

The Navy and Marine Corps Magazine for Afloat and Shore Safety

SEA & SHORE

FALL 2008

In this issue:

Focus on

ATV Safety

. . . plus features on

- ▶ PPE
- ▶ Boat-davit ops
- ▶ ORM

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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 dangerous and demanding enough; the time to learn to do a job right is before combat starts.

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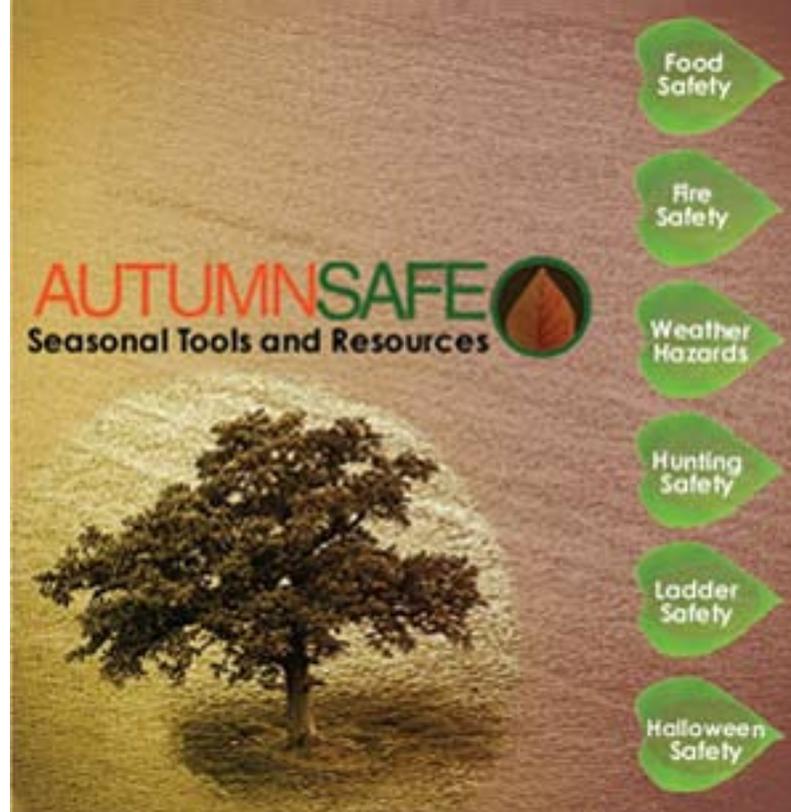
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Ad designed by Gordon Tolson Jr.

What starts the day after Labor Day and runs through the end of November?

The Fall Safety Campaign.

Led by the Air Force, this joint campaign is aimed at continuing the momentum of mishap prevention gained during the Critical Days of Summer.

Be watching our website in coming days, www.safetycenter.navy.mil, for full details.

FRONT COVER



An ATV tackles some rough terrain.

Why So Much Fuss About ATVs?

By Ken Testorff,
Naval Safety Center

That “go-fast, try-anything, nothing-can-happen-to-me” mentality of young Sailors and Marines isn’t just reflected in Navy and Marine Corps statistics about traffic wrecks. It’s also revealed in mishap statistics for ATVs (all-terrain vehicles). Since FY2000, there have been 69 (seven Class A, three Class B, and 59 Class C) reported mishaps involving Sailors and Marines who were riding ATVs.

Here are a few examples:

- An MM2(SS) was test-driving his new 4-wheel ATV in the woods behind his house. He was experienced and had taken a class. The problem was that this ATV was bigger and heavier than his previous one, and when he tried a 1-to-2-foot jump, the ATV rotated forward and launched him over the handlebars. He suffered massive injuries, including a fractured skull, memory loss, one eyeball swollen shut, and several days’ worth of seizures.

- An AM3 showed up at a friend’s house one Saturday night and, in the course of the evening’s libations and festivities, asked his buddy if he could take his 400cc Suzuki ATV for a “test drive.” The Sailor made it all of about a block and up to 20 mph before losing control while making a right turn and crashing into a parked car. The cost: \$500 in damage to the car, \$900 to the ATV, 26 lost workdays, a 12-night stay in a hospital, a broken leg, a cracked sternum, and a damaged aorta.

- A DC3 was riding his ATV in a field. He was wearing a helmet, boots, goggles, and gloves. When he launched himself off a 30-inch ramp at 30 mph, his ATV nosed over, and the Sailor sailed off. His collarbone ended up in pieces, and he landed in a hospital for a day, en route to losing 16 workdays.

- A gunner’s mate was roaring around on a 660cc ATV. He wasn’t familiar with the local

Annual Estimates of ATV-Related Deaths and Risk of Death for 4-Wheel ATVs as of Dec. 31, 2005					
Year	Reported Deaths*	Estimated Deaths Associated With ATVs With 3, 4 or Unknown No. Wheels	Estimated Deaths Involving 4-Wheel ATVs	Estimated 4-Wheel ATVs in Use (Millions**)	Estimated Risk of Death per 10,000 4-Wheel ATVs in Use
2004	609	767	734	6.9	1.1
2003	636	757	721	6.2	1.2
2002	540	603	566	5.5	1
2001	517	593	549	4.9	1.1
2000	451	552	502	4.2	1.2
1999***	398	536	488	3.6	1.4
1998	251	287	245	3.1	0.8
1997	241	291	243	2.7	0.9
1996	248	267	208	2.4	0.9
1995	200	276	212	2.2	1
1994	198	244	168	2	0.8
1993	183	211	144	1.9	0.7
1992	221	241	158	1.9	0.8
1991	230	255	152	1.8	0.8
1990	234	250	151	1.8	0.9
1989	230	258	153	1.6	0.9
1988	250	286	152	1.4	1.1
1987	264	282	126	1.1	1.1
1986	299	347	95	0.7	1.3
1985	251	295	55	0.4	1.5

Source: U.S. Consumer Product Safety Commission, Directorate for Epidemiology, Division of Hazard Analysis.

Note: Although these data indicate a rise in the absolute number of ATV-related deaths and injuries, the risk of death for ATV riders remains relatively constant due to increased usage.

* Denotes reporting for period 2002-2004 is incomplete.

** Rounded.

*** Values starting with 1999 in the table above reflect a revised classification system from the one used in earlier years, specifically the switch from the Ninth Revision of the International Classification of Diseases (ICD-9) to Tenth Revision (ICD-10) in January 1999.

ATV-Related Deaths and Injuries for All Ages 1985-2005 (ATVs With 3, 4 or Unknown No. of Wheels)			
Year	Reported Deaths*	Estimated Deaths*	Estimated Number of Emergency Room Treated Injuries
2005	467	***	136,700
2004	609	767	136,100
2003	636	757	125,500
2002	540	603	113,900
2001	517	593	110,100
2000	451	552	92,200
1999**	398	536	82,000
1998	251	287	67,800
1997	241	291	52,800
1996	248	267	53,600
1995	200	276	52,200
1994	198	244	50,800
1993	183	211	49,800
1992	221	241	58,200
1991	230	255	58,100
1990	234	250	59,500
1989	230	258	70,300
1988	250	286	74,600
1987	264	282	93,600
1986	299	347	106,000
1985	251	295	105,700

Source: National Electronic Injury Surveillance System and other CPSC data-collection systems, Directorate for Epidemiology, U.S. Product Safety Commission, 2006.

Note: Although this data indicates a rise in the absolute number of ATV-related deaths and injuries, the risk of death for ATV riders remains relatively constant due to increased usage.

* Deaths reported as of Dec. 31, 2005. Death-data collection for 2002 and forward is incomplete.

** Values starting with 1999 in the table above reflect a revised classification system from the one used in earlier years, specifically the switch from the Ninth Revision of the International Classification of Diseases (ICD-9) to Tenth Revision (ICD-10) in January 1999.

*** Death estimate not calculated in most recent year due to the degree of incompleteness in the death-data collection.

**** Estimate not available.

terrain, which, unfortunately for him, included an embankment with a 7-foot drop on the far side. He collided with it, flew over the handlebars, and tore a six-inch piece of flesh off his knee (it took 20 stitches to sew it up).

These Navy ATV mishaps reflect a national trend. As noted in a summer 2007 report from the Specialty Vehicle Institute of America (SVIA), there are more than 7 million ATVs in use by Americans. Annual sales figures for the vehicle indicate continued popularity (e.g., more than a 200 percent increase in sales occurred between 1995 and 2006). As a result, serious and even fatal mishaps are common.

Most fatalities involve behaviors the ATV industry warns against in its rider-education programs, in all its literature, and on vehicle labels. The proof came in an analysis of a random sampling of CPSC (Consumer Product Safety Commission) in-depth investigations of ATV fatalities in the United States between 1997 and 2002. That analysis showed 92 percent of the fatalities related to one or more “warned against behaviors.”

Reported ATV-related deaths between 1982 and 2005 numbered 7,188, with another estimated 1.8 million injuries. According to the CPSC, people under 16 comprised slightly more than 21 percent of the fatalities. This same demographic group accounted for 36 percent of the total estimated ATV injuries treated in hospital emergency rooms from 1985 to 2005.

Small wonder then that the Naval Safety Center’s Summary of Mishaps often jokes about ATV standing for “Anyone Tossed-off Violently.” Don’t add to the statistics. Have fun in a way that ensures you keep having fun. For starters, here are some safety rules from the All-Terrain Vehicle Safety Institute (ASI):

- Wear proper protective clothing. This includes an approved motorcycle helmet, over-the-ankle boots, gloves, eye protection, a long-sleeved shirt, and long pants.
- Inspect your ATV before you begin.
- Consult your owner’s manual.
- Check the practice area for potential hazards.
- Bring along an experienced friend to help if anything goes wrong, and to critique your progress.
- Don’t mix alcohol or other drugs with ATV riding.
- Don’t carry passengers. 

Resources:

- ATV Safety Institute, <http://www.atvsafety.org/>
- 4-H ATV Safety, <http://www.atv-youth.org/>
- All-Terrain Vehicle (ATV) Safety, <http://www.nsc.org/library/facts/agriatv.htm>
- 2005 Annual Report of All-Terrain Vehicle (ATV)-Related Deaths and Injuries/Amended, <http://www.cpsc.gov/library/atv2005.pdf>



An Expensive Lesson About PPE

By LCpl. Kyle E. Holliman, USMC,
HMH-466 Avionics

Statistics show that Marines returning home from deployment are at greater risk of injury or death from mishaps than we face while serving in Iraq. The problem is rooted in a tendency to think we're invincible and nothing can happen to us after serving in a combat zone, which is far from the truth.

About a month after returning from Iraq, I had an all-terrain-vehicle crash. The week had started with my squadron's main body returning home, which prompted a couple of safety stand-downs. I attended a MAG-11 stand-down, where I listened to extensive coverage of the need to wear personal protective equipment and to practice risk management. The unit's sergeant major detailed several reports involving cars, motorcycles and ATVs. He then covered underage drinking and hazing incidents. That Friday, I attended my command's own safety stand-down, where instructors covered similar topics.

I traveled to Gila Bend, Ariz., after getting off work that day, arriving there about 2200. I hung out for a few hours, then hit the rack and didn't wake up until 1000 Saturday morning. I had breakfast and, around 1200, decided to go to the cemetery to bar-

beque and ride 4-wheelers in the wash nearby. It's a Mexican tradition to barbeque next to the grave of a loved one.

Before we left, my friend, Vee, was warming up the quad at her father's house to ensure it was operating properly. I never had driven a quad before, but I had ridden one as a passenger. I asked Vee to teach me some basics before we went to the wash. After making several trips up and down the street, I felt I had all the knowledge I needed. I should point out here that I wasn't wearing a helmet during any of my warm-ups.

When we got back to the house, we drove to the wash and didn't take very long to fire up the barbecue. I then hopped on the quad—for the second time, without any PPE—and started making my way into the wash. I rode about a half-hour, trying to get used to the turns and bumps, then returned to the barbecue.

I decided to go for one more ride a little later, before I began drinking any beer. Once more, I violated several safety precautions; I had no helmet, no goggles, no gloves, no chest protector, and I was wear-

ing a short-sleeved shirt and shorts. I took the quad on a trail I hadn't traveled yet.

Everything was OK until I gunned it, while moving quickly in high gear. I came upon a tight snake turn—one that went to the right and led into a decline with lots of small ruts. The trail then went slightly left before opening into a straightaway. I made the right turn but hit the bumps too fast and went airborne. I landed on my right two wheels and bounced back up, straight into a large bush, but didn't fall off the quad, and it didn't roll. I immediately stopped and sat there a couple minutes, soaking in what just had happened.

I then got off the quad and berated myself for being so stupid. I was bleeding badly from a 2-inch gash across the top of my nose but didn't notice it at first. A few minutes later, I noticed something sticking out behind my right ear. Reaching back and feeling the object, I realized it was a stick that had lodged about 2.5 inches under the skin in the back of my head.

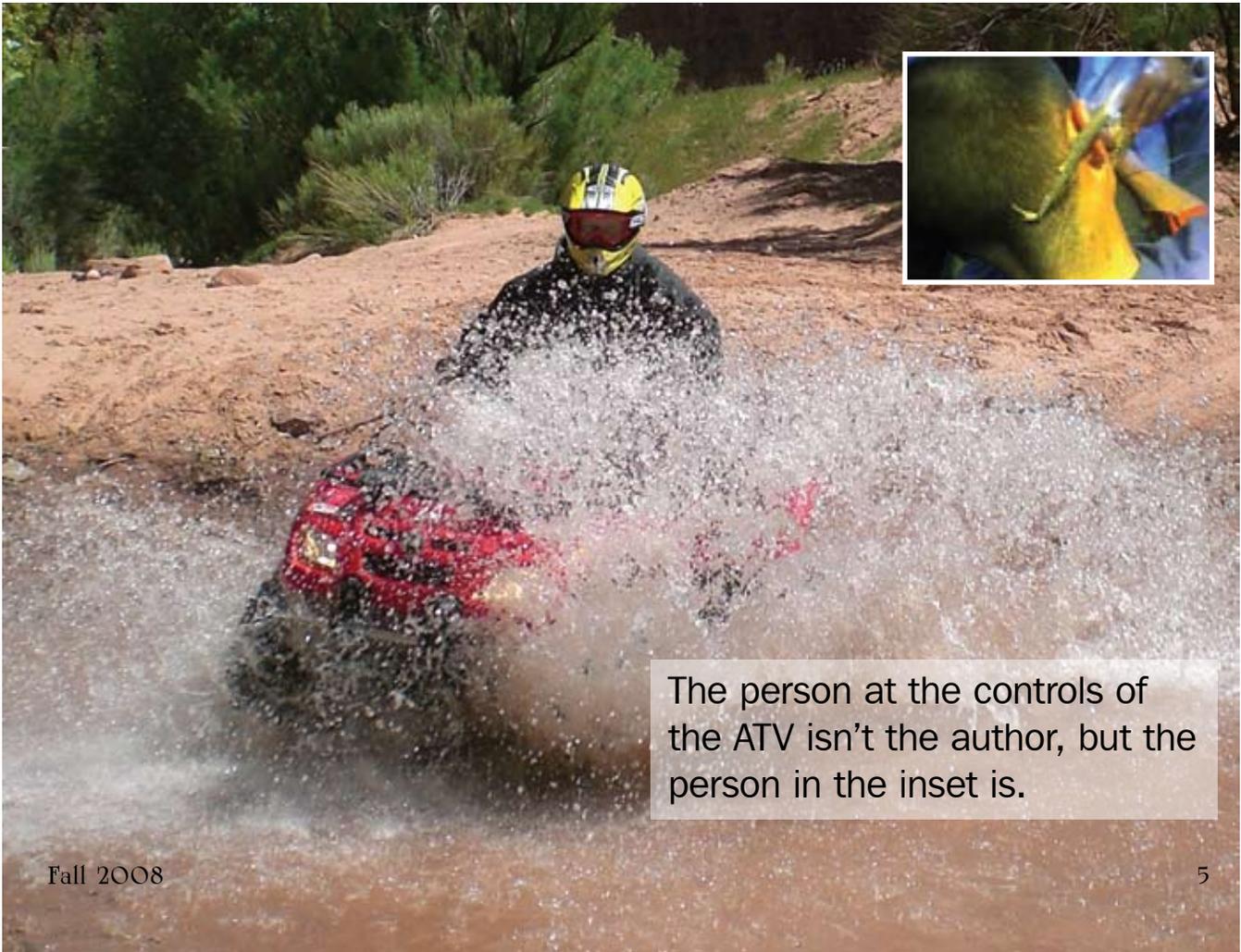
An 8-year-old boy behind me had seen what had happened and really was freaked out. I told him to get Vee's sister, who was riding her quad nearby. He returned shortly with her, and they both told me to stay put while they went to get help. I told them I was

fine, though, and removed the quad from the tree, then started it back up and rode the quarter-mile to the barbeque, where everyone was leaving because of high winds.

One of the people, who worked at the local fire department, drove me to where he worked. Both he and his passenger were freaked out by the stick protruding from my head. I told them I felt fine, which was the gospel truth, except for a very small amount of pain. When we arrived at the fire department, I got out of the vehicle and waited on them to get the paramedics.

When the paramedics arrived, they decided to take me to the nearest hospital's emergency room, rather than to a trauma unit. I still didn't think it was anything serious at that time. I was perfectly alert and coherent, and I had no problem answering questions. My vitals were normal, except for a high pulse rate. When I arrived at the emergency room, it seemed like every person who worked there wanted to see the "dude with the stick protruding out of his head." All I could do was laugh and smile.

Once the doctor arrived, he gave me four shots in the wound before extracting the stick. Only one problem remained: The blood wouldn't stop flowing. At that point, I was extremely glad I had waited to have



The person at the controls of the ATV isn't the author, but the person in the inset is.

PROTECT YOURSELF

- *Never ride intoxicated
- *Wear your gear
- *Emergency plan
- *Take your trash out

RIDING JACKET

ELBOW PADS

HELMET

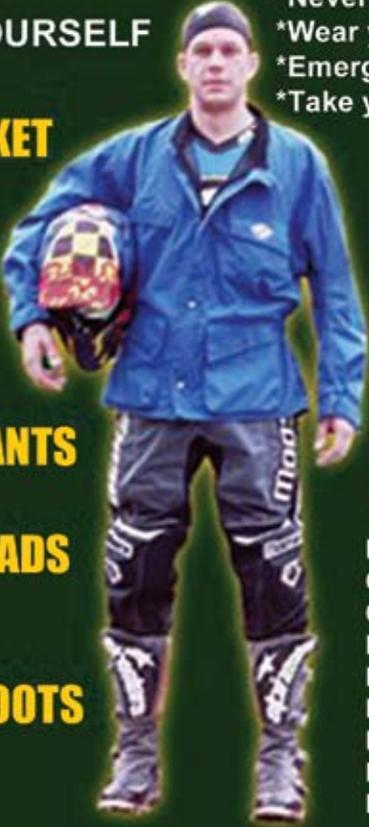
RIDING PANTS

KNEE PADS

RIDING BOOTS

Wear riding gear, it may save your life!

- Helmet
- Goggles
- Chest Protector
- Elbow Pads
- Riding Gloves
- Kidney Belt
- Knee Pads
- Riding Boots
- Riding Gear



The moral to my story is this: If you want to enjoy your ATV, be safe and responsible while riding it, and be cautious of others who are not riding safely.

Many factors can cause an ATV crash. Here are a few: improper positioning of the vehicle, too many riders, lack of protective gear, operating at an unsafe speed, and operating under the influence of drugs or alcohol. Other possible factors are manufacturing defects and flaws in the manufacturing process.

Every year, manufacturers recall thousands of ATVs in the United States because of problems that can cause loss of control, resulting in serious injury or death. In 2008, Kawasaki recalled about 6,000 youth ATVs that had throttle problems. Thirty-five percent of all ATV-related deaths occur to children under the age of 16.

ATV-related incidents warranting emergency-room visits jumped 100 percent in a recent five-year period.

I could have done many things to prevent my mishap and injuries. For starters, I should have gotten some training; my duty station offers classes that teach you handling techniques for a safer ride. I also should have driven more slowly, given my lack of experience. Finally, I should have worn the prescribed PPE for operating an ATV: helmet (most states require you to wear a DoT-approved model), goggles (an often overlooked but must-have item if you want to protect your sight), chest protector, long-sleeved shirt, full-length pants, and gloves. In my case, I wasn't wearing any protection, and I paid the price. **S**

the stick removed at the hospital, instead of pulling it out myself.

Upon leaving the hospital, I went back to my friend's house for the night to rest. I returned to San Diego the next day and reported into my command, where they decided I should be sent to non-judicial punishment. I was charged twice with violating Article 92 of the Uniform Code of Military Justice: first for disobeying my CO for not wearing a helmet, and second for disobeying my master sergeant. My punishment was a reduction in rank to PFC, one-half month's pay for one month, and 45 days restriction/45 days extra duty, all of which were suspended for six months, except for the half-month's pay (\$846). The CO also banned me from driving any motorized vehicle that I wasn't licensed for, which boiled down to everything but a car or truck.

An average adult-sized ATV weighs between 500 and 1,000 pounds and can travel 75 mph. Hence, it's easy to seriously injure yourself with this type of vehicle. Many states don't have an age limit for riding these vehicles, but there are suggested sizes for each age group. Those ages 6 through 11 should ride ATVs under 70cc. Those ages 12 through 15 should ride 70cc-to-90cc models, and those ages 16 and older can ride models over 90cc.

Resources:

- Off Road Vehicles Resources, <http://safetycenter.navy.mil/toolbox/offroadvehicles/default.htm>
- All-Terrain Vehicle (ATV) Safety, <http://www.nsc.org/resources/Factsheets/ag/atv.aspx>
- Riding Gear, <http://www.atvsafety.org/asi.cfm?spl=2&action=display&pagename=Riding%20Gear>

A Lack of Respect

By Derek Nelson,
Naval Safety Center

Kevin Frantum has taught the basics of ATV safety to more than a thousand Marines at Camp Pendleton during the past few years. A couple things have become very clear to him. “Everybody thinks they can drive a car, ride a motorcycle and ride an ATV,” he says. When he watches them get behind the handlebars, though, it’s a whole other story.

“People start out thinking ATVs are toys,” he explains. “They think ATVs won’t tip over, for example. They don’t seem to have much respect for them.” Frantum, who also teaches advanced off-road courses off-base on weekends as a business, says that it isn’t just kids who need an attitude readjustment, but adults, as well. “Anything that will do 35 miles per hour or better over terrain is something you need to learn how to handle. Many of those ATVs have 400cc-plus engines, but people don’t look at them like high-horsepower, high-performance vehicles.” Part of the lack of respect may derive from the fact you don’t need a separate license for ATVs.

Yet, he says, lots of ATV riders seem content to learn by trial and error. The errors aren’t always minor. An avid and experienced rider, Frantum has seen plenty of mishaps. He often rides in the desert and has been first on the scene a few times. When the helmet comes off, he always can tell if it’s a local service member. “I had a young Marine almost hit my brand new camper once,” he recalls. The Marine’s ATV skidded to a halt 20 feet from the camper, but the Marine broke his collarbone.

Frantum saw a teenaged girl seriously injure her back on a recent Sunday. “She came by and caught a rut,” he explains. “Most people get back up. She just lay there.” Frantum, who always carries a cellphone,

called for an ambulance. His wife, an instructor and a licensed vocational nurse, is well-equipped to tend injured riders until the ambulance arrives.

What causes these mishaps? Excessive speed and “just plain carelessness.” Frantum doesn’t think terrain is necessarily the problem. “You just need the right techniques for the terrain,” he says. He has had a couple incidents himself, the most recent when he stalled on a steep hill. As always, his protective gear paid off.

“A lot of riders test their limits,” he says, and sometimes that test goes too far. “Or complacency sets in. They think, ‘I’ve ridden this trail a hundred times,’” but terrain changes. Ruts appear or get deeper. Another common error is to slack off on the PPE when the temperatures start to climb. Frantum insists, though, that six things are mandatory and not weather-dependent: helmet, goggles, gloves, long pants, long sleeves, and boots that cover the ankle.

He is puzzled by the trial-and-error attitude, especially because ATV manufacturers offer rebate incentives, ranging from \$50 to \$150 and free training, if new owners will get training.

The ATV safety class is four and a half hours on the range, punctuated by several 10-to-15-minute lectures. He teaches the basics: getting on, starting, turning, stopping, crossing obstacles and hills. He uses 4-by-4s as the obstacles. In all these exercises, we are teaching correct techniques. After the class, he says, “A lot of the students tell me they learned quite a bit.”

If you haven’t taken a class, he can sum up his experience in six words: “Wear your gear and get trained.” Riding ATVs is a lot of fun. Wrecking them and getting hurt isn’t. ■

Deciding If Your Child Is Ready To Ride an ATV



Forty-three states and the District of Columbia require a minor to be at least 16 years old to obtain a license to drive an automobile. And, because young drivers more frequently are involved in fatal mishaps, 34 states and the District of Columbia also have provisional or graduated licensing systems. These systems withhold full driving privileges until age 17 or 18. It's a different picture for all-terrain vehicles, though.

Twenty-four states don't set any minimum age for driving ATVs, with 19 more letting 8 to 12 year olds operate them. And, while every state in the nation requires all automobile drivers to have a license, there are 42 states that do not require a license to drive an ATV.

RIDER AGE & ENGINE SIZE

ATV Size	Minimum Age
Under 70cc	6 years
70-90cc.....	12 years
Over 90cc	16 years

For that reason, parents must decide if their children have the strength, judgment and skills necessary to ride these vehicles. Here are some points to consider:

Visual Perception and Motor Development

Children should be able to do all of the following:

- Perceive depth or distance.
- Rely on peripheral or side vision.
- Judge speed and follow the movement of objects.
- Follow a moving object while using their hands.
- Maintain their attention while taking in a lot of sights, sounds and instructions.

Physical Development

Children should be able to sit comfortably on the ATV and safely reach the controls. They also should have enough strength and familiarity to operate the controls with ease. They further need to be coordinated (at least enough to ride a bicycle, skateboard or roller-skate) and have sufficient endurance to maintain strength over time.

Emotional Development

Parents should ask themselves these questions:

- Can my child understand and follow rules and obey my (and supervisors') orders?
- Can my child control his/her behavior according to expectations?
- Can my child understand that other youngsters may be permitted to do what he/she may not be allowed to do?
- Can my child give reasons and solutions to problems they encounter?
- Can my child make decisions based on reality, not fantasy?

Decision-Making

Child riders need to know that bad decisions they make can result in injury. They also need a basic understanding of what "being careful" means, as well as understanding that rules are made to increase safety and lead to long-term enjoyment of ATVs.

Children should not be allowed to ride if any of the following are true:

- They do not have a basic understanding of the physical limitations of stopping and turning.
- They cannot describe cause-and-effect experiences.
- They cannot concentrate on more than one element at a time in solving a puzzle or problem.

"Parents, Youngsters and All-Terrain Vehicles" was developed especially for parents to help determine whether their youngsters are ready to ride an ATV. This booklet provides important safety information and tips on learning to ride. To obtain a free copy, call toll-free 800-852-5344 or download a copy online at <http://atvsafety.org/downloads/pya.pdf>.

Parents also might be interested in "Ride Safe, Ride Smart," a nine-minute video that takes a rider-friendly look at how to get a proper start in ATV riding. The video profiles two families: one who rides only for recreation, the other who uses their ATVs for working on a farm, for camping, and for riding trails. Both sets of parents lead by example, emphasizing riding an ATV that is right for your age [see accompanying chart], wearing proper protective gear, and respecting the environment. Both sets of parents also recommend taking an *ATV RiderCourse* to get the most from your ATV, to enjoy the opportunity to meet other enthusiasts, and to find out about the best places to ride. Single copies of the video are available from the ATV Safety Institute, 2 Jenner St., Suite 150, Irvine, Calif. 926180-3806, ph. 949-727-3727. 

ATV Preflight

Check the mechanical condition of your ATV before each ride. This inspection will help minimize the risk of being injured or stranded. It also will extend your machine's lifespan.

Your owner's manual will show you what equipment to check on your particular machine. Here are the most common items:

Tires and Wheels

Air Pressure. Always maintain the recommended tire pressure (usually 2 to 6 psi). Automotive tire gauges are not accurate for use on ATVs.

Condition. Check for cuts or gouges.



Wheels. Make sure axle nuts are tight and secured by cotter pins. Grasp the tire at the front and rear and try to rock it on the axle to detect worn-out bearings or loose nuts. There should be no free play or slippage as you do so.

Controls

Throttle and Other Cables. Make sure the throttle moves smoothly and snaps closed with the handlebars in any position. Check throttle operation while moving the handlebars from fully left to fully right. If your ATV is equipped with an adjustable throttle limiter, make sure the adjustment is appropriate for the rider and that it's set securely. Check cables and controls for damage from a spill or accumulated dirt and mud, which may restrict full operation.

Brakes. Make sure the controls operate smoothly and are adjusted according to the instructions in the owner's manual. The controls should be positioned for your easy reach.

Footshifter. Make sure it is firmly attached and positioned for safe operation. It shouldn't be so low that your toes are pointed downward at the ground or so high that shifting is awkward.

Lights and Switches

Ignition Switch (if equipped). Check the condition of the switch and make sure it works by switching it off and on during your warm-up period.

Engine-Stop Switch. Be sure it turns off the engine.

Lights (if equipped). Make sure all lights are working.

Oil and Fuel

Levels. Always check both levels; check oil level while the

engine is off. Start each ride with a full tank of gas to give yourself the best chance of getting home from a long day's adventure.

Leaks. If you find any, get them fixed before you ride. Small leaks have a way of turning into big ones.

Chain/Driveshaft and Chassis

Chain. Make sure it is adjusted and lubricated. Also check for wear.

Driveshaft. If your ATV is equipped with a driveshaft, rather than a chain, check for oil leaks. Maintain the oil supply as outlined in your owner's manual.

Nuts 'n' Bolts. After a ride over rough terrain, look and feel for loose parts while the engine is off. Shake handlebars, footrests, etc., before each ride, and periodically check major fasteners with a wrench.

Tool Kit

After completing the pre-ride inspection, check to make sure you have an adequate tool kit in case you encounter any mechanical problems. Examine the tool kit that came with your machine. You may want to add a few spare parts: a spark plug or two, some wire and tape, or a headlight bulb. Also consider carrying a strong tow rope. Be prepared to handle any emergencies.

Maintenance

Because off-road riding is hard on your ATV, it's especially important to perform periodic maintenance as outlined in your owner's manual. **S**

Resources:

- ATV Pre-Ride Inspection, http://www.thetipzone.com/vault/checklists/ATV_Pre-ride.pdf
- Pre-Ride Inspection, <http://www.atvmag-online.com/output.cfm?id=1046035>
- ATV Buggy – Safety Guide & Basic Riding Tutorial, <http://palmsportsarena.com/download/Safety.pdf>



A Wounded Safety Officer Confesses

By Lt. Lawrence Behr,
USS *Bataan* (LHD-5)

“It’s true, shipmates. I’m the first person among you to have a reportable mishap this year. That’s why I’ve been hobbling around the ship.

“I knew as soon as I hurt myself that I’d be getting a full ration from the crew... and I must admit that you haven’t disappointed me.

“Perhaps you’re saying, ‘The safety officer never is supposed to get hurt,’ and you’re right. After all, I pride myself on being an operational risk management instructor for five years. Be that as it may, I failed to ask myself some simple ORM-oriented questions, and it ended up costing me!”

That’s how I began my confession to the crew. I went on to explain I was starting a health kick at the time. I had quit smoking for about a week, had been trying to eat well, and was exercising. This particular day, I was doing weight training for my legs. The day’s exercises nearly were complete; I had only one set of calf exercises left. I was doing one leg at a time for better isolation. I also was going pretty light—150 pounds—since I just was starting up my training cycle.

Before I knew what had happened, my foot slipped off the machine, and the 150-pound sled dropped on my left shin bone. The pain was excruciating, and at first glance, I thought I had a compound fracture. I worked my

way out of the machine, while gripping my wound, with blood flowing through my fingers. My wife was with me at the time and asked to see the extent of the damage. The swelling below the point of impact was immediate; it looked to be the size of a tennis ball. She, too, thought I had suffered a compound fracture.

It turns out that a protruding bolt on the leg-press machine caused the stitches I ended up with. A later return visit to the machine revealed some flesh inside the bolt threads, some leg hair that had been pulled out, and a little blood.





After the incident, I immediately washed the wound and applied direct pressure to stop the bleeding. I have to thank HM1 McCartney for the awesome duty-section medical training he provided. My wife then drove me to Portsmouth Naval Hospital, where doctors took X-rays and gave me four stitches. They said nothing was broken. I'm convinced that if I had had more weight on the machine, I would have snapped my leg in half.

What did I learn from all this? For openers, mishaps can happen to anyone—even the safety officer. Second, I failed to ask a critical ORM question: “What if...?” Had I asked that question, I wouldn't be writing this article. I also violated an ORM principle: Accept risk only when the benefits outweigh the cost. In this



case, the benefit of stronger calves didn't outweigh the cost of pain and the minimal physical activity I'm restricted to for the next two weeks.

This event easily could have been a Class C or B mishap. Instead, though, it only turned out to be a case where I had to call the Naval Safety Center and let them know that one of their Sailors had done something dumb and ended up requiring medical treatment beyond first aid.

Please learn from my mistake and the mistakes of others. Use ORM at work and at home. Ask the simple questions that will keep you safe. This whole thing could have been avoided if I had had the safety bars on the machine engaged. I didn't because I wasn't able to obtain a full range of motion. I should have come up with a whole different exercise.

Incidentally, now that I've 'fessed up, you all can stop busting my chops. Thank you. 



Resources:

- Safety in the Gym—Are You Putting Your Athletes at Risk, <http://www.101healthmatters.com/safety-in-the-gym-are-you-putting-your-athletes-at-risk/>
- Operational & Non-Operational/Off-Duty Risk Management, http://safetycenter.navy.mil/orm/downloads/USN_ORM_101.ppt#366, 1, Operational & Non-Operational/Off-Duty Risk Management

Revisiting “The Fall Guy”

By John Mapp,
MARMC

I once wrote an article about a PO2 who fell down a ladder on board ship and broke his leg—all because he was in a hurry and didn’t pay attention. Fast forward almost four years... to the same port, same pier, same ship, and even the same frame number (just one deck up). The victim is different, but the similarities are spooky. Cue the “Twilight Zone” music... “you’re traveling in another dimension... .”

On second thought, cue the theme music from “The Three Stooges.” This year’s “fall guy” was part of a rigging team trying to get a 400-pound chill-water pump moved from a pier to the auxiliary machinery room (AMR). We’ll call the team members BM2 Larry, BM2 Moe, and BM2 Curly.

After the usual hi-jinks (poking of eyes, bonking of heads, and several slaps to various faces), the trio decided to get a crane to accomplish the task. A helpful crane operator, who just happened to be nearby, agreed to do the lifting. All our heroes had to do was tell him where to set it down.

Because the ship was a DDG, they only had three options: the flight deck, the 01 level amidships, or the fo’c’s’le. The Three Stooges—er, I mean, the three riggers—all had a different favorite. Larry’s choice was the flight deck. Moe wanted to use the 01 level, and Curly settled on the fo’c’s’le. He originally had liked the idea of using the 01 level but changed his mind because he didn’t want to duplicate Moe’s selection. None of the three riggers thought to inquire how pumps normally got delivered—a move that ultimately would have saved BM2 Curly a lot of pain.

After poking his fellow riggers in the eyes a few times, BM2 Moe actually thought out the operation. If we drop the pump on the fo’c’s’le or flight deck, we’ll then have to haul the pump through the ship, which will require us to cross several knee-knockers. That seemed like a lot of work. On the other hand, if the pump was delivered to the 01 level amidships, it would be almost directly above the AMR, just two

decks up. Lowering the 400-pound pump down two ladder wells appeared to be a lot easier than hauling it through the ship’s starboard passageway before rigging it down one ladder. Appearances can be deceiving, though.

A few minutes later, our band of merry funsters was standing on the 01 level of the destroyer, waving their thanks to the nice crane operator who’d done the heavy lifting for them. Curly opened the water-tight door to the ladder running down to the main deck, then turned to Moe and said, “Hey, there’s no place to hook a beam clamp in here!”

Moe tried to see, but Curly was in the way (of course). He elbowed his fellow rigger out of the way and snarled, “Spread out! Spread out!” before taking a look for himself. Sure enough, the overhead was obscured by ventilation ducts and cableways. Drat and other comments followed.

For those of you watching the show at home (convulsing with mirth, no doubt), this was another point where our heroes should have thought to ask them-



selves how pumps normally were delivered to this class of ship. Because of the lack of useful anchor points in the access trunk in question, pumps and other such loads normally are delivered to the flight deck. Then the loads laboriously (but relatively safely) are hauled through the starboard main-deck passage-way—rigging up and over the knee-knockers along the way.

“Okay, wiseguys. There’s a procedure for this. We’ll just rig up a “clothesline” across the space with some spare straps, and then we can lower the pump down to the main deck.”

Strapping was duly produced and tied off to the only available anchor points: some angle iron under a communications console and the handle to a ventilation-access panel. The chainfall was shackled to the

clothesline, the pump was hooked to the chainfall, and The Three Stooges—make that the three riggers—were all set to deliver another hilarious episode.

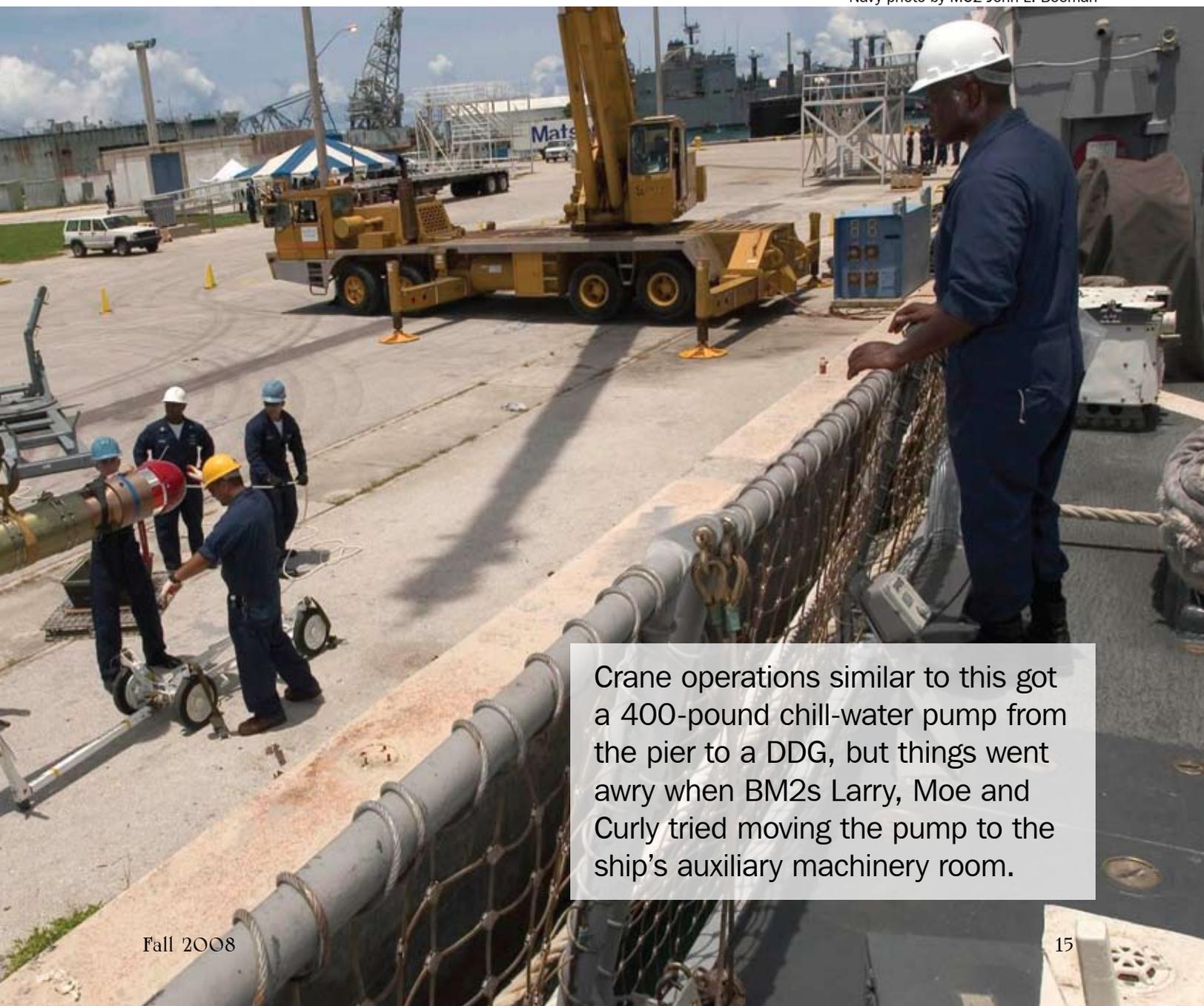
BM2 Larry was waiting down in the space below, and Moe was standing back, looking on, so BM2 Curly got stuck with the dirty work, as usual. He started raising the pump with the chainfall and managed to get it over the ladder well with only minor amounts of excitement. That’s when things went awry.

“Hey, Moe!” Curly exclaimed. “The pump got caught on the top ladder tread.”

“Well, get it uncaught, you meathead!”

Curly obediently tried raising the pump with the chainfall a few times, but it wouldn’t go up any higher. He swore a bit and shuffled, mumbled something about a wiseguy several times, and made a few woop-

Navy photo by MC2 John L. Beeman



Crane operations similar to this got a 400-pound chill-water pump from the pier to a DDG, but things went awry when BM2s Larry, Moe and Curly tried moving the pump to the ship’s auxiliary machinery room.

woopwoops, then finally decided to lean over and give the pump a little push to get it clear.

Since our heroes were so concentrated on doing things “the easy way,” they hadn’t done a very good job of tying off the clothesline to the anchor points. We’ll ignore (for the moment, anyway) the fact that the so-called “anchor points” were not designed (or intended) for use as tie-down points.

As soon as BM2 Curly succeeded in getting the pump free of the top step of the ladder, the full weight of the pump and chainfall was supported by the knots at both anchor points, which promptly gave up the ghost.

Hilarity ensued.

Suddenly having no visible means of support, the chainfall surrendered to gravity and started downward. Since the pump and chainfall were joined at the hip (so to speak), one followed the other down the ladder. After a moment or two of swaying precariously back and forth at the top of the ladder, BM2 Curly lost his balance and joined them.

Larry heard the commotion from his station below and looked up to see the pump, chainfall, and Curly hurtling down the ladder toward him. He promptly made the wisest decision of the day and dove out of the access trunk into the messdeck.

Fortunately for everyone concerned, the stainless-steel slide plates had been lowered over the stairs to help control the pump’s descent. The ladder treads lost a few flecks of nonskid but largely were undamaged. The mostly bronze pump thundered onto the deck like the fist of an angry god but didn’t appear to be the worse for wear. Likewise, the chainfall, which undoubtedly had been through much worse in its career, ended up mostly unscathed.

Unlike the ladder treads, deck, pump, and chainfall, BM2 Curly was made of fragile flesh and blood. The slide plates saved him from 13 separate bumps on the noggin, but he landed on his back atop the chainfall and pump at the bottom of the ladder.

So much for doing things “the easy way.”

Aside from delaying an underway period for lack of a chill-water pump, the three riggers caused no other damage to the ship. The chainfall received a thorough inspection and was put back in service almost immediately—rigging the pump back off the ship. The pump was taken to a local repair facility to get checked out and repaired. BM2 Curly also was taken to a local repair facility—otherwise known as a branch medical clinic—to get poked, prodded and probed (in a non-humorous manner this time) to see if he’d received any permanent damage. His only inju-

ries were a few bruises and a lot of damage to the soft tissue of his lower back, along with a major hit to his pride. He also got a week of light duty and a stern set of lectures from his chain of command.

Let’s look at the failure points for this little escape, shall we? The three riggers were less interested in doing things right, than in doing things right now. They took a couple of shortcuts with basic procedures in the interest of doing things the easy way. Once they made the initial bad risk-management decision to do things “the easy way,” they kept making bad risk-management decisions to compensate for that first mistake. Each new bad decision led to yet more bad decisions. This sort of cascading failure in the risk-management process always ends badly. Our three riggers got off very lightly in this case.

It always “seems” easier to try and compensate for an initial bad decision, than to start over. The “easiest way,” though, is rarely the safest way. If our heroes had acted like professional riggers instead of “The Three Stooges,” they would have refused to become emotionally invested in their initial bad decision (getting the job done “the easy way”). Every time they faced an obstacle as a result of poor risk-management decision-making, they could have stopped and rethought the task and prevented the mishap.

Here’s a tip: When you start thinking about the best way to get a job done, automatically reject any idea that contains the words “shortcut,” “easy way,” or “fastest.” If you’re a rigger trying to get a load delivered on board ship, walk through the route you plan to use before you start the job. Look for places along the route to use for anchor points (hint: handles for ventilation-access covers are not good anchor points). Bring all the tools you’ll need with you. Unless bullets are flying, and people are dying, never ever jury-rig something to “save time.” Any time you manage to “save” doing the work probably will be lost while you’re in the emergency room. ■

Resources:

- Operational Risk Management, <http://safetycenter.navy.mil/orm/generalorm/downloads/intro-toorm.doc>
- ORM Presentations, <http://www.safetycenter.navy.mil/presentations/orm/Default.htm>
- Rigging With Chainfalls Checklist, <http://safetycenter.navy.mil/orm/checklists/afloat/ENCLOS7A.DOC>

Bubble Trouble

By MM1(SW/AW) Lamont S. Stith,
PCU *George H. W. Bush* (CVN-77)

It was a steamy December day in the Arabian Sea, with temperatures so hot you could fry eggs on the deck plate. Our ship, an AOE, was making preparations to set the replenishment-at-sea (RAS) detail.

We had six main auxiliary turbines pumping at a rate of 3,000 gallons per minute (gpm), while two turbines pumped at 6,000 gpm. This arrangement would accommodate two ships—one on each side. I had been working in A division for some time now, so I was familiar with the system. I knew how the process of sending fuel worked and when we stopped pumping.

I was topside, on the riser, from where an aircraft carrier would get its fuel. The carrier was making its approach to move in and receive fuel and supplies. A boatswain's mate had fired the shot line. As the rig line started over, I noticed a bubble in the fuel hose. The bubble was at the top of the rig, just before the U-bend joint, making it less likely to be seen by any of the rover supervisors. The bubble had been stretched from the wear and tear of continuous use.

Because the rig lines were headed over to the carrier, I had to hustle and let fuel control know about this problem. Fuel control is the center console where we coordinate the pumping and stopping of fuel. Fuel control then notified the CO about the bubble, but his response was, "The show must go on." With that, we started delivering fuel.

Thirty-five minutes into the event, the bubble burst, spraying fuel everywhere. The turbines in the pump room couldn't slow down in time to stop fuel from coming out the rig. With approximately 12,000 gallons of fuel on our main deck, the underway at-sea fire party was called away, and we conducted an emergency breakaway, just in case the fuel ignited.

We spent countless hours soaking up the fuel from the deck and washing down with AFFF (aqueous film-forming foam). All this work could have been prevented by taking time to conduct a RAS check-off list and noticing the bubble in the rig line beforehand. Always take time to check your gear before a major evolution. **S**

The author was assigned to USS Detroit (AOE-4) when this event occurred.

Resources:

- ORM Brief VERTREP/RAS, <http://safetycenter.navy.mil/presentations/orm/source-file/Vertrep.ppt>
- Unrep Hazard Prompts Change in Ship's ORM Planning, <http://safetycenter.navy.mil/media/seashore/issues/summer07/unrephazardprompts.htm>
- Scenario (Underway Replenishment), <http://safetycenter.navy.mil/orm/generalorm/scenarios/unrep.ppt>

The Sky Is Falling!

By Ens. Tom Sauer,
USS *Kearsarge* (LHD-3)

If you've ever been lowered from the davit of a "big deck" in a small boat, especially if you're afraid of heights, you know how unsettling it can be. Swinging from the boat 50 feet above the water makes you nervous enough, but you're also holding onto knotted monkey lines just in case the boat falls out from under you. Sounds like a risky operation, doesn't it?

Besides ensuring procedural compliance in lowering and raising boats, safety observers also must be ever-vigilant for drop hazards. This lesson was demonstrated aboard our ship during a small-boat exercise. We were lowering the ship's landing craft personnel, large (LCPL), when the ship's vibration made the belly-band tensioner come loose. The tensioner fell from the davit, hitting the ship's security officer in the thigh and causing a minor injury.

All personnel were wearing proper PPE, including hard hats. Had the tensioner landed on the security officer's head, instead of his leg, the injury likely would have been far more severe, even though he was wearing a hard hat.

What did we learn from this incident? Use lanyards to secure anything that can fall off the davit, and ensure safety observers know any possible drop hazards.

Observers need to maintain that suspicious, questioning attitude when it comes to mitigating risks. They constantly should ask themselves, "What can go wrong here? What can I do to stop it?"

Whether anyone would have noticed the tensioner coming loose remains to be seen, but now that it's a known hazard, our safety observers and everyone involved will be watching for it and other possible hazards (e.g., gear adrift and unsecured objects on the davit). Anyone who has regular interaction with a small-boat davit would be well-advised to do the same. Adding this lesson to your ORM planning process can ensure both mission and personnel readiness. ■

The author is the ship's 1st division officer.

A BM1 directs the lowering of the captain's gig from an amphibious assault ship.



Navy photo by PH3 D. Keith Simmons

Making Boat-Davit Operations Safer

By LCdr. Danny Achterfeld, USN(Ret.)

Boat-davit operations are dangerous if you don't do them correctly. We can divide this danger into two parts: not following procedures around heavy, moving equipment, and not paying attention while doing several things at once.

Consider that, after you lower the keel rest on a boat davit, you have a 6,000-to-10,000-pound boat (fully outfitted) dangling from one or two hooks and wires. Up to six crewmen control the operation. Despite this danger, the crewmen sometimes don't follow procedures.

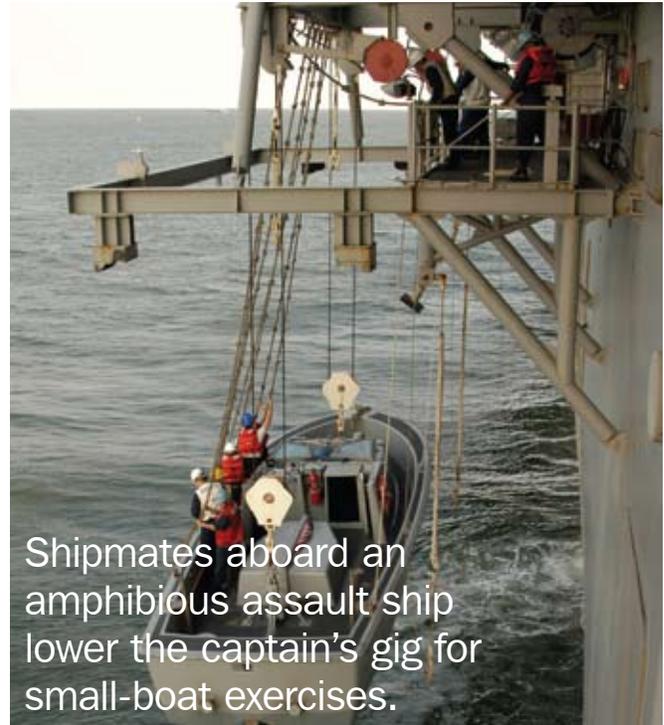
For example, several mishaps have resulted from crewmen not inspecting the boat before hoisting or lowering it. Because they bypassed this procedure, they didn't know the boat exceeded the davit's weight limits—by 1,400 pounds, as one safety officer reported.

There's also a report about a POIC who decided to hand crank the davit for the CO's gig when it was 5 feet from the hooks. As a seaman rotated the handle, it suddenly spun the other way and hit him in the face, breaking his cheekbone.

In other cases, crewmen failed to correctly handle steadying lines, or they didn't do repairs or PMS on the davits as required. In one case, the brake handle on a keel rest had sheared off. Instead of repairing it (part of a pre-use PMS check and safety walk-through), crewmen substituted a paint scraper for the broken handle. With the lifelines still down after recovering a boat on the davit, a crewman needed to raise the keel rest. To do this, he had to release the brake. He was leaning over the side, outboard of the boat, holding the paint scraper when it broke, and he fell over the side. He wasn't wearing a life jacket or safety harness.

I don't know if the maintenance person had reported the broken handle. However, I do know the safety officer hadn't recognized the danger the crewman was in.

When you combine these problems with an unforgiving sea, it should become clear that you and your people are at serious risk. To overcome this hazard, you must look at how you plan for events. Ideally, boat-davit operations start with an operational risk management (ORM) assessment. Assess the hazards by asking these questions:



Shipmates aboard an amphibious assault ship lower the captain's gig for small-boat exercises.

Navy photo by PH3 D. Keith Simmons

- What is different about this davit operation from any others? Do these differences produce new hazards?

- If so, what guidance do we have in place to make sure those hazards are controlled?

Once you've completed the ORM assessment, move to a safety brief and walk-through (including a discussion about the PPE people should wear). If you omit any of these steps, you increase the hazards to you and your shipmates. You may get lucky and put the boat in the water without anyone being hurt, or you may end up the victim of a mishap. ❏

The author was assigned to the Afloat Directorate at the Naval Safety Center when he wrote this story for Fathom magazine.

Resources:

- Deck Seamanship & Safety, <http://navsci.berkeley.edu/ns1/PPT/deckseamanship.ppt>
- Small Boat Davit Checklist, <http://www.spawar.navy.mil/fleet/insurv/files/Preps%20and%20checksheets/Hull/Deck/DK%20Postings%202006.1/SMALL%20BOAT%20DAVIT%20CHECK%20LIST.pdf>

A New Use for Vaseline

By LCdr. Douglas K. Parrish, MSC,
PCU *George H. W. Bush* (CVN-77)

I've seen many interesting things during my time in the Navy, but something I witnessed at the start of a deployment took the cake.

I was rolling off a midwatch on the bridge of our carrier, headed aft toward my rack for a couple hours of shuteye before starting another day. Being a safety bubba (the ship's respiratory-protection program manager), I became suspicious when I saw an exhaust trunk heading down to a storeroom under the mess-

decks. I knew I hadn't seen a painting chit the previous evening, which was required for all spray-painting operations.

I followed the exhaust trunk down two decks and, lo and behold, found three guys spray-painting a large storeroom. I guess they thought they could get away with what they were doing, since it was the middle of the night, with few people around—especially safety department reps.

Navy photo by PHAA Shannon K. Garcia



A respirator fit-test coordinator checks for leaks by spraying a harmless substance into the hood.

All three were wearing paint-laden coveralls, and none had eye or respiratory protection. As a matter of fact, one had nothing on his face; the other two were wearing bandannas. I knew word was out about the requirement to wear PPE, and I knew plenty of PPE was available, so I was at a loss why these three Sailors were taking shortcuts.

I noticed SN Schmuckatelli, the head painter, had Vaseline on his face and around his eyes, so I asked him why?

“To keep the paint from sticking to me,” he responded with a straight face.

“Why didn’t you get a respirator?” I then asked.

“Well, it’s just too much trouble, and the paint is hard to clean off a respirator,” he said.

I privately was thinking, “I guess it’s easier to clean spray paint off your eyeballs and clothes, than

it is to wear the right PPE and Tyvek coveralls.” The spray-painter and his helper should have been using supplied-air respirators. The third Sailor would have been OK with a fitted half mask, plus eye protection, or a full-face respirator with the appropriate cartridges (pre-filter and organic vapor cartridge).

At this point, though, I’d heard enough. I just shut them down and had a good discussion with their chain of command and departmental respirator fit-test coordinator the next day. ■

The author was assigned to USS Constellation (CV-64) when this event occurred.

This story reminded me of another I once wrote for Fathom magazine; an amended version of it follows.—Ed.

A Sailor and a Pair of Paint-Splattered Goggles

Before grinding a deck area, a Sailor got a pair of goggles. Soon his supervisor wandered by and noticed that the lenses were splattered with paint. “Don’t you think you should get a different pair of goggles?” he asked.

“Naw,” the young Sailor replied. “These are fine.”

“Look,” said the supervisor, “I want you to stop right now and go get another pair of goggles.” With that, he turned and walked away but returned a little later to check on the Sailor. He still was wearing the paint-splattered goggles. “What part of my order didn’t you understand?” the agitated supervisor asked.

“I heard all that you said,” the Sailor returned, “but I really can see with these goggles. Besides, think about the time I’ll lose if I have to go back and check out another pair.”

“My original order still stands!” snapped the supervisor, as he wheeled around and hustled away... before losing control of the situation.

More time passed, and the supervisor came back a third time. The Sailor saw him coming and ducked his head, but that action didn’t fool the supervisor.

When he was standing directly in front of the Sailor, the supervisor said, “Look at me.”

The Sailor’s obedience shocked the supervisor beyond words. The imaginative young man had removed the lenses from the goggles.

Although this tale turned out laughable (even the supervisor couldn’t contain a grin), it could have ended in tragedy.

There are five key elements in an effective PPE program: the equipment user, the user’s supervisor, the command, Navy procedures and policies, and support personnel. If any of these key elements fail, the PPE program suffers, and one of your shipmates could be injured or killed. ■

Resources:

- Why Use PPE?, <http://safetycenter.navy.mil/media/fathom/issues/JanMar02/WhyUse.htm>
- Fresh Air Only a Respirator Away, <http://safetycenter.navy.mil/media/fathom/issues/JanMar02/FreshAirRespirator.htm>
- Here’s to Paint in Your Eye, <http://safetycenter.navy.mil/media/fathom/issues/OctDec02/Paint.htm>

It's Hard To Train When You're Woozy

By CS2 Jon Hughes,
USS *Boxer* (LHD-4)

My commanding officer likes to say, “Our greatest assets are the Sailors and Marines who bring our warship to life. The ability to combat our enemies is degraded each time we suffer from an unnecessary accident or injury. As operational commitments arise, we cannot always place safety first; however, all endeavors must be planned and executed with safety in mind.”

When the CO says “all endeavors,” he’s not just talking about high-risk evolutions. Being alert and maintaining situational awareness are essential for *any* evolution, including relatively benign cleanliness training.

One morning, seven months into what would become a twice-extended nine-month cruise, I was in a fan room, showing four junior Sailors how to clean a space. The other PO2 in my division was helping me. I was explaining the differences between cleaning agents when, suddenly, I started to get dizzy and noticed it was becoming increasingly harder to breathe. I turned to the junior personnel observing my lecture and saw that they, too, looked uncomfortable.

I then noticed dark smoke quickly filling the entire space from a vent on the bulkhead. At this point, I wasn’t sure what was creating the smoke, or where it was coming from, but I knew I needed to get everyone out of the space. I told them to exit through the hatch and asked my fellow PO2 to notify damage-control central while I tried to find the cause. He snapped into action and quickly ushered the junior people out of the space ahead of him.

The smoke appeared to be coming from an area under the fan room; it somehow was being sucked

inside the space. Still dizzy, I decided my best course of action was to exit the room myself and wait for reinforcements armed with personal protective equipment. I sealed the hatch as I left the space.

By the time everyone was safely in fresh air, the ship’s flying squad was on the scene. They determined the “smoke” was exhaust from an LCAC doing maintenance turns in the well deck below the space. We had no idea the fan room we had been working in was serving as an exhaust port to the outside of the ship. On their way outside the skin of the ship, carbon monoxide and other noxious fumes were passing directly through our fan room!

Because the fan room was noisy, none of us had heard the 1MC announcement for well-deck operations. It was later I remembered reading about the maintenance turns in the POD that morning. With a little fresh air, everyone was fine. The space was sealed long enough for all the exhaust to clear out, and after ensuring there would be no more LCAC operations, we continued our cleanliness training.

This incident was an excellent learning experience for everyone. The moral of the story is to pay attention to the Plan of the Day. That uneventful five minutes of reading very well could keep you out of harm’s way. ■

Resources:

- A Fire Waiting To Happen, http://www.dcfp.navy.mil/mc/articles/fathom/Jan-Feb_1993_6.htm
- Acquisition Safety—Confined Spaces, <http://205.85.32.3/acquisition/confinedspace/default.htm>



A Run-In With Unnecessary Risk

By Capt. Robert Oldani,
Deputy Commander/Chief of Staff, NavSurfLant

Preparing for the Shamrock half-marathon, I started a Saturday morning with a long training run. It was a beautiful day, and I was feeling good as I found my stride. I was dressed appropriately, complete with my good running shoes, and I was keeping clear of traffic. What could go wrong?

I consider myself very knowledgeable about the principles of operational and off-duty risk management (ORM), particularly time-critical ORM. However, that morning, I foolishly assumed unnecessary risk.

Typical of all my runs, I was absorbed in my thoughts, concentrating on the exercise itself, when I came upon a car stopped at an exit driveway of a shopping plaza. I was running on the sidewalk against traffic, and the driver was waiting for traffic to clear so he could turn right. As I approached, I saw him looking to his left at the oncoming traffic; he didn't see me.

I, too, saw the oncoming traffic and quickly assessed that the first oncoming car was too close for the stopped car to try turning in front of it. I continued running straight and passed in front of it, instead of diverting my track slightly so I would pass astern of the stopped car. With that action, I assumed unnecessary risk.

I'm fortunate not to be writing this article from a hospital bed, while recovering from broken bones, or worse. As soon as I stepped in front of that stopped car, I suddenly realized what could have happened to me.

What if the driver had thought he could beat the oncoming car and gunned the gas to make his

turn? What if the oncoming car, unknown to me, had signaled the stopped car to proceed? In either case, I would have had little reaction time to avoid serious injury.

Although the probability of the stopped driver darting forward was very low, the severity of that danger, while I was directly in front of the car, was very high. I felt a chill as I thought about what could have happened. Luckily for me, the stopped car waited for the oncoming car, allowing me to pass harmlessly in front of it.

The point of this story is twofold. First, even experienced ORMers can unthinkingly violate ORM principles in a time-critical situation. This fact reinforces the need to always be wary of trouble and keep ORM in mind. Second, any unnecessary risk, no matter how small, should be avoided.

We work in an inherently dangerous business: taking ships to sea. That's a necessary risk. While we always seek to minimize that risk, we accept it as necessary to accomplish the mission.

Unnecessary risk has no place at work or at home. I got away with my excursion into unnecessary risk; you might not be as lucky. ■

Resources:

- Operational Risk Management (ORM), <http://www.safetycenter.navy.mil/orm/Default.htm>
- Running to Safety, <http://www.safety.com/articles/running-to-safety.html>

Airsoft

It's Not for Softies

By Ken Testorff,
Naval Safety Center

If you don't mind a few bumps and bruises on various parts of your body, this rapidly growing sport—or hobby, as some refer to it—may be for you. Airsoft, as it's called, is enjoyed by military, law enforcement, and everyday Joes who like the rush of simulated war games and a chance to pit tactics

against other enthusiasts. Unlike paintball, airsoft uses realistic-looking weapons, ranging from M-4s with M-203 grenade launchers to the M-249 squad automatic weapon.

Marines and Sailors from U.S. Marine Corps Forces, Pacific, as described by one Marine reporter,



A member of the Double Tap unit crawls through tall grass to reach an enemy tower during an airsoft competition.

“have taken to this sport like ducks to water,” forming an “elite” unit called Double Tap. For these service members, airsoft isn’t just a fun thing to do on the weekends.

“You can apply military training in a highly competitive and exciting sport,” said one participant. “The challenge of having a target, an objective, and using basic skills to achieve them makes this sport very appealing.”

According to members of Double Tap, their combined military experience gives them an edge over their competition. “Some of the guys we play against have been playing this kind of sport for 20 years,” noted one member. “They try to use paintball tactics that don’t work in this game. We gain the advantage by using basic warfighting tactics to take the fight to them.”

Airsoft weapons are powered by batteries and compressed air and shoot small plastic pellets. Typical out-of-the-box airsoft guns shoot at velocities ranging from 250 feet per second (fps) to 350 fps. However, the guns can be modified to shoot faster, with speeds between 375 and 400 fps usually the maximum velocities allowed by U.S. airsoft teams. More experienced private teams may allow up to 550 fps for long-range, bolt-action, sniper-rifle-type guns. In the case of Double Tap, members can have sniper rifles with a muzzle velocity of 700 fps. An M162A assault rifle has a muzzle velocity of 3,050 fps.

Marine Corps photo by Cpl. R. Drew Hendricks

“Even though the rounds are small, they are fired at an fps that is hundreds faster than paint balls,” said a member of Double Tap. “They hurt and leave welts but cause no serious damage,” provided the players are wearing the required eye protection. Goggles suitable for use with airsoft must meet these requirements:

- The impact standard must meet American National Standards Institute (ANSI) Z87.1.
- They must fully encompass the eyes, with no gaps.
- They must be fitted with a head strap to keep them from falling off during a game.
- The lens frame must be sturdy enough to keep the lens in place during play.

Although not required, these items are highly recommended when playing airsoft:

Full-face mask. Such a mask protects your ears, mouth, nose, and other soft-tissue areas from pellet impact. People have had their teeth broken from being shot in the mouth.

Balaclava (cloth head mask). This piece of gear provides extra skin protection if you’re hit.

Gloves. One of the most painful places to take a hit is to the fingers. A direct hit from an upgraded AEG (auto electric gun) can break your finger. Paintball and tactical gloves can help ease the pain of such hits and protect you from field hazards (such as thorn bushes, barbed wire, etc.).

Hat. Besides protecting you from the sun, a hat keeps brush out of your hair and provides limited shot protection.

Boots. You need good ankle support during movement over rough ground. A military-style 8-inch combat boot is recommended.

Knee and elbow pads. These items can protect your joints if you have to hit the deck in a hurry, or while lying in the prone position for a long time.

The simplest rule to remember with airsoft guns is to treat them as real firearms. In other words, always keep the gun pointed in a safe direction, always keep your finger off the trigger until ready to shoot, and always keep the gun unloaded until ready to use. Here’s another cardinal rule: Never shoot at anyone who isn’t wearing eye protection.

As most enthusiasts will agree, airsoft is only a game... It’s all about teamwork, honor and sportsmanship. If you don’t want that, find another game to play. 

Documented eye injuries to date from playing airsoft include corneal abrasions, bleeding into the front and back parts of the eye, traumatic dilation of the pupil, tearing of the iris from the wall of the eye, cataracts, and tearing of the membrane beneath the retina. The victims, in most cases, are children playing with airsoft weapons in the backyard. Although surgery sometimes is required, the majority of victims retain 20/20 vision afterward.—Ed.

Resources:

- Airsoft Safety, <http://www.airsoftgunhelp.com/airsoft-gun-safety.htm>
- Airsoft (history, methods of play, etc.), <http://en.wikipedia.org/wiki/Airsoft>
- Marines, Sailors Play Airsoft Hard, <http://www.usmc.mil/marinelink/mcn2000.nsf/main5/0D47320274AFB903852573DA0062CD16?opendocument>

Your Head May Look Like a Bowling Ball, But...

By AD2 Jeffrey Quichocho,
CTU3204

How are your eyebrows? That's the "burning" question I was left agonizing over one Friday. The morning had dawned beautifully, and I had decided to take leave so I could work on my truck. I needed to shave down all four brake calipers to fit my new rims—a job that I knew wouldn't be easy.

After a good breakfast, I donned my coveralls, safety glasses, gloves, and closed-toe shoes. It was about 0830 when I started to work. I figured it would take about six hours, with breaks, to finish.

Every time I took a break, which was often, I removed my goggles and gloves, then rolled my coveralls to my waist and tied them. I also washed my hands with soap before every break. It was about 1330 when my wife asked me how much longer I would be working on my truck. "I need another 30 minutes," I said. Sure enough, it was 1400 when I started putting away my tools and cleaning up the area.

About 1430, I headed for a shower, feeling very happy that my truck finally was ready to drive. I had shampooed my bald head and was washing my body when I first felt a burning sensation in my left eye. Not long afterward, I felt a similar burning sensation in my right eye.

I got dressed, then went downstairs and told my wife I was ready to get out of the house. The burning sensation kept getting worse, so I asked my wife to put some drops in my eyes before we left. En route to the store, my vision kept changing, and the sunlight really hurt. I had to put on my sunglasses to alleviate some of the pain. Even then, I constantly was rubbing and blinking my eyes to get them to focus.

At the store, the pain grew worse. Besides the burning sensation, both my eyes now felt like dust was in them. I bought more drops at the store and had my wife put some in both eyes—but the pain remained. In fact, it was getting worse, and my vision was blurring. To keep my balance, I had to squat on the floor. My wife checked my eyes and noticed small, black

particles in them. The iris of my right eye looked especially bad.

I figured if I went to the bathroom to rinse my eyes, the particles would wash away, but they didn't. I even used my fingers to rub my eyeballs as the water was running, but that also didn't work. By this time, my eyes were bloodshot, and the pain nearly was unbearable.

My wife suggested we should go to the hospital. Before we could do that, though, we had to go back home and drop off our children with my in-laws. The emergency-room staff immediately had me see a physician. My wife and I got a good laugh when the ER admission nurse asked me what had happened. I told her I had shaved some metal, then jumped into the shower, where my eyes had started burning. Not looking at me while writing, she said, "Maybe some metal particles in your hair washed into your eyes."

When she finally looked up, I asked, "What hair, ma'am?" The receptionist, the nurse, my wife, and I all became teary-eyed from laughing so hard about the comment.

In the optometry room of the ER, the attending physician examined my eyes with a special machine [called a "slit lamp"]. He identified at least seven particles in my right eye and nine in my left. He also noticed that one of the particles on the cornea of my right eye had developed a ring around it [see accompanying photo for sample of what it looked like]. He even let my wife look into the machine so she could see it. The physician explained that the metal particle was just under the surface of the eyeball, and exposure to the oxygen of my eye already had begun causing a rust ring to form.

The physician administered anesthetic eye drops to both my eyes, which immediately caused an awful burning sensation. Both eyes, though, quickly were soothed. While the pain was gone, the gritty feeling still existed. The attending physician was able to remove 15 of the 16 metal particles using Q-tips and



saline flush. The only particle he couldn't remove was the one imbedded into the cornea of my eye. He tried scraping off the particle with a tool that resembled a file [*probably a "curette"*] but with no success. Two-and-a-half hours later, he suggested calling in a specialist eye doctor [*an ophthalmologist*] on call. The attending physician said he was afraid he might cause more harm than good to my eye if he continued.

Within 45 minutes, the ophthalmologist came to my rescue. He checked my eyes with the same machine the physician had used and confirmed that the only particle he saw was the one embedded in my cornea. He then administered more anesthetic eye drops and moments later used a tool similar to a cordless Dremel [*called a "corneal burr" or "corneal-burr drill"*] to polish my eye. In just a few seconds, it was over. The ophthalmologist had polished off the metal particle, as well as the rust ring. He then administered some antibiotic eye drops and told me to repeat this procedure every six hours for the next five days. I also received a tetanus shot and was instructed to do a follow-up with him in 48 hours at his office, so he could monitor my progress.

The specialist explained that, although I didn't have hair on my head, metal particles likely had collected on my eyebrows and had washed into my eyes

while showering. He told me it was a good thing I had worn safety gear, or even more particles probably would have embedded into my eyes.

At the end of this ordeal, I had to question myself. Here was a person trained to use proper safety equipment whenever it's needed, and I had used it. However, I didn't give any thought to the fact my eyebrows would catch so many metal particles. How many more particles would have entered my eyes if I hadn't been bald or hadn't worn any PPE? In retrospect, I realize that proper PPE always is critical for the job being performed. I should have used a full face shield or goggles that would have covered my eyebrows, instead of the safety glasses. ■

Resources:

- Eye Safety, <http://www.cdc.gov/Niosh/eye-safe.html>
- Corneal abrasion (scratch): First aid, <http://www.mayoclinic.com/health/first-aid-corneal-abrasion/FA00037>
- Corneal Abrasions, <http://familydoctor.org/online/famdocen/home/healthy/firstaid/basics/205.html>
- Corneal Foreign Body, <http://www.drugs.com/cg/corneal-foreign-body.html>

Understand the Process

By Ted Wirginis,
Naval Safety Center

A year ago, the Naval Safety Center published a special magazine called ORM, the Essentials, which outlined where we want ORM to be in our Navy culture. We stated, “We want everyone to understand risk management. We want them to know how to apply the principles and the process at the right level in their specific tasks and activities, on and off duty. We need every Sailor and Marine to understand that every death on the highway robs us of a vital part of our team, every bit as much as a loss in combat.” Since then, we have not progressed very far in teaching and training to the application and integration of organizational and individual risk management.

To get where we want to be, we need to understand how ORM fits into our daily lives. This is the first article in a series to help you get a better understanding of ORM and how it applies to you. This article concentrates on the three levels of ORM.

A review of the attached figure shows that the three levels of ORM are defined by time.

- If you have very limited or no time to plan and are in the execution phase of the event or task, you are at the **time-critical level** of ORM.

- If you have plenty of time to plan, to get the *right* answer, you are in the **in-depth level** of ORM.

- The **deliberate level** lies between the two other levels, when you don't have unlimited time yet need to get the *best* answer.

We depict those levels in the shaded gradient because there are no definitive lines between the levels. You flow from one level to another as you approach the task or event. However, most of the time, we are in the doing or execution phase, which is at the time-critical level.

Why is it important to understand the three levels of ORM? Because each level plays a role in improving your chances of a successful mission. The controls developed

from one level become resources for the next. It's important to know we have resources to tap into to accomplish our job or mission during its execution. These resources make it easier to do our job and help us catch errors that have consequences detrimental to task or mission success.

The resources are broadly categorized into the following:

- **Policies, procedures, and routines**, such as general orders, SOPs (standard operating procedures) and guides. These resources speed up decision-making and increase predictability through standardized operations.

- **Checklists and job aids**, such as instructions and MIMs (maintenance instruction manuals). These resources decrease potential for error and improve coordination.

- **Automation**, such as alarms, warning lights, auto door locks, autopilots, and seat-belt warning, provide another opportunity to reduce risk by providing faster interpretation of information, process of information, provide warnings and distribute the workload.

- **Briefings and external resources** transfer situational awareness from a supervisor, shipmate, briefer, or crew member. These resources increase predictability and create expectations.

- **Knowledge, skills and techniques**, such as training, practice and drills. These resources are brought by the individual to the task or mission. In addition to helping us do a particular task, knowledge and skills improve situational awareness.

The attached figure includes additional resources that are familiar to you.

You can draw on the resources created by you or others in the in-depth and deliberate levels as you execute the task or mission. Resources help us to be more effective and successful.

Please send your questions, comments or recommendations to: Cdr. Allen McCoy, Code 16
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 375 A St., Norfolk, VA 23411-4399
 (757) 444-3520, ext. 7266 (DSN-564)
 E-mail: allen.mccoy@navy.mil



A leader makes sure the doers have the resources to do their jobs. Integrating ORM into your organization requires a full review of those resources and their current applicability. If we expect our skills to catch errors and complete the task or mission, we need to make sure it is current, effective and relevant.

If you think of risk management as a tactic that enhances mission accomplishment, you can see that we use it daily, normally without giving it much thought. This behavior, unfortunately, has not guaranteed our success. Why? Do we have a problem with managing

risk? No. Over the years we have developed these types of resources on the job to improve mission effectiveness and reduce risk. The simple truth is, these resources work equally well when applied to daily life. This is an important realization when we consider the magnitude of injury and death that occurs off duty. Our goal in this series is to give you a better understanding of ORM, its applicability, and use in our daily lives—both on and off duty. **S**

Mr. Wirginis is the ORM manager with the Naval Safety Center.

Non-Traditional Vehicles in the Workplace

By Stan Willingham,
Naval Safety Center

My focus here will be “non-traditional” vehicles, specifically all-terrain vehicles (ATVs), golf carts, low-speed vehicles (LSVs), and hybrid-electric vehicles (HEVs). When any one or all are used in the workplace, they must comply with all the pertinent regulations, including not only those of the Occupational Safety and Health Administration (OSHA) but the Department of Transportation (DoT) and Environmental Protection Agency (EPA), as well.

Many people feel these vehicles are less dangerous than the cars, trucks, motorcycles, and other such “traditional” conveyances that we find on the nation’s roadways. They attribute that feeling to the non-traditional vehicles’ reduced size, limited speed, and lack of sheer horsepower. However, those perceptions in the wrong circumstance can and do reap tragic consequences.

ATVs

As defined in OpNavInst 5100.12H (Navy Traffic Safety Program), an ATV is any self-propelled vehicle with three or four wheels and designed for off-highway use. Other traits are low-pressure tires, a wheel base of 50 inches or less, overall steering, and a seat designed to be straddled. According to the U.S. Consumer Product Safety Commission (CPSC), ATVs aren’t intended for use on concrete or paved roads. Injuries and fatalities often are the result when you do use them that way.

Most ATVs now in existence are used primarily as recreational vehicles. However, in the last two decades, a variety of America’s workplaces, including law enforcement, agriculture, construction, facilities management, defense, and oil production, have introduced them into the workplace. Because ATVs enable



employees to traverse rough terrain and to get to remote locations quickly, their value is immeasurable.

Mishap Experience and Statistics. OSHA and CPSC say that employees who use ATVs while doing their jobs are exposed to hazards similar to those experienced by recreational users. The Bureau of Labor Statistics says Americans are experiencing 11.3 fatalities and 162 recordable injuries annually while using ATVs in the workplace. Most mishaps with ATVs involve rollovers (e.g., 23 of 50 incidents investigated from 1990 to 2003 involved ATVs overturning). Contributing factors were excessive speeds, unstable loads, rough terrains, and excessive inclines.

ATVs are engineered for certain operating conditions and for handling specific loads, period. Modifications and non-manufactured changes to either increase the possibility for an accident. This point was demonstrated in an OSHA investigation conducted in North Dakota, where an employee was injured fatally while driving an ATV uphill on rough terrain. The employer had mounted a sprayer on the rear cargo rack so the employee could apply herbicide to off-road weeds. As the employee drove the ATV uphill, the front wheels came off the ground, and the ATV flipped over.

The employee first tried to prevent the mishap by standing and shifting her weight. As a last resort, she jumped from the vehicle moments before it went over and crushed her beneath its weight. The ensuing OSHA investigation identified decreased vehicle stability as the major cause of the accident. Addition of the sprayer had caused the vehicle's weight distribution over the wheel base to change. The sprayer exceeded the manufacturer's weight limit by 55 pounds.

Mishap Mitigation. Though ATVs are considered "non-traditional" vehicles, mishap investigations and lessons learned have determined most causes and contributing factors to be "traditional" in nature. Excessive speed, little or no operator experience, and transporting passengers (most ATVs are not designed to carry anyone but an operator) contribute to rollovers. These problems, combined with not using the proper personal protective equipment (PPE) and a lack of training, lead to fatalities and serious injuries.

Employers and employees alike must become familiar with 29 CFR, part 1960, subparts .8, .9, and .10, which outline responsibilities for complying with safe and healthful work environments, following regulations, and using PPE. Pay particular attention to these recommendations:

- Train operators in the hazards of using an ATV. Include statistics indicating higher fatality rates among ATV users as compared to drivers of other vehicles, and emphasize the primary causes of incidents, such as carrying passengers, excessive speed, or overloading. Note that a much higher incidence rate occurs among new ATV users.
- Establish workplace rules for ATV operation that specify speed limits and prohibit horseplay, such as performing "wheelies" or "hot-rodding." Enforce the rules.
- Require the use of personal protective equipment, including a DoT-approved helmet, appropriate boots, gloves, and goggles.

Golf Carts

OpNavInst 5100.12H defines a golf cart as a "motorized cart designed for transporting persons playing golf and their equipment on a golf course." A golf cart typically doesn't exceed 15 or 20 mph and isn't classified as a "government motor vehicle." Because of their low emissions and cost effectiveness when compared to traditional motor vehicles, golf carts are being used much more frequently in the workplace. It's important to note, however, that, during the last 17 years, as golf carts have become faster and more powerful, the potential for mishaps and injuries have increased.

According to Dr. Gerald McGwin of the Center for Injury Sciences, "Golf carts are perceived as little more than toys, but they are quite dangerous when used on public roads." The highest risks are rollovers and ejections. When used as non-traditional vehicles in the workplace, golf carts don't require operators to have a traditional driver's license. As a result, little or



no training is provided operators, which contributes to many accidents. Most injuries take the form of fractures and head traumas. The highest injury rates involve young males.

No federal guidelines currently exist regarding the operation of golf carts. Here are some recommendations for safe operation provided by the Texas Department of Insurance, Division of Worker's Compensation Resource Center:

Management and Supervision.

- Develop a written policy statement for golf carts, stressing safety, employee awareness, and involvement.

Maintaining a Golf Cart.

- Inspect daily before use.
- Check tires for proper inflation.
- Check for normal steering.
- Check brakes for proper operation.
- Check for any indication of battery-fluid leaks.
- Recharge cart in a designated charging area, close to a fire extinguisher. Do not recharge near an open flame or source of ignition; don't smoke in the recharging area. Use only an approved battery charger (must shut off automatically when battery is fully charged).

- Pour baking soda on all spilled battery acid before cleaning up the spill. Wash skin thoroughly with cold water if skin is exposed to battery acid.

- Disconnect all battery-charger cords before using the cart.

Operating a Golf Cart.

- Become familiar with the manufacturer's operating manual.
- Ensure all drivers receive training.
- Drivers and passengers must remain seated while the vehicle is moving.
- Allow only authorized employees to drive cart.
- Never exceed the number of available seats for the number of passengers.
- Seat belts/restraining devices should be installed and worn by all passengers.
- Only allow a cart to be towed if it's specifically designed for towing.
- Slow down and honk the horn at all intersections.
- Reduce speed when approaching pedestrians, who always have the right of way.
- Use mirrors at each intersection to ensure pedestrian safety.
- Reduce speed when turning or passing through doorways.

- Don't park carts where they will become a safety hazard.

- Operate carts at a safe speed. The maximum speed of a cart depends on the terrain being driven over, weather conditions, and the combined total weight of passengers, equipment and the cart.

- Observe all vehicle traffic laws and signs.
- Drive on streets or roadways whenever possible.
- Make sure all passengers keep their hands, arms, legs, and feet within confines of the cart when in motion.
- When the cart is not in use, place its control lever in the "neutral" position, and remove the key.
- When the cart is not in use for a long period of time, such as overnight, secure it with a cable and lock or other equivalent locking mechanism.
- Never leave the key in a cart that is unattended.

LSVs

Low-speed vehicles originally were derived from modified golf carts. In 1998, the National Traffic and Safety Administration published a final rule, Federal Motor Vehicle Safety Standard (FMVSS) 500, which recognized a new class of vehicles defined as "low-speed vehicles."

FMVSS 500 noted that an LSV is a street-legal vehicle capable of going at least 20 mph but no faster than 25 mph on a paved, level surface. The gross vehicle weight (GVW) is limited to 2,500 pounds. Federal designation requires LSVs to meet the standards of DoT's 49 CFR 571. By statute, these vehicles must be





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equipped with the following: (a) head lamps, (b) front and rear turn signals, (c) tail lamps, (d) stop lamps, (e) reflex reflectors (one red on each side, as far to the rear as practicable, and one red on the rear), (e) an exterior mirror mounted on the driver side, and either an exterior mirror mounted on the passenger side or an interior mirror, (f) a parking brake, (g) a windshield conforming to 49 CFR 571.205—the FMVSS standard on glazing materials, (h) a Vehicle Identification Number (VIN), and (i) a type 1 or 2 seat-belt assembly, conforming to 49 CFR 571.209, installed at each designated seating position

At this writing, LSV-specific accident statistics could not be found. The following information should be considered by anyone planning to buy and/or operate an LSV:

- 45 states (excluding Connecticut, Idaho, Maine, Minnesota, Washington, and Wisconsin) allow LSVs on roads.
- LSVs offer virtually no protection for occupants in the event of collision with larger and heavier vehicles.
- Though LSVs are street-approved, you should use caution in selecting routes of travel. Less densely trafficked and slower speed routes are recommended.
- Training and vehicle operation procedures are imperative.
- Because of LSVs' size, the average motorist may have problems seeing them.

HEVs

Hybrid-electric vehicles arrived on the scene as an emissions-reduction alternative to fossil-fuel-powered vehicles. Operating these vehicles, in fact, does significantly reduce air pollution. Their efficiency lies

in the fact they use both electrical and non-electrical sources for power. Their electrical source is derived from generators that operate and charge special batteries, which, in turn, provide power. Their non-electrical source is derived from an internal-combustion engine that burns either gasoline or diesel.

From an OSH perspective, HEVs meet all federal motor-vehicle-safety requirements. Their batteries are sealed, and all high-voltage circuits are protected from casual contact. High-voltage circuits are marked, color-coded, and posted with warnings to advise of their presence. They pose no additional risks over a conventional (internal-fuel-combustion engine) vehicle.

Research for this article did highlight one area of safety: the role of first responders in the event of an emergency. There are a number of HEV manufacturers, and each one uses an electrical system with unique characteristics. High-voltage battery packs, three-phase alternating current, converters, inverters, controllers, and the like present unique challenges and concerns in emergent conditions. As a result, first responders should receive special training to prevent accidental electrocution. ■

Resources:

- OpNavInst 5100.12H (Navy Traffic Safety Program), <http://doni.daps.dla.mil/Directives/05000%20General%20Management%20Security%20and%20Safety%20Services/05-100%20Safety%20and%20Occupational%20Health%20Services/5100.12H%20CH-1.pdf>
- 29 CFR 1910 (OSHA General Industry Standards), http://www.osha.gov/pls/oshaweb/owastand.display_standard_group?p_toc_level=1&p_part_number=1910
- 49 CFR 571 (Department of Transportation Federal Motor Vehicle Safety Standards), http://www.access.gpo.gov/nara/cfr/waisidx_00/49cfr571_00.html
- Department of Labor (OSHA Safety and Health Bulletin 08-03-2006), <http://www.osha.gov/dts/shib/shib080306.pdf>
- Legislative Report on Hybrid Electric Vehicles, Jan 2005, <http://www.leg.state.vt.us/jfo/Reports/2005-01%20Hybrid%20Electric%20Vehicle%20Report.pdf>
- CDC National Institute for Occupational Safety and Health, <http://www.cdc.gov/NIOSH/>
- Occupational Health & Safety Online, <http://www.ohsonline.com/>