NATIONAL SCIENCE FOUNDATION SHIP INSPECTION PROGRAM

2017 RVOC MEETING

JMS
NAVAL ARCHITECTS

Naval Architecture
Marine Engineering
Marine Surveying
Salvage Engineering

Purpose

The major purposes of the NSF Ship Inspection Program are:

1. To assure that the capabilities of the research vessel and technical support meet accepted scientific community standards and expectations;
2. To assure the seaworthiness and safety of research vessels supported by NSF meet or exceed the standards set forth by the *UNOLS Research Vessel Safety Standards (RVSS)*, and applicable requirements of the International Maritime Organization, American Bureau of Shipping (ABS), the Code of Federal Regulations (CFR), and the U.S. Coast Guard;
3. To ensure NSF-owned ships as capital assets, are being adequately maintained;
4. To ensure NSF-funded science is scheduled on properly outfitted and maintained vessels.

Recently Completed

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Upcoming Inspections

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Best Practices & Areas for Improvement:

- Effective safety briefs
- Realistic drills
- Mitigating risk factors associated with fatigue
- Lithium Battery policies and procedures
- Appendix A extenuating circumstance procedures
- Use of Environmentally Acceptable Lubricants and Fluids. VGP Annual Report must identify the complete brand names of EALs used. The vessel should also maintain a copy of certificates and technical data sheets for each EAL. Applies to wire rope.

Best Practices: Safety Brief

- Welcome aboard handout
  - ATLANTIS
- Ship-specific safety information
  - Use ship photos, PowerPoint or videos
  - ATLANTIC EXPLORER, SALLY RIDE, PELICAN
- Safety Brief
  - Pre underway is best
  - Provide information prior to cruise
  - SALLY RIDE, REVELLE
- Be sure to include shipboard policies
  - Harassment, drug & alcohol, environmental, etc.
- Reinforce in the Cruise Planning Manual, ship's web site, in labs and in staterooms

Best Practices: Realistic Drills

NTSB
SAFETY ALERT
National Transportation Safety Board

Mariners: Improve Your Chances of Survival When Abandoning Ship

Good preparation and proper use of safety equipment is key

The problem

The NTSB recently investigated an accident that required the crew to abandon a weather-damaged liftboat in near-hurricane-force conditions.[1] Several problems leading up to and during the vessel abandonment negatively impacted the 10 crewmembers' probability of survival once they were in the water, and four of them died as a result:

- The company hurricane plan did not account for rapidly and locally developing low pressure weather systems. This reduced the crewmembers' ability to properly plan for the developing storm and to make an early decision to leave the vessel through routine means before the onset of the storm.
- The vessel had recently been equipped with two new inflatable throw-over-type liferafts. However, the liferafts were inflated on deck instead of in the water when the crew prepared to abandon the vessel. This led to the liferafts blowing away from the vessel and vanishing in the high winds and seas. The crewmembers ended up clinging to a lifefloat, which, unlike the liferafts, did not provide out-of-water flotation, shelter from the elements, and nonperishable food and drinking water.
- Although the crewmembers had gathered additional food, drinking water, and other supplies while preparing to evacuate, they failed to take these with them.
- The vessel was equipped with an emergency position indicating radio beacon (EPIRB), which if activated would have quickly alerted authorities and narrowed the search area. However, the crewmembers did not take the EPIRB with them when they abandoned the vessel. As a result, they spent 3 days in the water before search and rescue assets were able to locate them.

[1] *Personnel Abandonment of Weather-Damaged US Liftboat* Trinity II, *with Loss of Life, Bay of Campeche, Gulf of Mexico, September 8, 2011.* The report is available at www.ntsb.gov, under report number NTSB/MAR-13/01.

What can mariners do?

- **Develop and execute a thorough weather preparedness plan.** Ensure that your plan takes into account surface low pressure systems, nontropical storms, and other weather systems that may form rapidly and locally. (For example, not all hurricanes approach from the east.)
- **Ensure you know how to use safety equipment.** Don't wait until a real emergency to find out whether you know how to properly use lifesaving equipment. Instead, include in your regular weekly or monthly drills a thorough step-by-step assessment of all such equipment, especially liferafts, which can't actually be deployed during drills.
- **Plan before evacuating.** Before an emergency, ensure you know your assigned duties and responsibilities—such as who's bringing what supplies—and ensure the responsible person is aware of the location of those items.
- **Drill as if it is a real emergency.** Conducting realistic drills gets the attention of crewmembers, builds their confidence and proficiency in emergency response procedures, and reinforces a strong safety culture. Review drill performance with crew to identify areas for improvement.
- **Even in coastal waters, plan for the worst.** Despite being close to shore and/or in a normally high-traffic waterway, don't assume that others will be able to come to your immediate aid, especially if your location changes. Be physically and mentally prepared for the possibility of a prolonged exposure situation.
- **Follow your plan.** In emergency situations involving high stress and exhaustion, ensure all aspects are covered by running through step-by-step emergency procedures in accordance with established checklists. Use shoreside support resources to assist you with this.
- **Don't forget the EPIRB.** The EPIRB is a vital piece of equipment that can significantly shorten the time necessary to locate and rescue you. Take it with you! In addition, carry a personal locator beacon (PLB); it is an inexpensive and effective device.
- **Stay together in the water.** Search and rescue personnel will more easily spot a group of people in the water than dispersed swimmers.

Areas for Improvement: Mitigating Fatigue

NTSB 2017–2018 MOST WANTED LIST OF TRANSPORTATION SAFETY IMPROVEMENTS

Reduce Fatigue-Related Accidents

MARINE

MWL

MOST WANTED LIST

What is the issue?

Marine vessels are machines that require complex human interaction and an operator's complete attention and proficient skill. All too often, however, operators, maintenance personnel, and other individuals performing safety-critical functions are impaired by fatigue stemming from insufficient or poor-quality sleep.

To manage the risks of operator fatigue in public transportation, companies must ensure that employees have sufficient off-duty time to obtain high-quality sleep. Moreover, employees must actually use their off-duty time to get adequate sleep, as well as make personal choices to attend to medical and quality-of-life problems that negatively affect their fitness for duty and sleep quality.

Over the years, we have investigated many accidents in all transportation modes in which fatigue was cited as the probable cause or a contributing factor. Nearly 20 percent of the 182 major National Transportation Safety Board investigations completed between January 1, 2001, and December 31, 2012, identified fatigue as a probable cause, contributing factor, or a finding.

The consequences of fatigue on human performance can be subtle. Operators, maintenance personnel, and other individuals may not recognize loss of attention, slowed reaction times, and poor judgment until it is too late. The traveling public can unknowingly and unwillingly be placed at risk because a fatigued operator cannot safely execute his or her duty.

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Human fatigue can be acute or chronic; both often arise from poor sleep and inadequate health management. Fatigue impairs performance and degrades a person's ability to stay alert, attentive, and engaged in the task of controlling a vehicle safely.

What can be done?

People need to be awake and alert to be at their best, but when they operate vehicles while fatigued, they are endangering themselves and others. We must acknowledge that fatigue is a real threat to transportation safety, and there is no single solution to it. We must draw attention to the medical conditions that may affect sleep quality,

Continued on next page

UNITED STATES COAST GUARD
U.S. Department of Homeland Security

MARINE SAFETY ALERT

Inspections and Compliance Directorate

September 1, 2015
Washington, DC

Safety Alert 8-15

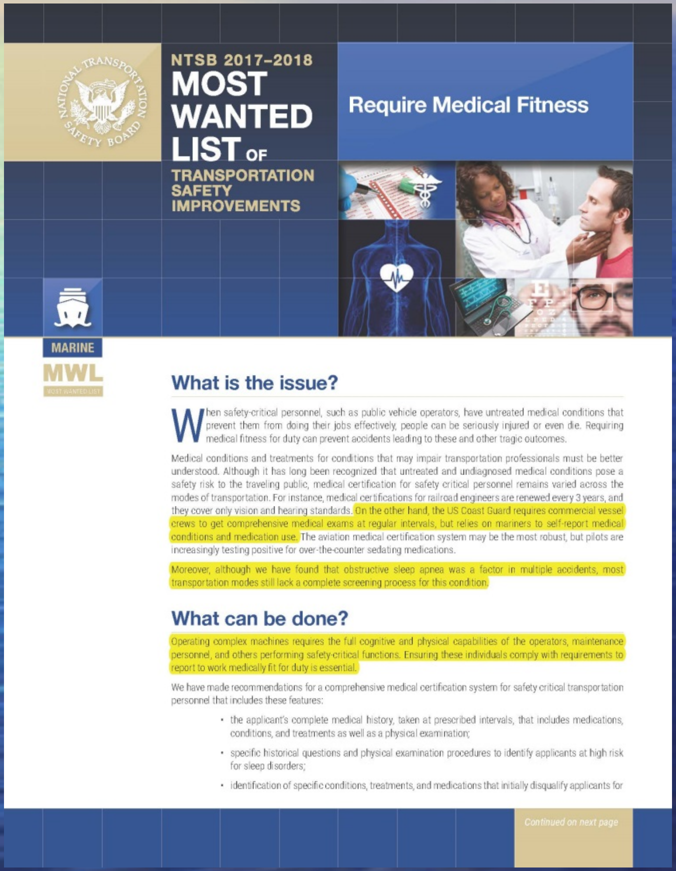
ASLEEP AT THE WHEEL
When fatigue catches up.

This safely alert addresses a recent increase in the number of groundings on Alaskan shorelines involving uninspected commercial fishing vessels. Since July 14, 2015, a total of 16 reported groundings have occurred. In a number of investigations, it was learned that the captain or crewmembers on the vessel had fallen asleep at the wheel after working extensive hours over several days. Fatigue may have been a causal factor in many of these instances. Fatigue symptoms are not limited to just a person falling asleep. Fatigue issues are strongly related to human errors and poor performance. Nearly all modes of transportation are impacted by fatigue and many studies have been performed about its negative short and long term effects.

"The International Maritime Organization (IMO) has formulated a definition of fatigue in which fatigue is conceptualized as a "reduction in physical and/or mental capacity as the result of physical, mental, or emotional exertion which may impair nearly all physical abilities including strength, speed, reaction time, coordination, decision making or balance." The IMO acknowledges the relation between fatigue and human error as indicated above. Fatigue can also be divided into categories in many different ways. However, systematic studies seem to find between three and five dimensions, including general fatigue (e.g., tired, bushed, exhausted), mental fatigue (e.g., cognitive impairment), physical fatigue, sleepiness with a tendency to fall asleep, and sometimes lack of motivation or complacency. In very general terms, fatigue and its ill effects can be minimized by persons receiving periods of good quality uninterrupted rest." For additional fatigue research related information, access http://tinyurl.com/fishingfatigue.

Crewmembers often work long hours on fishing vessels, performing physically demanding tasks in harsh environments. Crewmembers may not be afforded sufficient time for recuperative sleep to prevent the development of acute fatigue due to vessel navigation and fishing or process demands. Many of the processes onboard a vessel must occur in a timely fashion and particular

Areas for Improvement: Mitigating Fatigue


NTSB 2017–2018 MOST WANTED LIST OF TRANSPORTATION SAFETY IMPROVEMENTS

Require Medical Fitness

MARINE

MWL

What is the issue?

When safety-critical personnel, such as public vehicle operators, have untreated medical conditions that prevent them from doing their jobs effectively, people can be seriously injured or even die. Requiring medical fitness for duty can prevent accidents leading to these and other tragic outcomes.

Medical conditions and treatments for conditions that may impair transportation professionals must be better understood. Although it has long been recognized that untreated and undiagnosed medical conditions pose a safety risk to the traveling public, medical certification for safety critical personnel remains varied across the modes of transportation. For instance, medical certifications for railroad engineers are renewed every 3 years, and they cover only vision and hearing standards. On the other hand, the US Coast Guard requires commercial vessel crews to get comprehensive medical exams at regular intervals, but relies on mariners to self-report medical conditions and medication use. The aviation medical certification system may be the most robust, but pilots are increasingly testing positive for over-the-counter sedating medications.

Moreover, although we have found that obstructive sleep apnea was a factor in multiple accidents, most transportation modes still lack a complete screening process for this condition.

What can be done?

Operating complex machines requires the full cognitive and physical capabilities of the operators, maintenance personnel, and others performing safety-critical functions. Ensuring these individuals comply with requirements to report to work medically fit for duty is essential.

We have made recommendations for a comprehensive medical certification system for safety critical transportation personnel that includes these features:

- the applicant's complete medical history, taken at prescribed intervals, that includes medications, conditions, and treatments as well as a physical examination;
- specific historical questions and physical examination procedures to identify applicants at high risk for sleep disorders;
- identification of specific conditions, treatments, and medications that initially disqualify applicants for

Continued on next page

- NTSB states the best defense against a fatigue-related navigation casualty is a well-rested watchstander who is later relieved by another watchstander
- To prevent these types of casualties, the Coast Guard recommends that vessel owners take advantage of the existing technology that can help prevent persons from falling asleep at the helm. Such technology may include the installation of watchstander alarms. *However, it is critically important that such equipment should only be used as backup measures and not as a methodology to facilitate a navigator's sleep while underway.*
- Ultimately, fatigue-related accidents can be avoided with a combination of
  - science-based regulations,
  - comprehensive fatigue risk management programs,
  - **individual responsibility**

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Best Practices: Lithium Batteries

2/10/2017: New battery chemistries for commercial vessels « Coast Guard Maritime Commons

COAST GUARD MARITIME COMMONS

THE COAST GUARD BLOG FOR MARITIME PROFESSIONALS

2/10/2017: New battery chemistries for commercial vessels

Posted by LT Amy Midgett, Friday, February 10, 2017

Last week Marine Safety Center engineers Cdr. Sean Brady and Lt. Kate Woods gave presentations on plan review for battery power installations at the Passenger Vessel Association annual MARITRENDS convention and the Pacific Maritime's forum on Liquefied Natural Gas and alternative fuels. The following is an excerpt from the presentation comments.

As designers and operators are looking to alternative power sources in order to reduce vessel fuel costs or air emissions, battery power is becoming an increasingly attractive option. The Marine Safety Center (MSC) currently has more than a dozen different battery powered vessel designs under review. There is quite a bit of variation among the different proposals, however each faces the same challenge. Any battery powered design submission must demonstrate that the new technology is equivalent to the level of safety afforded by the current regulations.

With the newly affordable, high performing, light weight lithium ion batteries on the market today, many designers and operators are looking toward new hybrid vessel designs, and in some cases even modifying their traditional propulsion systems. Prior to the development of lithium ion batteries for widespread applications in the maritime domain, alternative chemistries did not see much use aboard commercial vessels. Therefore, the current regulations address installations based on traditional lead acid battery design. While these regulations are well developed and appropriate for lead acid battery installations, there are key differences between the technologies described in the regulations and the battery technology that is commercially available today. These differences stem from the chemical make-up of the battery cells, the physical design of the casing or components, and methods for managing the charging/discharging cycle.

The MSC has the authority to evaluate equivalencies to the existing regulations in the absence of specific regulations. To best respond to the rapid innovation in the absence of a comprehensive industry standard for battery installations, MSC has taken a performance based approach to their equivalency reviews. A primary concern with non-traditional battery installation is the risk of thermal runaway and subsequent fires which threaten crew, passengers, cargo and the structural integrity of the vessel. To reduce overall risk, the MSC has identified the need to review designs for preventative controls and mitigation strategies should thermal runaway occur.

Designs should address the following factors:

- Maintenance of the system and emergency procedures in case of failure.
- Battery module design and functionality of the monitoring system.
- Capability of the battery management system to regulate charging and discharging.
- Climate control of the battery compartment and ventilation arrangement.
- Fire detection and suppression capability within the battery space.
- Structural fire protection surrounding the batteries, and emergency electrical isolation.
- Automation testing for the propulsion system where required.

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file:///TERASHARES/...2017/2_10_2017_%20New%20battery%20chemistries%20for%20commercial%20vessels%20«%20Coast%20Guard%20Maritime%20Commons.html[4/17/2017 10:45:23 AM]

Policy should account for:

- Maintenance of the system and emergency procedures in case of failure.
- Climate control of the battery compartment and ventilation arrangement.
- Fire detection and suppression capability.
- Structural fire protection surrounding the batteries, and emergency electrical isolation.
- Battery module design and functionality of the monitoring system.
- Capability of the battery management system to regulate charging and discharging.

Best Practices: Appendix A
Extenuating Circumstance Procedures

- Operators shall develop a procedure on how, and under what circumstances, the vessel will safely continue operations in the event the operating requirements are not met .
- RV BARNES drafted 4 emergency scenarios while overboarding science gear including: tension member in propeller, package stuck on the bottom, winch failure, and loss of ship's power.
- RV SIKULIAQ drafted winch/overboard handling system electronic control failure (getting the gear aboard).

Best Practices: Environmentally Acceptable Lubricants [EAL]

- All vessels (not only new vessels) must use environmentally acceptable lubricants (EALs) in all oil-to-sea interfaces, unless technically not feasible.
- EPA defines EALs as lubricants that are "biodegradable" and "minimally-toxic" and are "not bioaccumulative".
- The vessel's Annual Report must identify the complete brand names of EALs used. The vessel should also maintain a copy of certificates and technical data sheets for each EAL.
- EALs are only mandated for use in specific oil-to-sea interfaces. Vessels are not required to change to an EAL for above deck equipment, but EPA strongly encourages the use.

Oil-to-Sea Interfaces include:

- Controllable pitch propeller
- Thrusters
- Stern tubes
- Thruster bearings
- Stabilizers
- Rudder bearings (excluding head bearing)
- Azimuth thrusters
- Wire rope
- Mechanical equipment subject to immersion (including dredges and grabs)

Overboard Handling Systems:

The BIG picture still applies:

The Overboard Handling System (OHS) should be designed to withstand and operate in excess of the breaking strength of the strongest section of tension member to be used in any condition of loading with an appropriate factor of safety.

Note that 46 CFR 189.35 does not specifically allow for weak links or render capability.

Overboard Handling Systems:

UNITED STATES COAST GUARD
U.S. Department of Homeland Security

MARINE SAFETY ALERT

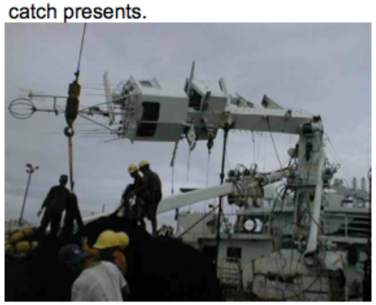
Assistant Commandant for Prevention Policy

June 20, 2012
Washington, DC

Alert 02-12

OVERLOADED LIFTING GEAR ON FISHING VESSELS

Recently, several catastrophic failures of masts, booms, and lift cables have occurred on purse seine fishing vessels that have resulted in loss of life and severe injuries. Over the years many casualties have occurred onboard all types of fishing vessels attempting to haul in catches that exceeded the capacity of their winches, hoists, and associated equipment. These types of casualties are not unusual. This alert serves to remind all purse seine fishing vessel owners/operators and other fishing segments to ensure safe use of the haul equipment particularly matching the size and the capacity of the nets to the rated size and capacity of the winch/haul/hoist equipment, taking into account safety factors for various species, and other concerns such as the variable platform that a rolling fishing vessel and variable catch presents.



Owners / operators, and vessel *Insurers* must ensure that vessel winch, haul and hoist systems are not modified by crew members to increase the lifting capacity beyond the rated design which in some cases can be done very easily. Such boosting of hydraulic systems must be prohibited and certain components should be protected with special seals. The machinery should be properly maintained and records kept in a historical log. It is imperative that owners / operators ensure every load bearing structure and its associated components are maintained in original condition, that they will be operated as designed using all appropriate safety margins for anticipated working conditions. All such equipment will experience fatigue over time and as result must be inspected and monitored routinely. Bearings, limit switches, brakes, safety devices, sheaves, cables and other components, should be routinely inspected by certified organizations.

Overloaded Lifting Gear:

Several catastrophic failures of masts, booms, and lift cables have occurred on vessels that have resulted in loss of life and severe injuries.

The Coast Guard strongly recommends:

- **Know the design limits of load bearing structures and winches, hoist, and haul components;**
- **Ensure they are inspected and tested on a regular basis;**
- **Evaluate and revise operational procedures as needed.**

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Questions?

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