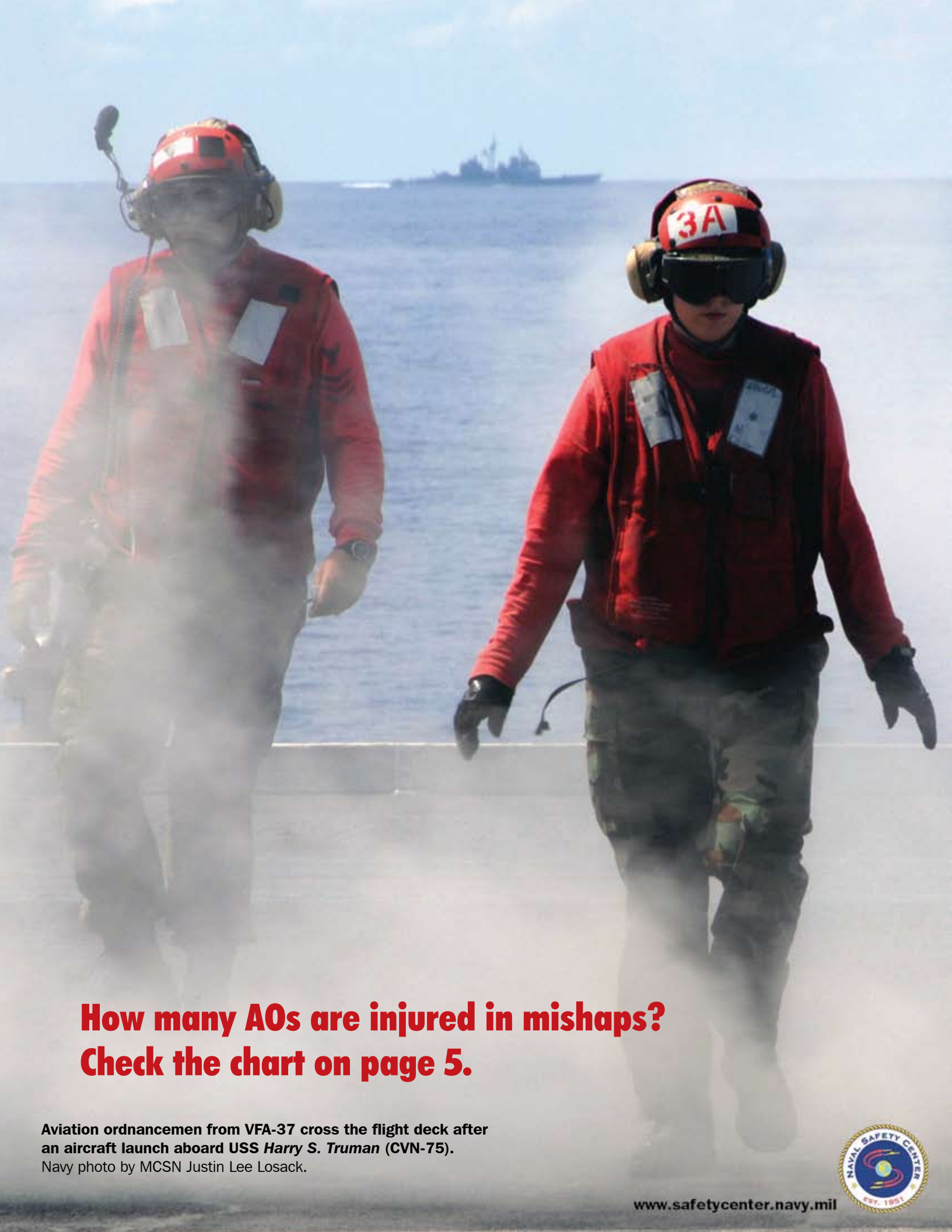
Culture Workshops

VMFA-112
VMA-223
VMA-231
VMFA (AW)-533
HHS MCA Futenma
HMLA/T-303
HMM-262
NSAWC
VMA-513
HS-3
HSM Weapons School
VFA-11
VFA-213
VFA-87
VP-10
VP-26
VP-30
VP-45
HS-14
HSL-45
NAS Fallon SAR
VAQ-136
VFA-102
VFA-195
VFA-27
VFC-13
VRC-30 Det 5
HSC-85
VR-48
VR-57
Blue Angels
VT-2
VT-3
VFA-2
VR-64
VFA-137
HMMT-164

For more information or to get on the schedule, please contact: Safety Surveys: Maj. Anthony Frost, USMC at 757-444-3520 Ext. 7223, MRM: AMCS(AW) James Litviak at 757-444-3520 Ext. 7276, Culture Workshop: Cdr. Duke Dietz at 757-444-3520 Ext. 7212.

Our Website:
information to help you prevent mishaps.

Visit our Podcasts and Vodcasts
www.safetycenter.navy.mil



How many AOs are injured in mishaps? Check the chart on page 5.

Aviation ordnancemen from VFA-37 cross the flight deck after an aircraft launch aboard USS *Harry S. Truman* (CVN-75).
Navy photo by MCSN Justin Lee Losack.